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**3(d) No. of Books Authored/ Edited Books / Book Chapters
published with ISBN (List to be uploaded under
mandatory disclosures)**

Number of Books Authored by Faculty

S.No.	Author Name	Book Name	ISSN No.	Publisher	Year
1	Dr. Vinay Kumar Nassa	Fundamentals of Competitive Intelligence and Business Development	978-93-5823-787-0	Books clinic Publishing	2024
2	Dr. Sandeep Kumar Dr. Ajay Kumar Dr. Pushpa Rani	Embrasing Industry 4.0	978-81-980386-7-8	Paramount Book Distributers	2024
3	Dr. Sandeep Kumar Dr. Ajay Kumar Dr. Pushpa Rani	Innovative Marketing Dynamics	978-81-967696-5-9	Paramount Book Distributers	2024
4	Vinay Kumar Nassa	Chapter 7 From Tradition to Technology: Utilization of AI and ML for Digital Transformation in Supply Chain Management	979-8-3693-1347-3	IGI Global	2024
5	Vinay Kumar Nassa	Chapter 10 Internet of Things (IoT) Integrated Technologies in the Agriculture Sector	979-8-3693-2069-3	IGI Global	2024
6	Dr. Sandeep Kumar Dr. Ajay Kumar Dr. Pushpa Rani	Marketing Innovations for the Modern Era	978-81-967696-6-6	Paramount Book Distributers	2024
7	Dr. Sandeep Kumar Dr. Ajay Kumar	Media & Society Interactions and Influences	978-81-967696-3-5	Paramount Book Distributers	2024
8	Dr. Sandhya Bindal Dr. Ajay Kumar Dr. Sandeep Kumar	Media Innovation and Unleashed	978-81-980386-9-2	Paramount Book Distributers	2024
9	Dr. Ajay Kumar Dr. Sandeep Kumar	New India - Vision for 2047	978-93-95033-9-2	A K Publication	2024
10	Dr. Ajay Kumar Dr. Sandhya Bindal Dr. Shivendu Kr Rai	Next-Gen Media Dynamics	978-81-980386-5-4	Paramount Book Distributers	2024
11	Vinay Kumar Nassa	Chapter 7 Pattern Analysis for Feature Extraction in Complex Images	979-8-3693-1910-9	IGI Global	2024
12	Dr. Sandeep Kumar Dr. Ajay Kumar Dr. Shivendu Kr Rai	Revolutionizing Industry 4.0	978-81-967696-2-8	Paramount Book Distributers	2024

13	Dr. Pushpa Rani Dr. Sandeep Kumar Dr. Ajay Kumar	Transformative Marketing	978-81-967696-9-7	Paramount Book Distributers	2024
14	Dr. Vinay Nassa	Professional Ethics	ISBN:978-93-5757-405-1	Scientific International Publishing House	2024
15	Dr. Vinay Nassa	Fundamentals of Competitive Intelligence and Business Development	ISBN:978-93-5823-787-0	Books clinic Publishing	2024
16	Dr. Vinay Nassa	Internet of Things (IoT)- Integrated Technologies in the Agriculture Sector	979-8-3693-2069-3	IGI Global	2024
17	Dr. Vinay Nassa	Pattern Analysis for Feature Extraction in Complex Images	ISBN 979-8-3693-1910-9	IGI Global	2024

Number of Chapter Publishes by Faculty (93+78 =171)

S. No.	Author Name	Book Name	Title of the paper	Calendar Year of publication	ISBN number of the proceeding	Name of the publisher
1	Dr. Sandeep Kumar	Media & Society: Interactions and Influences	Emerging Spaces in Journalism	2024	978-81-9696-963-9	Paramount Book Distributors
2	Dr. Ajay Kumar	Media & Society: Interactions and Influences	Empowering Voices: The Rise of People- Powered Journalism	2024	978-81-9696-963-9	Paramount Book Distributors
3	Dr. Sandhya Bindal	Media & Society: Interactions and Influences	Globalization and Journalism	2024	978-81-9696-963-9	Paramount Book Distributors
4	Dr. Pushpa Rani	Media & Society: Interactions and Influences	Journalism and Socio- Political Conflict	2024	978-81-9696-963-9	Paramount Book Distributors
5	Dr. Surbhi Jain	Media & Society: Interactions and Influences	Science and the Pursuit of Truth in Journalism	2024	978-81-9696-963-9	Paramount Book Distributors
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93	Dr. Sandhya Bindal	Transformative Marketing	Leveraging TikTok for Business Growth	2024	978-81-9676-969-7	Paramount Book Distributors

Number of Chapter Published in Book Proceedings by Faculty

Sl. No.	Name of the teacher	Title of the proceedings of the conference	Name of the conference	National / International	Calendar Year of publication	ISBN number of the proceeding	Name of the publisher
1	Dr. Sandeep Kumar	The Principles of Responsible Consumption and Production: Foundations and Frameworks	40th National Conference, New Media Vision for 2047	National	2024	978-93-95-033-541	A.K. Publications
2	Dr. Ajay Kumar	Circular Economy: Redefining Waste as a Resource	40th National Conference, New Media Vision for 2047	National	2024	978-93-95-033-541	A.K. Publications
3	Dr. Sandhya Bindal	Sustainable Supply Chains: From Raw Materials to End Products	40th National Conference, New Media Vision for 2047	National	2024	978-93-95-033-541	A.K. Publications
4	Dr. Pushpa Rani	Consumer Behavior and Sustainability: Shifting Towards Responsible Choices	40th National Conference, New Media Vision for 2047	National	2024	978-93-95-033-541	A.K. Publications
5	Dr. Madhavendra Nath Jha	Innovative Solutions for Reducing Single-Use Plastics	40th National Conference, New Media Vision for 2047	National	2024	978-93-95-033-541	A.K. Publications
6	Dr. Shivendu Kumar Rai	Green Manufacturing : Techniques and Technologies for Sustainable Production	40th National Conference, New Media Vision for 2047	National	2024	978-93-95-033-541	A.K. Publications
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9	Dr. Monisha	Eco-Design: Integrating Sustainability into Product Development	40th National Conference, New Media Vision for 2047	National	2024	978-93-95-033-541	A.K. Publications
10	Dr. Kirti Miglani	The Impact of E-Commerce on Consumption Patterns and Environmental Sustainability	40th National Conference, New Media Vision for 2047	National	2024	978-93-95-033-541	A.K. Publications
11	Dr. Kanika Gupta	Promoting Energy Efficiency in Production Processes: Best Practices and Case Studies	40th National Conference, New Media Vision for 2047	National	2024	978-93-95-033-541	A.K. Publications
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17	Mr. Aashish Kumar	The Circular Economy in the	40th National Conference, New	National	2024	978-93-95-033-	A.K. Publications

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		Patterns and Environmental Sustainability	2047				
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Fundamentals of Competitive
Intelligence
and Business Development

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Chapter 7

From Tradition to Technology: Utilization of AI and ML for Digital Transformation in Supply Chain Management

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ABSTRACT

The combination of AI and ML is driving supply chain digitalization. This chapter discusses supply chain management (SCM) in the digital age, including AI, ML, and classical techniques, SCM aspects and components, and supply chain network strategies. The chapter also covers AI and ML applications in supply chain optimisation, resilient supply chain network (SCN) methods, warehouse automation and robotics, transportation and route optimisation, and supply chain risk management. AI and ML enable supply chain stakeholders to use massive data streams for predictive analytics. AI-driven demand forecasting, inventory optimisation, and predictive maintenance reduce hazards and streamline resource allocation, improving cost-effectiveness. In a world of rapid change and innovation, organisations must use AI and ML as the supply chain ecosystem evolves.

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INTRODUCTION

In today's rapidly evolving business landscape, supply chain management has become a critical component for organizations seeking to stay competitive and responsive to market demands. Traditional supply chain practices are being reshaped by the infusion of cutting-edge technologies, and among these, Artificial Intelligence (AI) (Boopathi, S. et al., 2023) and Machine Learning (ML) have emerged as transformative forces that hold the potential to revolutionize how supply chains are planned, executed, and optimized (Strusani & Hounghonon, 2019). With reports estimating that 400 - 800 million jobs will be displaced by 2030 due to AI and automation, every advance that is reported is met with a degree of reticence (Bughin et al., 2017; Smithies, 2017). AI refers to the simulation of human intelligence processes by computer systems ((National Academies of Sciences, Engineering, and Medicine, 2018; Long & Magerko, 2020; Fourtane, 2021; Littman et al., 2021). It involves the development of algorithms that enable machines to perform tasks that typically require human intelligence, such as problem-solving, decision-making, and pattern recognition (Bringsjord, Govindarajulu, & Sundar, 2020).

In the same vein, Machine Learning (Meslie, Y. et al., 2021), a subset of AI, involves the construction of algorithms that allow computers to learn from and make predictions or decisions based on data without explicit programming (Wenzel, Smit, & Sardesa, 2019). As the supply chain ecosystem continues to evolve, embracing AI and ML becomes imperative for organizations aiming to thrive in an era of constant change and innovation. AI and machine learning (Parthiban, K. et al., 2021) integration into supply chain management (SCM) can significantly optimize tasks both at the strategic and tactical levels. This integration facilitates superior utilization of AI-driven tools to enhance business planning, fortify supply chain structures, forecast demand, conduct risk analysis, and tackle an array of other essential tasks. On the operational front, the incorporation of AI leads to streamlined SCM operations, refining the intricate pathways of both inbound and outbound material flows. Leveraging machine learning algorithms (Singh, H. et al., 2022), AI bolsters product and process quality management and enables sophisticated stock management through modern visual pattern recognition techniques. Furthermore, this augmentation allows for precise product and process quality management, fostering informed decision-making and heightened optimization capabilities.

By empowering better preparation and control of the shop floor, AI facilitates intricate, comprehensive, and efficient operational management. Therefore, this chapter present the basic concept of AI, ML and machine learning, AI, ML and traditional supply chain approaches, elements and components of supply chain management and strategies to build supply chain networks.

THE BASIC CONCEPTS OF AI AND ML

Algorithms, models, and learning paradigms work together to enable machines to learn from data and make predictions or decisions (Thomas, 2019, Liao & Wu, 2020; Long & Magerko, 2020). The field of AI and ML is continually evolving, with new algorithms and paradigms being developed to tackle increasingly complex tasks and challenges. The basic concepts of Artificial Intelligence (AI) (Pandey, B. K. & Pandey, D. 2023) and Machine Learning (ML) are:

1. **Algorithms:** AI and ML algorithms are the computational procedures that process data and generate insights or predictions (Min, et al. 2019). These algorithms can range from simple operations to

From Tradition to Technology

complex mathematical calculations. Different AI and ML algorithms are designed to tackle various tasks, such as classification, regression, clustering, and more.

2. **Models:** In AI and ML, a model is a representation of a real-world phenomenon or process. Models are created using algorithms and are trained on data (Pandey, J. K. et al., 2022) to learn patterns and relationships. The model captures the underlying patterns from the training data (Pandey, B. K. et al., 2021) and can be used to make predictions or decisions on new, unseen data. Models can be thought of as the result of the learning process, where the algorithm adjusts its parameters based on the training data to create a representation of the target concept.
3. **Learning Paradigms:** Learning paradigms refer to the different approaches that AI and ML algorithms use to learn from data. There are several key learning paradigms in ML (Zhou, et al., 2017; Makkar, Devi, & Solanki, 2019; Wenzel, Smit & Sardesa, 2019) such as:
 1. Supervised learning, as the first type, involves the algorithm learning from provided pairs of inputs and outputs. In this process, labeled datasets are employed where the outcome for a specific input is known, often in the form of probabilities. Through repeated iterations, the system is trained to establish meaningful correlations between various inputs and corresponding outputs, bridging the gap between them. The term ‘supervised’ pertains solely to the learning phase. Once the algorithm is trained, it becomes capable of autonomously predicting outputs. This type of learning is useful for both regression tasks (predictions) and classification tasks (assigning to predefined categories).
 2. Unsupervised learning, the second type, focuses on uncovering concealed patterns within provided data where potential outcomes are entirely unknown. As a result, training the algorithm with predefined outcomes is not feasible. Instead, this method employs the algorithm to delve into unlabeled datasets and unveil meaningful clusters (groupings based on similarities) or associations (identification of interdependencies). Unsupervised learning is particularly valuable in data mining processes, facilitating data preparation and evaluation.
 3. Reinforcement learning sets itself apart from the previous two by not mandating a dataset. This learning approach can be likened to a form of conditioning, wherein the algorithm is rewarded for accurate responses and penalized for unsatisfactory outcomes. Essentially, it operates as a trial-and-error process, retaining knowledge of both correct and incorrect actions.

THE CONCEPT OF SUPPLY CHAIN MANAGEMENT

The term “supply chain management” (SCM) emerged during the 1980s, incorporating key business processes that span from end-users to initial suppliers (Ryan, 2017). The foundational concept underlying SCM posits that businesses and organizations engaged in a supply chain should collaborate by sharing insights about market conditions and production capacities (Janvier-James, 2012). The evolution of supply chain management in the digital age has seen a progression from manual and disjointed processes to integrated, data-driven, and agile systems. Digital technologies have enabled companies to optimize operations, enhance visibility, and respond to customer needs more effectively, leading to improved efficiency and competitiveness in today’s global market (Min, 2015). The key stages in the evolution of supply chain management in the digital age are:

From Tradition to Technology

1. **Manual and Fragmented Processes (Pre-Digital Age):** Before the digital age, supply chain management was largely a manual and isolated process. Companies relied on spreadsheets, paper documents, and phone calls to manage inventory, procurement, production, and distribution. This approach often led to inefficiencies, lack of visibility, and difficulty in coordinating activities across the supply chain.
2. **Introduction of Electronic Data Interchange (EDI):** In the late 20th century, the adoption of EDI allowed businesses to exchange documents electronically, such as purchase orders and invoices. While this marked a significant improvement over manual processes, EDI was limited in its capabilities and required standardization among trading partners.
3. **Rise of Enterprise Resource Planning (ERP) Systems:** ERP systems emerged as comprehensive software (Kirubasri, G. et al., 2022) solutions that integrated various business functions, including supply chain processes. These systems provided centralized data management, allowing companies to monitor inventory, production, and logistics more effectively. However, early ERP systems were often complex and expensive to implement.
4. **Introduction of Advanced Planning Systems (APS):** APS solutions emerged in the 1990s, offering more sophisticated tools for demand forecasting, inventory optimization, and production planning. These systems laid the groundwork for data-driven (Pandey, B. K. et al., 2022) decision-making and better coordination among supply chain components.
5. **Adoption of E-Commerce and Online Retail:** The growth of e-commerce and online retail introduced new challenges and opportunities for supply chains. Companies needed to adapt to fulfill direct-to-consumer orders, manage shorter lead times, and ensure efficient last-mile delivery.
6. **Integration of IoT and Sensor Technologies:** The Internet of Things (IoT) brought about a new era of connectivity, enabling the collection of real-time data from sensors placed throughout the supply chain. This data helps monitor the condition of products during transit, track assets, and optimize processes.
7. **Big Data Analytics and Predictive Analytics:** With the proliferation of data, supply chain management embraced big data analytics and predictive modeling. These technologies allowed companies to analyze large datasets to identify trends, make accurate demand forecasts, and optimize operations based on insights.
8. **Blockchain Technology:** Blockchain technology gained attention for its potential to enhance transparency and traceability across supply chains. It enables secure and immutable recording of transactions, helping to prevent fraud, counterfeiting, and ensuring authenticity.
9. **Artificial Intelligence and Machine Learning:** AI and machine learning algorithms are being used to analyze vast amounts of data to generate insights, optimize routes, and predict potential disruptions. AI-driven demand forecasting and inventory management have become key areas of focus.
10. **Digital Twins and Simulation:** Digital twin technology allows companies to create virtual representations of their physical supply chain processes. This enables simulation and testing of various scenarios, helping managers make informed decisions and optimize processes without disrupting the actual supply chain.
11. **End-to-End Visibility and Collaboration Platforms:** Advanced digital platforms and cloud-based solutions offer end-to-end visibility into supply chain operations. These platforms enable seamless collaboration among all stakeholders, from suppliers to customers, facilitating communication and decision-making. The digital age has also brought a stronger focus on sustainability. Supply chains

From Tradition to Technology

are adopting practices to reduce environmental impact, optimize resource use, and implement circular economy principles.

TRADITIONAL, ML AND AI SUPPLY CHAIN APPROACHES

The utilization of Artificial Intelligence (AI) and Machine Learning (ML) algorithms presents an array of advantages in tackling the prevailing challenges that the Supply Chain Management (SCM) encounters in the contemporary digital landscape (Charran & Sweetman, 2019). The convergence of AI and ML is effecting transformative changes within the supply chain sector. By pinpointing deeply ingrained inefficiencies and uncertainties, these analytical technologies provide an overarching view of every facet of the supply chain, offering an unprecedented level of granularity and methodologies that surpass human capabilities on a grand scale. The integration of analytics into supply chain processes is not only propelling the realization of robust optimization capabilities but also contributing to more precise capacity planning, heightened productivity, elevated quality standards, reduced costs, amplified output, all while fostering a heightened focus on ensuring safer working conditions.

The difference between Artificial Intelligence (AI), Machine Learning (ML), and traditional supply chain approaches in terms of their characteristics, capabilities, and impact on supply chain management are as follows:

1. **Traditional Supply Chain Approaches:** Traditional supply chain approaches are characterized by manual processes, limited data analysis, and a reactive mindset. These approaches rely heavily on human decision-making and often involve siloed operations. Some key differentiating factors include:
 - i. **Manual Decision-Making:** Traditional supply chains rely on human judgment and experience for decision-making, which can be time-consuming and prone to errors.
 - ii. **Limited Data Utilization:** Data analysis is basic and relies on historical data. Advanced data analytics techniques are often underutilized.
 - iii. **Reactive Responses:** Traditional approaches tend to react to disruptions after they occur, leading to delays and increased costs in resolving issues.
 - iv. **Lack of Visibility:** The lack of real-time visibility across the supply chain can result in inefficiencies, delays, and difficulties in tracking inventory and shipments.
 - v. **Limited Optimization:** Optimization of processes, inventory, and resources is limited, which can lead to suboptimal performance and higher costs.
2. **Machine Learning (ML) in Supply Chain:** Machine Learning (ML) constitutes a subdivision of artificial intelligence that introduces a distinct paradigm of programming (Kourou, et al., 2015, Siau et al., 2018). Instead of relying solely on rigid software algorithms, ML leverages data as a substitute for deterministic calculation rules. Within this framework, information, learning methodologies, and algorithms collaboratively extract statistical patterns from provided examples and subsequently encapsulate them in the form of models. These models, adept at discerning underlying regularities, exhibit the capacity to classify novel, unfamiliar data into predefined categories or make predictive inferences (Wenzel, Smit & Sardesa, 2019). ML algorithms can learn patterns from historical data and make predictions or recommendations. Some key differentiating factors of Machine Learning (ML) (Pandey, D. et al., 2021b) include:

From Tradition to Technology

- i. **Predictive Analytics:** ML algorithms can predict future outcomes based on historical data, enabling better demand forecasting, inventory management, and risk assessment (Khasis, 2019).
 - ii. **Data-Driven Insights:** ML leverages large datasets to uncover hidden patterns and correlations, leading to more informed decision-making.
 - iii. **Automation and Optimization:** ML algorithms automate routine tasks and optimize processes, leading to higher efficiency and reduced operational costs. Robotic Process Automation (RPA) can handle routine data entry, freeing up human resources for more strategic and creative tasks. This leads to higher efficiency, reduced errors, and cost savings.
 - iv. **Real-time Monitoring:** ML enables real-time monitoring of supply chain operations, allowing for proactive responses to disruptions and better resource allocation.
 - v. **Production Planning and Scheduling:** ML algorithms optimize production schedules considering factors like machine availability, capacity constraints, and order priorities. This minimizes production downtime and maximizes resource utilization.
 - vi. **Personalization and Customer Experience:** AI-powered recommendation engines analyze user preferences and behaviors to provide personalized product and content recommendations. This enhances customer engagement and satisfaction by delivering tailored experiences, ultimately boosting sales and loyalty.
 - vii. **Dynamic Decision-Making:** ML algorithms can adapt to changing conditions and make dynamic decisions based on real-time data.
 - viii. **Inventory Management:** ML models predict optimal reorder points and quantities based on factors like demand variability, lead times, and costs. This prevents overstocking and stockouts, reducing carrying costs and improving customer satisfaction.
3. **Artificial Intelligence (AI) in Supply Chain:** The term “Artificial Intelligence” having been coined in 1956 encompasses a broader spectrum of capabilities, including ML, and involves simulating human intelligence in machines (Liao & Wu, 2020). AI systems can reason, learn, and solve complex problems (Russell & Norvig, 2016; Long & Magerko, 2020; Berente et al., 2021). Some key differentiating factors of Artificial Intelligence (AI) in Supply Chain include:
- i. **Cognitive Abilities:** AI systems can perform tasks that traditionally required human intelligence, such as natural language understanding, sentiment analysis, and problem-solving.
 - ii. **Advanced Analytics:** AI goes beyond traditional data analysis by incorporating techniques like natural language processing, image recognition, and pattern recognition.
 - iii. **Autonomous Decision-Making:** AI can make autonomous decisions based on data analysis and predefined rules, reducing the need for constant human intervention.
 - iv. **Natural Language Processing (NLP):** NLP allows machines to understand and interpret human language. Virtual assistants and chatbots, for instance, can handle customer inquiries, provide support, and even automate complex interactions, enhancing customer service and reducing response times.
 - v. **Optimization Across Multiple Variables:** AI can optimize processes considering multiple variables, constraints, and objectives simultaneously.
 - vi. **Quality Control and Defect Detection:** AI-powered image recognition systems identify defects in real-time by analyzing images (Pandey, D. et al., 2021a) of products or components. This improves product quality and reduces waste.

From Tradition to Technology

- vii. **Improved Collaboration:** Digital tools enable better collaboration between different stakeholders within the supply chain, such as suppliers, manufacturers, distributors, and retailers. Cloud-based platforms and collaboration tools facilitate information sharing, communication, and coordination, leading to smoother operations (Dwivedi et al., 2021).
- viii. **Carbon Footprint Reduction:** AI optimizes transportation routes and modes to reduce fuel consumption and emissions. It also assists in designing sustainable supply chain practices to minimize environmental impact.
- ix. **Pricing and Revenue Management:** AI analyzes market conditions, competitor pricing, and customer behavior to optimize pricing strategies. This maximizes revenue and profit margins while staying competitive. AI analyzes return patterns and reasons to identify opportunities for process improvements, reducing the cost and impact of product returns.
- x. **Sustainability and Environmental Impact:** Digital transformation can help companies monitor and reduce their environmental impact by optimizing transportation routes, reducing energy consumption, and minimizing waste through data-driven insights.

ELEMENTS OF SUPPLY CHAIN MANAGEMENT

Supply Chain Management (SCM) is a strategic methodology employed to oversee manufacturers, distributors, warehouses, and stores. Its aim is to ensure the production and delivery of goods in optimal quantities, at appropriate locations, and within the designated time frame. This serves to minimize system costs while fulfilling service level requirements (Kaminsky, et al., 2003). Since the configuration of supply chains varies across industries, the most common elements are:

1. **Demand Management:** Demand management centers around understanding and quantifying consumer requirements. Demand not only dictates supply but also informs production strategies, which subsequently influence financial, logistics, and marketing decisions. The unreliability of demand information is a prime contributor to business failures. Unpredictable demand patterns lead to inadequate supply, resulting in customer dissatisfaction, or excessive supply, causing wastage of valuable resources. Given the inherent volatility of demand, acquiring accurate demand information is a formidable challenge. Forecasting based on historical market trends is a customary method to gauge potential future demand (Min, 2015).
Though demand forecasting is integral to demand management, its accuracy hinges on the predictive methodologies, time horizons, and nature of demand. Moreover, accurate demand information must be communicated to producers and suppliers to render predictions meaningful. The speed at which demand information disseminates among supply chain partners influences demand management outcomes. According to Min (2015), demand management entails several steps, including:
 - i. **Demand Planning:** A more intricate process than mere forecasting.
 - ii. **Demand Transmission:** Involves seamless integration of supply chain partners, fostering cohesive production strategies.
 - iii. **Demand Influencing:** Encompasses marketing strategies, pricing, and product positioning.
 - iv. **Demand Prioritizing:** Involves monitoring customer orders and categorizing clientele.
2. **Customer Relationship Management (CRM):** Customer Relationship Management (CRM) constitutes a strategic approach to fostering engagement between an organization and current and

From Tradition to Technology

prospective customers. CRM involves data evaluation to comprehend customer behavior, strengthen consumer-business relationships, prioritize customer retention, and ultimately bolster revenue growth. CRM systems play a pivotal role in aggregating data from diverse communication channels, including websites, phone calls, emails, live chats, social media, and more. Employing the CRM approach and associated tools enables organizations to gain insights into their target markets and better tailor responses to their needs. Some key components of Customer Relationship Management (CRM) according to Ryan (2017) are:

- i. Establishing and sustaining customer relationships through targeted marketing initiatives.
 - ii. Monitoring relationships as they evolve through various stages.
 - iii. Nurturing relationships at each level while acknowledging that the value of each relationship to the organization isn't uniform. Organizations leverage an array of resources, from organizational design to reward programs, to optimize their marketing strategies while nurturing and retaining customer relationships.
3. **Order Management:** Order management forms the backbone of virtually every mechanism within the supply chain. Many organizations no longer retain exclusive control over orders within their premises. Parties such as component manufacturers, assembly facilities, packaging centers, distribution hubs, and more contribute to the fulfillment process, which can result in diminished visibility and control. Consequently, manual processes become costly and error-prone. Adopting an Order Management System (OMS) can mitigate expenses and enhance revenue by automating manual tasks and minimizing errors.
- Externally, order management significantly shapes how customers perceive a brand. In today's omnichannel landscape, customers expect a seamless experience. They may initiate orders online and seek clarifications via a call center. Notifications regarding order fulfillment and delivery are anticipated. Seamless returns and interactions through various channels enrich customer experience and elevate engagement and sales. Moreover, the omnichannel ecosystem presents opportunities for upselling, cross-selling, and increased revenue. Modernizing order management involves embracing an Order Management System (OMS) that oversees the entire lifecycle of an order. It encompasses entry, inventory, fulfillment, and post-sales support. An OMS augments visibility for both companies and customers, providing real-time insights into inventory status and order progress (Glasheen, 2020).
4. **Inventory Management:** Inventory, as a strategic asset, enables companies to respond promptly to consumer demands while acting as a buffer against unexpected fluctuations, quality issues, and supply chain disruptions. Conversely, inventory can also be a liability, draining resources through carrying costs, tying up personnel, and masking the root causes of logistics or quality challenges. Inventory management is fundamentally the science of determining the types and quantities of stored products. This process must precede the routine flow of material production and storage across various locations within a facility or the broader supply chain network. Inventory management encompasses a broad scope of considerations, including replenishment lead time, carrying costs, asset management, forecasting, valuation, visibility, price projections, physical space constraints, quality control, replenishment strategies, returns management, and demand forecasting.

The pursuit of balance amid these competing objectives yields optimal inventory levels, an ongoing process that adapts to changing business landscapes. Effective inventory management requires a retailer to maintain a diverse product range while controlling sourcing, shipping, and storage costs. It entails

From Tradition to Technology

systems and procedures to determine inventory needs, set objectives, define replenishment processes, monitor actual and projected inventory status, and manage all related material functions. These may encompass tracking (Pandey, D. et al., 2022b) inflows and outflows, conducting ABC analysis, batch tracking, and facilitating cycle counting. Inventory management, rooted in maintaining inventory volumes within the physical distribution network, strikes a balance between product availability and cost containment (Ryan, 2017).

WAREHOUSE AUTOMATION MANAGEMENT IN SUPPLY CHAIN

Despite growing demand for flawless customer service, today's warehousing is being forced to increase the standards for stock quality, reliable distribution service, individually tailored order fulfilment, customizable value-added features, and sensitivity to consumer specific requirements. To achieve these high-standards targets, the warehousing needed to minimize waste, optimize processes, and boost warehousing activity quality in every area. A Warehouse Management System (WMS) is one of the most pro-active ways of doing this to speed up the order completion, improve the accuracy of inventory, give instant information regarding the order status, manage storage space and improve labour productivity. WMS has completely changed the process in which orders are scheduled, prepared and executed, inventories tracked and the correct goods delivered in right time.

Recently, WMS has extended to include new features capable of managing light production, transportation, ordering process and full accounting practices (Min, 2015).

AI-powered robotics have revolutionized warehouse operations by introducing automation, efficiency, and scalability to the logistics industry. These advanced technologies combine artificial intelligence, machine learning, and robotics to handle a wide range of tasks, from order fulfillment to inventory management. AI-powered robotics are transforming warehouse operations (Ryan, 2017; Caballero & Rice, 2018; Hellingrath, & Lechtenberg, 2019) in the following ways:

1. **Order Picking and Fulfillment:** Robotic systems equipped with AI vision technology can accurately identify and pick items from shelves. They optimize the sequence of picking to minimize travel time, improving order fulfillment speed and accuracy.
2. **Autonomous Guided Vehicles (AGVs) and Drones:** AGVs and drones navigate through warehouse spaces using AI algorithms and sensor technologies. They transport goods between different areas, reducing manual labor and streamlining material flow.
3. **Sorting and Packing:** AI-powered robotic systems sort and pack items into appropriate containers, boxes, or parcels with high precision. These systems ensure uniformity and minimize the risk of errors during the packing process.
4. **Inventory Management:** Robotic systems with AI capabilities can conduct real-time inventory scans, track item locations, and update inventory records. This reduces stock discrepancies and enhances inventory accuracy. Inventory management, with the primary objective of assessing/managing stock volumes within the physical distribution network, balances the need for product availability against the need to reduce stock keeping and handling costs.
5. **Goods Transportation:** AI-powered mobile robots transport goods within the warehouse, optimizing the movement of items between storage and processing areas. This reduces the need for manual transportation.

From Tradition to Technology

6. **Autonomous Forklifts:** AI-driven forklifts use sensors and cameras to navigate and move goods around warehouses autonomously. They can efficiently transport and stack items, improving overall warehouse productivity.
7. **Collaborative Robots (Cobots):** Cobots work alongside human workers, assisting with tasks such as heavy lifting, assembly, and quality control. AI algorithms enable cobots to adapt to human movements and work safely in shared spaces.
8. **Predictive Maintenance:** AI monitors robotic systems for signs of wear and tear, predicting maintenance needs before breakdowns occur. This proactive approach reduces downtime and maintenance costs.

TRANSPORTATION AND ROUTE OPTIMIZATION IN SUPPLY CHAIN

Transportation generates utility position via transferring people and/or products from one place to a targeted end point. Therefore, transportation is a critical link in the supply chain, because of its role in linking the spots in the supply chain. That means the efficiency of transportation should reflect the efficiency of the supply chain. As such, designing an effective transport strategy is the first step toward supply chain effectiveness. Given its importance for the supply chain, the supply chain specialists will prepare, handle and optimize transportation better. However, as human culture progresses, transport becomes more complicated. Part of the complexity of transportation stems from expanded geographic reach, different modal choices, evolving regulatory/deregulatory laws/rules on transportation, restricted fuel availability, and multiple stakeholders (Liu, et al., 2016).

To facilitate the complexities of transportation it is important to understand and evaluate the essential functions and contexts surrounding it. Transportation, for example, enables the delivery of raw resources and components/parts necessary for production to the locations of the manufacturers. Similarly, transportation enables the delivery of finished products produced by manufacturers to the locations of customers. Therefore, transport generates value by shifting the position of the raw resources, components/parts, and finished products to the locations where they are required or consumed. Transportation can also establish time-based utility through the transportation of the necessary resources at the same time at the same location.

Routing algorithms and techniques are essential tools for optimizing transportation logistics (Conde & Twinn, 2019). They consider various factors such as distances, constraints, vehicle capacities, and real-time information to create efficient routes that minimize costs and enhance supply chain performance. The choice of algorithm depends on the complexity of the problem, the nature of constraints, and the specific objectives of the transportation logistics optimization (Rashed, 2017). Real-time tracking, route adjustments, and minimizing delivery delays are interrelated strategies that leverage technology and data for efficient transportation logistics as follows:

1. **Routing algorithms for transportation logistics:** Routing algorithms and techniques play a pivotal role in optimizing transportation logistics by determining the most efficient paths for vehicles to reach their destinations while considering various constraints and objectives. These algorithms help reduce transportation costs, improve delivery times, and enhance overall supply chain efficiency.
2. **Real-time tracking, route adjustments, and minimizing delivery delays:** Real-time tracking, route adjustments, and minimizing delivery delays are critical aspects of modern transportation

From Tradition to Technology

logistics that rely on technology and data-driven strategies. These components ensure efficient, responsive, and customer-centric delivery operations.

- i. Real-time tracking involves monitoring the location, status, and condition of vehicles and shipments in real time. This is achieved through technologies such as GPS, RFID, IoT sensors, and telematics.
- ii. **Route Adjustments:** Route adjustments involve modifying planned routes in response to real-time data, traffic conditions, weather changes, and unforeseen obstacles.
- iii. **Minimizing Delivery Delays:** Real-time tracking and route adjustments contribute significantly to minimizing delivery delays by addressing the following challenges:
- iv. **Traffic Congestion:** Real-time traffic updates enable drivers to avoid congested areas, reducing delays caused by traffic jams.
- v. **Unforeseen Events:** Unexpected Road closures, accidents, or construction can disrupt planned routes. Real-time tracking allows for quick adjustments to minimize delays.
- vi. **Customer Satisfaction:** Accurate real-time tracking information keeps customers informed about delivery progress, reducing uncertainty and frustration associated with delays.
- vii. **Efficient Resource Allocation:** Real-time tracking and route adjustments optimize the allocation of vehicles and resources, ensuring deliveries are made on time with minimal idle time.

RISK MANAGEMENT IN THE SUPPLY CHAIN

Identifying potential disruptions and vulnerabilities in the supply chain is a proactive approach that allows businesses to build resilience and responsiveness. By conducting comprehensive assessments, analyzing various factors, and implementing robust risk management strategies, companies can minimize the impact of disruptions and maintain the smooth functioning of their supply chains (Gesing, Peterson, & Michelsen, 2018) in the following ways:

1. **Supply Chain Mapping:** Create a comprehensive map of your supply chain, identifying all the tiers of suppliers, manufacturers, distributors, and transportation routes involved. This visualization helps in understanding the complexity and potential weak points.
2. **External Factors Analysis:** Identify external factors that could disrupt your supply chain, such as political instability, regulatory changes, natural disasters, pandemics, and economic fluctuations. Monitor news and trends related to these factors.
3. **Supplier Risk Assessment:** Evaluate the financial stability, operational capabilities, and geographical locations of your suppliers. A supplier with financial troubles or concentrated operations in a single region can pose significant risks.
4. **Labor Shortages and Strikes:** Monitor labor conditions in regions where your suppliers and manufacturers are located. Labor strikes or shortages can impact production and transportation.
5. **Natural Disaster Risk Zones:** Identify areas prone to natural disasters such as earthquakes, hurricanes, and floods. Suppliers or facilities located in these zones are more susceptible to disruptions.
6. **Continuous Monitoring:** Supply chain risks are dynamic. Implement continuous monitoring systems that provide real-time information about potential disruptions, allowing for swift responses.

From Tradition to Technology

7. **Collaboration and Transparency:** Build strong relationships with suppliers and partners based on collaboration and transparency. Open communication can help identify risks early and develop joint mitigation strategies.

AI AND ML APPLICATIONS CHALLENGES IN SUPPLY CHAIN NETWORKS

An artificial Intelligence (AI) and Machine Learning (ML) application in supply chain brings numerous benefits in terms of efficiency and productivity. However, their implementation comes with a set of challenges that need to be carefully addressed to ensure the well-being of human workers, the integrity of the robotics systems, and the overall success of the operation (Hellengrath & Lechtenberg, 2019). Some of the challenges facing AI and ML applications in supply chain optimization include:

1. **Human-Robot Interaction:** One of the primary safety concerns is ensuring the safe interaction between robots and human workers. Collaborative robots (cobots) that work alongside humans should be equipped with sensors to detect the presence of humans and immediately halt or slow down their movements to prevent collisions. Emergency stop buttons or switches should be easily accessible throughout the warehouse. These mechanisms allow workers to quickly halt robot movements in case of emergencies or safety hazards.
2. **Data Security:** Robotic systems often rely on data connectivity and communication. Ensuring the security (Kumar Pandey, B. et al., 2021) of these connections is crucial to prevent unauthorized access or control of robots, which could pose safety risks.
3. **Data Quality and Availability:** AI and ML models rely heavily on data. Inaccurate, incomplete, or inconsistent data can lead to unreliable predictions and suboptimal decisions. Supply chain data often resides in different systems and formats, making it challenging to consolidate and ensure data quality.
4. **Data Integration and Interoperability:** Supply chain data comes from various sources, including suppliers, manufacturers, distributors, and retailers. Integrating data from these disparate sources can be complex. Ensuring interoperability between different systems and data formats is crucial for effective AI and ML implementation.
5. **Complexity of Networks:** Modern supply chains are intricate networks with numerous nodes, suppliers, partners, and logistics options. Modeling and optimizing such complexity can be challenging for AI and ML algorithms.
6. **Lack of Historical Data:** Some supply chain disruptions (e.g., rare events or major shifts) might not have historical data for training AI models, making it difficult to predict and plan for such occurrences.
7. **Model Interpretability:** Many AI and ML algorithms, especially deep learning models (Pandey, B. K. et al., 2021a), can be complex and difficult to interpret. Understanding why a model makes a certain decision is crucial for gaining trust and acceptance.
8. **Change Management:** Implementing AI and ML involves changes in processes and decision-making. Employees and stakeholders might resist or struggle to adapt to these changes.
9. **Resource Constraints:** Developing and deploying AI and ML models requires computational resources and expertise. Smaller organizations might find it challenging to allocate these resources.

From Tradition to Technology

10. **Continuous Learning and Adaptation:** Supply chain dynamics change over time due to market trends, disruptions, and other factors. AI and ML models need to be continuously updated and adapted to remain effective.
11. **Unforeseen Events and Black Swans:** AI models might struggle to predict and plan for truly unexpected events, often referred to as “black swan” events, which can significantly disrupt supply chains.
12. **Limited Domain Expertise:** Effective AI and ML implementation requires a deep understanding (Pandey, B. K. et al., 2021b) of both supply chain operations and the capabilities and limitations of AI and ML technologies.
13. **Vendor Lock-in:** Depending heavily on specific AI and ML vendors or platforms can lead to vendor lock-in and limit flexibility.
14. **Regulatory Compliance:** AI and ML (Pandey, B. K. et al., 2021c) implementation in supply chain operations might need to adhere to specific regulations, especially in industries with strict quality and safety standards.
15. **Initial Investment and ROI Uncertainty:** While AI and ML promise significant benefits, the initial investment required for technology adoption might raise concerns, and the expected return on investment can be uncertain.

Addressing these challenges requires a multi-faceted approach, involving collaboration among domain experts, data scientists, IT professionals, and organizational leadership. It's crucial to develop a clear strategy, assess the organization's readiness for AI and ML adoption, and gradually implement these technologies while addressing challenges as they arise.

STRATEGIES TO BUILD SUPPLY CHAIN NETWORKS

Building supply chain networks is crucial for businesses to navigate unexpected disruptions, minimize risks, and maintain continuity in operations. Optimizing AI and ML applications in supply chain networks can significantly enhance efficiency, reduce costs, and improve overall performance (Hoffmann, 2019). Some key strategies for building resilient supply chain networks:

1. **Utilize Predictive Analytics for Demand Forecasting:** Utilize AI and ML algorithms to forecast demand accurately, thereby reducing inventory costs and minimizing stockouts.
2. **Implement Real-time Monitoring and Alert Systems:** Implement AI-driven monitoring systems to identify potential disruptions in the supply chain in real-time, enabling proactive responses to demand fluctuations, ensuring efficient use of resources.
3. **Employ Automated Inventory Management:** Employ ML algorithms to optimize inventory levels, minimize carrying costs, and avoid overstocking or stockouts.
4. **Implement Supplier Relationship Management:** Implement AI-based tools for analyzing supplier performance, identifying potential risks, and fostering long-term strategic partnerships.
5. **Utilize Natural Language Processing for Contract Management:** Use NLP to streamline contract management processes, including contract analysis, negotiation, and compliance monitoring.
6. **Risk Management and Mitigation:** Deploy AI-driven risk management tools to identify and mitigate potential supply chain risks, such as natural disasters, geopolitical issues, or market fluctuations.

From Tradition to Technology

7. **Blockchain Integration for Transparency:** Integrate blockchain technology to provide transparency and traceability across the entire supply chain, improving trust and reducing the risk of fraud.
8. **Collaborative Forecasting and Planning:** Facilitate collaborative planning and forecasting processes among various stakeholders in the supply chain using AI-powered tools, reducing overall operational costs and environmental impact.
9. **Adaptive Pricing Strategies:** Use AI algorithms to dynamically adjust pricing based on market trends, customer behavior, and competitor pricing, maximizing profits while remaining competitive.
10. **Establish Continuous Improvement through Feedback Loops:** Establish feedback loops to continuously improve AI and ML models by incorporating insights from real-time data and user feedback, ensuring ongoing optimization of supply chain operations.

REVIEW QUESTIONS

Answer the following question.

1. What are the basic concepts of AI and ML?
2. What do you understand by the concept of Supply Chain Management?
3. How do AI, ML and Traditional Supply Chain Approaches relate to each other?
4. What are the elements of Supply Chain Management?
5. How does warehouse Automation impact Supply Chain Management?
6. How does transportation and Route Optimization work in SCM?
7. What role does risk management play in the SCM process?
8. What are the challenges of AI And ML Applications in Supply Chain Networks?
9. What are the strategies that can be employed to build an effective Supply Chain Networks?

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Chapter 10

Internet of Things (IoT)– Integrated Technologies in the Agriculture Sector

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ABSTRACT

Industrialization and intensification in agriculture are becoming more necessary to meet the rising demand for food. The internet of things (IoT) is an exciting new development that has the potential to significantly improve agricultural practises worldwide. There is a continual effort by academic institutions and scientific communities to develop and market goods and services that use the IoT to solve various agricultural sectors. The primary objective of this study is to compile a comprehensive systematic literature review (SLR) that examines the utilization of internet of things (IoT) technologies in diverse agricultural domains, encompassing current applications, sensors/devices, communication protocols, and network categories. This entails consolidating research on IoT applications in agriculture. There's also a good discussion of the most pressing agricultural questions and problems.

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1. INTRODUCTION

The internet has become ubiquitous over the last two decades, and its use has benefited people and businesses everywhere in many ways. The capacity to create and consume services in real time was the most noticeable improvement brought about by this development. In recent times, the Internet of Things (IoT) has emerged as a promising avenue for revolutionizing various industries by leveraging its cutting-edge technologies. It offers a transformative potential to enhance users' perceptions and capabilities by reconfiguring their work environments. Across a wide array of sectors such as medicine, commerce, transportation, safety, housing, urban planning, and agriculture, IoT brings forth numerous advantages. Given the essential requirement for consistent observing and control in the field of agribusiness, IoT reception emerges as the optimal choice. Consequently, the agricultural industry employs IoT technologies at multiple points within its production chain (Medela et al., 2013).

Precision farming, livestock, and greenhouses are the primary use cases for IoT in agriculture and may be broken down further into their respective monitoring domains. Farmers are able to better gather data from sensing devices thanks to the widespread use of wireless sensor networks (WSNs) to monitor a variety of Internet of Things (IoT)-based applications. Researchers and farmers might benefit from more informed decision-making thanks to certain IoT-based setups that analyse and handle distant data using cloud services. These days, thanks to technological advancements, systems for monitoring the environment also provide supplementary administrative and decision-making conveniences. A user-free landslip risk monitoring system (Giorgetti et al., 2016) has been designed for rapid deployment in extreme situations.

The proposed system automatically handles node failures and reorganises low-quality communication connections in the network, which is quite intriguing. In (Zheng et al., 2016), the authors suggest an IoT management to track weather patterns and other environmental factors across a wide region. Identified are various sub-domains that stand to gain from IoT-enabled agricultural monitoring systems. These encompass soil, air, temperature, water, disease, geolocation, environmental, insect, also, preparation checking. Moreover, the IoT worldview enhances human connection with the regular world utilizing financially savvy electronic gadgets and correspondence conventions. It facilitates the generation of real-time, comprehensive maps detailing environmental aspects like noise, air and water quality, temperature, and potential harmful radiation, all achieved through the Internet of Things (Torres-Ruiz et al., 2016) (Hachem et al., 2015).

In addition, the user receives warnings or makes suggestions to authorities through text message (Liu et al., 2013) based on data gathered regarding various environmental characteristics. There has been a plethora of research published in the field of Internet of Things (IoT) agriculture during the last several decades. Therefore, it is necessary to assemble the current level of knowledge, synthesise it, critically examine it, and organise it. The objective of this exploration was to play out an extensive survey of existing writing concerning the use of internet of Things (IoT) applications in the agricultural sector.

2. APPLICATIONS OF IoT IN AGRICULTURE

Air, temperature, humidity, soil, water, fertilisation, pest control, lighting, and location tracking are just some of the many variables that can be monitored, controlled, and tracked with the help of IoT agricultural solutions.

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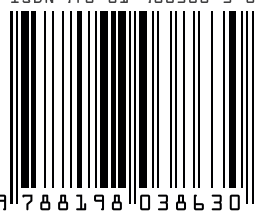
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Chapter 7

Pattern Analysis for Feature Extraction in Complex Images

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ABSTRACT

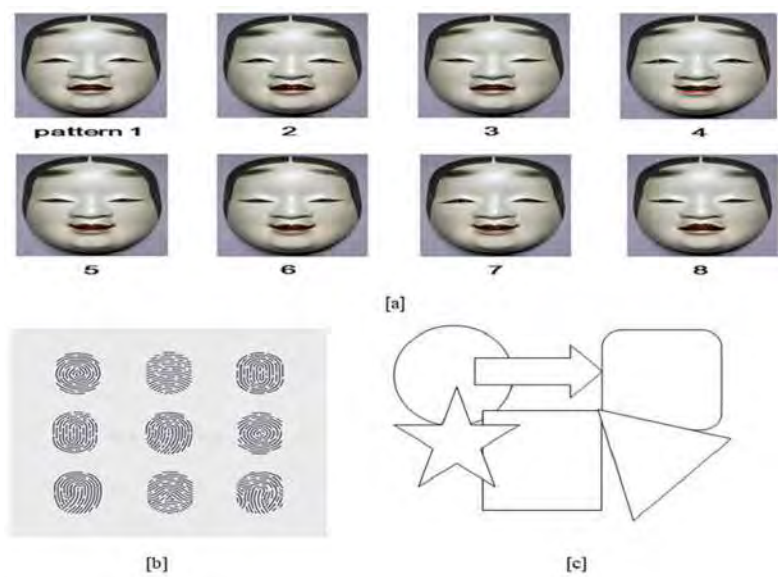
A concept that has been shown to be valuable in one circumstance and is likely to be useful in others is known as a pattern. A pattern can be interpreted in a variety of ways, and each interpretation has its own particularizations that are suited to the particular form of the pattern it represents. The term “pattern” can be used to describe anything, like a group of items that function in tandem with one another. The analysis of these patterns is important in order to improve recognition. Finding patterns in data is the primary emphasis of the field of pattern analysis, which is a subfield of artificial intelligence and computer science that employs the usage of algorithms. In the context of a data stream, the term “pattern” refers to any underlying correlations, regularities, or structures. If it finds significant patterns in the data already stored, a system may be able to anticipate generating predictions based on fresh information arriving from a source that is analogous to the one it is currently using.

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1. INTRODUCTION

Patterns have been one of the most popular subjects in the object community in recent years. They’re quickly becoming the hottest trend, generating a lot of interest and the usual buzz. Internal disputes over what belongs in the community are also raging, with various disagreements about exactly what a pattern is? Pattern comes from data (Pramanik, S. et al., 2023) and data comes from the word ‘datum’ that means basic unit of measuring and calculating anything. Generally, data is everywhere, whatever we use either to manipulate or to calculate we refer data. Data is any factual information (such as measurements or statistics) (Iyyanar, P. et al., 2023) that is used to support argument, debate, or calculation. The researcher frequently gather data in order to look for patterns, such as upward trending numbers or connections between two sets of numbers and can occasionally observe such pattern in a basic tabular presentation of the data, depending on the data and the patterns. Other times, a chart, such as a time series, line graph, or scatter plot, might aid to visualize the data.

Figure 1. Patterns



- A pattern, for example, could be an object or an event.

Alexander, an architecture professor at the University of California, Berkley, was the first to investigate patterns in engineering in a systematic way. His work, in which he

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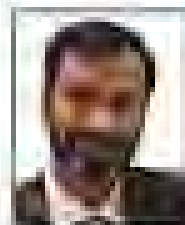
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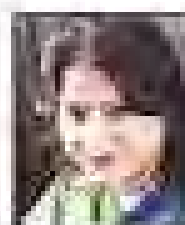
About the Book

This book of "Human Resource Management" highlights the important aspects of managing human resources in workplace. This book is designed specifically for students for the convenience of the book are written in a simple language with detailed information. Exercises and previous year solved papers are also included in the book. The contents of the book are supported with tables and figures. It is hoped that the book should serve as a useful text for the students.

About the Author



Dr. Ajay Pratap Singh is a Medical Graduate with Post Graduation & Ph.D. in Management. He is currently working as a Professor in the Department of Management at Mangalagiri Institute of Management & Technology, Guntur, Andhra Pradesh. He is also affiliated to ACT University, Urdhva, U.P. He has also been associated with the colleges of GGS Indraprastha University for 13 years. He has authored and published no. of papers in reputed Journals and Conference Proceedings. He has participated in more than 70 National & International Conferences, Workshops & Seminars. He has also presented papers at various National & International Conferences & Seminars at various levels. He is a Life Time Member of National Institute of Personnel Management (NIPM). His specialisation is in Human Resources (HR) especially in Organisational Behaviour, Industrial Relations, Labour Laws, Organisation Change & Development, Leadership, Strategic HRM & Business Communication.



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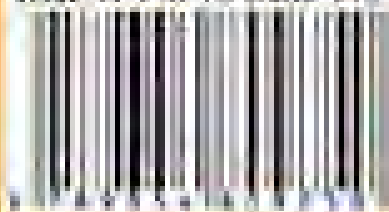
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Abstract

Document Sections

I. introduction(heading 1)

II. Literature Review

III. Objectiveof Study

IV. Conceptual Insight of Green Marketing Strategies

V. Model Building for Green Marketing Strategies

» Regression Weights: (group Number 1-Default model)

VI. Conclusion

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Figures

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Keywords

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The practice of promoting and selling products and services that are environmentally friendly is known as green marketing, sometimes known as sustainable marketing or env... **View more**

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Abstract:

The practice of promoting and selling products and services that are environmentally friendly is known as green marketing, sometimes known as sustainable marketing or environmental marketing. This includes the product's marketing and promotion as well as all facets of its production, packaging, and disposal. The goal of green marketing is to satisfy customer needs and wants while simultaneously creating and providing ecologically sustainable products and services. This requires a comprehensive strategy to marketing and consideration of the whole lifespan of the product, from its initial constituents to its final disposal. Another goal of green marketing is to encourage consumers to make more ecologically responsible purchases by educating them about the benefits a product or service has for the environment. This is typically achieved by using eco-labels, which make it easy for buyers to locate items that are environmentally friendly, or by advertising campaigns that highlight a product's beneficial environmental benefits. On the basis of the examination of management personnel's responses, this paper employed the SEM model to explore green management in more detail. According to the research conducted above to determine the critical components of green marketing, the product, pricing, and promotion are the primary factors impacting the environment for green marketing in the Delhi region.

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Contents

I. introduction(heading 1)

Marketing that is environmentally responsible, sometimes known as “green” marketing, is a method of doing business that takes into consideration the concerns of customers with regard to the promotion of the preservation and protection of the natural environment. Green marketing tactics highlight a company’s products and services that offer more environmental protection. The kinds of attributes that are often emphasized include things like reduced waste in the packaging, greater energy efficiency of the product that is being used, reduced use of pesticides in farming, or lower release of harmful emissions and other pollutants in the manufacturing process. The environment and the issues that it faces since that’s one of the reasons why green marketing came into being. The American Marketing Association defines “green promotion” as “the marketing of goods with the presumption that they are not harmful to the environment.” As a result, “green marketing” encompasses a wide variety of operations, such as adjusting the product, making adjustments to the manufacturing process, modifying the packaging, and modifying promotional strategies. [1] Green marketing is a holistic marketing concept in which the product, marketing, consumption, and disposal of products and services occur in a manner that is less harmful to the environment. As more people become aware of the implications of global warming, non-biodegradable solid waste, and the harmful impact of pollutants, etc., both marketers and consumers are becoming increasingly sensitive to the need for switching into green products and services. Green marketing refers to a holistic marketing concept in which the product, marketing, consumption, and disposal of products and services occur in a manner that is less harmful to the environment. Many individuals are under the impression that the term “green marketing” only relates to the promotion and advertising of items that have environmental attributes. Consumers often identify green marketing with concepts such as phosphate-free, recyclable, ozone-friendly, refillable, and environmentally friendly products. Other phrases that are commonly linked with green marketing include “refillable.” Yes, green marketing is a golden goose. According to Mr. J. Polonsky, the term “green marketing” may be defined as “any actions meant to produce and enable any transaction intended to meet human needs or desires so that satisfying of their needs and wants happens with little adverse effect on the national environment.” Marketing that is environmentally friendly is often referred to as ecological marketing and environmental marketing. Because there are only so many resources available and an infinite number of things that people desire, it is essential for the marketing department to make effective use of those resources while minimizing waste and working toward the overall goal of the firm. [2] So green marketing is inevitable. Concern for the health of the planet’s ecosystem is garnering an ever-increasing amount of attention from customers in every region of the globe. There is mounting data from throughout the world that demonstrates people are becoming more environmentally conscious and are altering their behaviours as a result. As a direct consequence of this, green marketing has developed, which is a reflection of the expanding demand for environmentally friendly and socially responsible goods and services.

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Abstract –Recent advances in information technology (IT) have had a profound effect on human resources (HR) procedures and practices. Despite this, there is a dearth of research on its effectiveness, and the studies that have been undertaken have not, in general, assessed how well these new technologies aid firms in attaining their HR goals of attracting, motivating, and retaining personnel. Current systems have limitations, such as being one-way, passive, impersonal, limiting opportunities for human connection, and creating too much physical and intellectual barrier between individuals and enterprises. Data preparation, feature extraction, and model training are the first three stages of the suggested procedure. Normalization is a tool used in the preliminary processing of data. PCA is used to extract features and identify the most informative ones. After feature extraction, the models are trained using BiLSTM-CRF. When compared to the two most common alternatives, BiLSTM and CRF, the proposed technique achieves better performance.

Keywords—Bidirectional Long Short Term Memory (BiLSTM), Extreme Learning Machine (ELM), Principal Component Analysis (PCA)

I. INTRODUCTION

To be competitive in today's business world, companies need to be able to strategically utilize both their existing knowledge assets and the new intellectual capital they generate every day. Businesses around the world today value their employees more than anything else. Employee flexibility, competence, dedication, and expertise are universally accepted as crucial factors in a company's success. Human capital is often overlooked despite its importance. It is rarely protected or utilized to its fullest potential. In order to quickly respond to the information explosion brought about by the electronic capture of data and its storage in giant data warehouses, modern organizations must assess the vast amounts of data they generate. Data mining, also known as knowledge discovery in enormous data, is a technique used to glean actionable insights from massive datasets for

the improvement of decision-making in business. Tools for analytical processing, generating reports, and querying data are all utilized. Traditional management in the business world has prioritized the attainment of short-term financial goals at the expense of more holistic long-term goals related to human issues. As a result of rising public awareness of the possible negative effects of business on the economy, environment, and society, more organizations are taking steps to show their commitment to sustainability. It is also important for businesses to have a sustainability statement to ensure that businesses are doing their part to ensure that society can continue to function in the long-term. The academic community is becoming increasingly interested in studying sustainability and sustainable development. Although there has been an increase in research on sustainability in recent years, there are still linguistic discrepancies when sustainability is presented as part of different scientific domains. And argues that the term sustainability has lost much of its original meaning since it is used mostly as a theoretical assertion, for political purposes, or as a passing trend. The country's SMEs have earned a reputation for their ability to weather economic storms. Having it available makes monetary resources far more distributive. Plus, it can spark innovation that enriches and preserves local traditions alongside the work of communities. Indonesia's small and medium-sized businesses (SMEs) are crucial to lowering the country's high unemployment rate. It's obvious that the primary goal of small and medium-sized enterprises (SMEs) is to provide people with work possibilities through the use of accessible technologies. The growth of small and medium-sized businesses (SMEs) in Indonesia is highly prioritized because they constitute the backbone of the country's populist economic system. The growth of SMEs aspires to fulfill many goals, not the least of which is the eradication of poverty and unemployment. This expansion can also strengthen local and national economies, as well as contribute significantly to the quickening of structural transformation. Organizations face a considerable level of

uncertainty in their search for solutions to today's "grand challenges". Many factors contribute to today's most pressing problems, such as climate change, economic instability, and political upheaval. Since these main challenges in today's interconnected world may immediately endanger the life and existence of organizations, they must be responsive and adaptive in how they organize and manage their workforces. The COVID-19 epidemic has thrown human resource management (HRM) into chaos, forcing managers to immediately investigate "unknown unknowns" in an effort to help their people adjust to and recover from the drastic changes to their working and social life.

II. LITERATURE SURVEY

In an effort to shed light on the causal links between GHRM practices and OCBE, the current system draws on Ability-Motivation-Opportunity theory. The proposed approach also use a mixed-methodology strategy to investigate how green training, green performance management, and green employee involvement in hotels contribute to OCBE in an unexplored region of the world: Vietnam. Together, the literatures on environmental management and human resource management [1] in the hospitality industry are brought together here. Managing one's impact on the environment has been increasingly important for corporations and governments over the past few decades [2]. As a result of increased customer and market expectations and new rules and laws, hotels and the hospitality industry as a whole have become more ecologically concerned and sophisticated [3]. As a result, environmental concerns have recently become a focus of academic inquiry in the discipline of management. Using and to integrate environmental management practices. Organizational support for environmentally responsible practices is essential environmental citizenship. In this is especially crucial because it aids in environmental challenges and bolstering businesses' long-term viability[4]. Traditional methods of hotel administration for environmental sustainability has led to a general improvement in environmental circumstances effectiveness and maintaining a competitive edge. There are a number of scholarly publications that discuss various elements of OHRMAA and OCBE. Improvements are produced in the theoretical world become yourself acquainted with the existing GHRM literature, [5]give further support. Learn more about the environmental impacts of GHRM through case studies. And performance effectiveness; this was found by management of the supply chain that is mindful of the environment the work. The purpose of Supply Chain Management is to "professionally utilize Information and Technology to expand, create, implement, and monitor supply chain operations"[6]. "Supply chain management" (SCM) is a strategy for maximizing organizational efficiency from the product's point of origin to the consumer's hands[7]. When employees violate HR policies, the company and its workers may be held liable in criminal and civil courts. More victims of ethical violations in human resources file complaints with the Better Business Bureau, the Equal Employment Opportunity Commission, and other

regulatory agencies than victims of ethics violations in other departments (such product development or accounting). Organizations can lessen the likelihood of allegations of discrimination and harassment in the workplace by instituting comprehensive ethics programs. Costs associated with legal disputes can be mitigated as a result. Increasing globalization, competition, privatization, liberalization, commoditization, and technical advancements have also contributed to SCs' growing complexity [8].Human resource development (HR development) is something a business should strive for if it wants to boost productivity and employee morale [9].Human resource micromanagement. Human resource management (HRM) is crucial to business success, but it isn't enough on its own [10] a competitive edge that will last for years. To better detect, assess, and capitalize on external opportunities, firms are under pressure to enhance their internal knowledge management capabilities[11]. These changes are being fueled by globalization and the evolution of the social, economic, and technological sectors, all of which call for novel, collaborative approaches to innovation[12]. In order to supplement and improve upon the information currently available within the organization, the open innovation paradigm asserts that companies can and should collect externally distributed knowledge. Organizations should encourage workers to combine their own knowledge and experience with those found elsewhere [13] in order to improve processes and outputs. Research in corporate responsibility, social responsibility, and human resource management have all contributed to the development of a new field: sustainable human resource management (HRM). It follows the standard practices and theories of HRM in the private sector [14].It addresses a wide range of issues, from making sure employees are treated fairly to encouraging a mindset of sustained leadership, teamwork, and cultural sensitivity. Socialization, risk administration, worker input, and environmental responsibility [15].They studied human resource management (HRM) in innovative companies, which benefit from the psychological strengths and flexibility of their employees, and discovered that these traits are financially advantageous significant effect on human resource sustainability. Similar to [16], a sustainable competitive advantage must be created and maintained benefit, companies require employees that stand out from the crowd and can't be easily replaced. Businesses that are sustainable operate at a high level of efficiency and competitiveness. Meeting the needs of employees is also widely acknowledged to be a top priority providing them with a nice environment to work in [17].Human resource management is a powerful tool for introducing new ideas and practices into an organization, such as those related to sustainability [18], Industry 4.0, and Corporate Social Responsibility (CSR). Adopting sustainable practices and the disruptive technology offered by the Fourth Industrial Revolution can improve professional operations and lead to the creation of new jobs. [19]The widespread use of disruptive technology has a disproportionate impact on today's youth. One positive outcome of their existence could be improved methods of instruction and content organization. To described in detail how using technology

improved the standard of their research. The authors also showed that effective HRM and a link between knowledge and technology delivery were key. [20] However, disruptive technologies may have unintended consequences if these digital tools are misused. The tools of the Fourth Industrial Revolution have the potential to facilitate learning and knowledge development, but their reckless usage should be discouraged. Therefore, these tools might be used to help spread information all across the world. As was mentioned in the prior statement, technology can be used as a teaching tool [21]. A secondary disruptive effect of the IoT is its ability to facilitate young people's incorporation into the digital context alongside other software and hardware.

III. PROPOSED SYSTEM

Programming across many countries (and time zones) is a totally different beast from writing code in a single locale. Effective human resource management is predicated on close coordination and cooperation amongst members of a team spread across multiple locations. The People Capability Maturity Model (People CMM) is an effective tool for improving the standard of HR management. While GSD has been widely embraced by corporations, the People-CMM has been more difficult to implement.

A. Data preprocessing:

When it comes to healthcare databases, having a wide variety of different data sources means that the data mined from them is often contradictory, insufficient, and redundant. Preprocessing healthcare data is essential for preserving its veracity, uniformity, exhaustiveness, and confidentiality. Before analysis, the data are normalized by scaling or altering them so that each feature contributes the same to the total. A new range can be constructed from an existing one using the normalization technique. This information could be used to make useful forecasts or predictions. No matter what transformations are applied to the raw data, the information gained from each feature remains the same. This method focuses on fixing two significant problems with data that can frustrate machine learning algorithms: outliers and dominant features.

Based on statistical measurements from raw (unnormalized) data, several approaches have been developed for normalizing data within a given range. Our data was normalized using the Min-Max and Z-score techniques. In contrast to normalization, which merely adjusts distributions, discretization modifies continuous variables by means of discrete intervals. These procedures are arranged in accordance with the statistics employed to normalize the primary data.

The first step of min-max normalization is a linear transformation of the data. By employing this technique, the proposed system are able to keep track of how various bits of data relate to one another. An essential technique for properly fitting data is the use of predetermined borders with predefined bounds. Using this method of normalization,

$$R' = \left(\frac{R - \text{min value of } R}{\text{max value of } R - \text{min value of } R} \right) * (O - Z) + Z \quad (1)$$

The first of R 's bounds is $[O, Z]$, which indicates that it makes use of min-max information. Both the original data and the mapped version have a range of R . I -score normalization takes data that is otherwise unstructured and uses the mean and standard deviation to create a normalized score. The I -score variable, as shown in (2), can be used to normalize the data.

$$q'_m = \frac{q_m - \bar{I}}{\text{Std}(I)} \quad (2)$$

Where q'_m displays the normalized I -score values and q_m reveals the m th column row Y in which the value can be found.

$$\text{Std}(I) = \sqrt{\frac{1}{(L-1)} \sum_{m=1}^L (q_m - \bar{I})^2} \quad (3)$$

$$\bar{I} = \frac{1}{L} \sum_{m=1}^L q_m \quad (4)$$

Rows beginning with E, D, Q and H through G hold the " m "-starting variables or columns. Each row can be analyzed using the I -score approach if the data's standard deviation is zero, as it would be if all the values in the row were set to zero [22]. Like the I -score, Min-Max normalization shows a continuous scale from 0 to 1. Decimal scaling allows for values between -1 and 1. According to this method,

$$q^m = \frac{h}{10^a} \quad (5)$$

Scaled values are denoted by q^m , the range of values by h , and the smallest integer possible, $\text{Max}(|q^m|) < 1$, by a .

B. Feature Extraction:

1) PCA:

Principal component analysis (PCA) reduces data complexity by ignoring or excluding unimportant factors. When a huge dataset is reduced in size using principal component analysis (PCA), a least-squares projection is produced. Reduce the size of a dataset by determining a subset of its original variables that nevertheless accurately represents its essential variability; this process is known as dimensionality reduction. The goal of principal component

analysis (PCA) is to find a transformation between a set of potentially correlated features and a set of features that are linearly uncorrelated. The rows that undergo this modification are known as major components. This strategy is optimized for matrices with few properties. Complex datasets can be simplified with PCA by keeping the most useful information while discarding the rest. Dimension reduction with this method is easy and nonparametric. Therefore, it can be applied to tasks such as data compression and categorization [23]. Principal component analysis has been put to use in numerous disciplines. Data reduction techniques, such as pattern recognition, can be used to process images and compress

them. The principal component of the covariance matrix and the direction of greatest variation within the input space can be found using a computer-assisted discrepancy analysis technique.

The algebraic, technical definition of PCA follows. Find the average and standard deviation of the N values.

$$\rho = Q\{U\} \quad (6)$$

Then, find the coefficient of correlation.

$$A = CON(N) = Q\{(N - \rho)\}(\rho)(N - \rho)^Y \quad (7)$$

C. Training the Model:

1) Bidirectional LSTM:

One sort of Recurrent Neural Network that can be used to comprehend long-term dependencies is the Long Short-term Memory Network (LSTM). With the help of structures called gates, the LSTM can add or remove information from the state of its cells. An LSTM update expression at time t is formally expressed as

$$z_v = \omega(B_z[u_v; g_{v-1}] + w_z) \quad (8)$$

$$q_v = \omega(B_q[u_v; g_{v-1}] + w_q) \quad (9)$$

$$r_v = \omega(B_r[u_v; g_{v-1}] + w_r) \quad (10)$$

$$\tilde{j} = \tan g(B_j[u_v; g_{v-1}] + w_j) \quad (11)$$

$$j_v = q_v \cdot j_{v-1} + z_v \tilde{j}_v \quad (12)$$

$$g_v = r_v \cdot \tan g(j_v) \quad (13)$$

Where ω is the sigmoid function applied to individual elements and is the matrix multiplication applied to individual elements. The hidden state vector is denoted by g_v , and the input vector at time v is denoted by u_v . The parameters to be learned are the weights B_z, B_q, B_r and B_j and biases (w_z, w_q, w_r, w_j). For each input vector x_t in a given sequence $(u_1, u_2, \dots, u_y)$, LSTM calculates a context representation vector g_v . When processing a string of words, features can be used effectively in both the right and left directions because both the past and future inputs are known at a given instant. This adaptation of the LSTM is referred to by its acronym, BI-LSTM: long short-term memory. Here, LSTMs (both forward and backward) are fed information to understand the left and right context of the word. By concatenating the left and right contexts of a word, they arrive at its final representation: $\vec{g}_v, \tilde{g}_v = [\vec{g}_v, \tilde{g}_v]$. Because they use LSTMs with 150 dimensions in both directions, the resulting vector representation of each learnt word has 300 dimensions. Next, a hidden layer is added on top of the BI-LSTM, and $\tilde{g}_v$ is projected into this hidden layer, with the size of the hidden layer equal to the number of unique labels. The output of this layer is a score matrix K , where $K_{z,c}$ is the value assigned to the c th tag of the z th input token. The following layer, BI-CRF, receives this score matrix.

2) Bidirectional CRF:

Modeling the conditional probability distribution $k(n|u)$ directly is the focus of the discriminative approach to classifiers. To predict a multivariate output n from a

large number of input features u , Conditional Random Field (CRF) takes this method. In CRF, all clique potentials $\phi_j, 1 \leq j \leq J$ are dependent on the characteristics that were initially used as input, making it a form of Markov Random Field. In most cases, the cliques' potential is considered to be represented as a logarithmic function [24]. Linear Chain CRF, a special example of CRF built on top of a BI-LSTM, simulates interdependence among labels in the output space effectively. Using the CRF specification as a whole, the proposed system may say that $u = \{u_1, \dots, u_v\}$ and $n = \{n_1, \dots, n_v\}$ stand for the observed input tokens and the corresponding output labels, respectively.

In the case of a linear chain, the CRF distribution $k(n|u)$ is

$$k(n|u) = \frac{1}{I(u)} \prod_j \phi_j(n, u) \quad (14)$$

When the normalization function $I(u)$ is used.

$$I(u) = \sum_n \prod_j \phi_j(n, u) \quad (15)$$

The CRF layer only needs to learn the transition probability of the output labels, $S \in \mathcal{O}^{P+2 \times P+2}$, because the hidden layer on top of the BI-LSTM calculates the score matrix K for a particular sequence. If there are P unique labels, then there should be two extra labels, one for each of the beginning and ending points. The score matrix K_z, n_z is learned by the hidden layer and serves as the input characteristics of tokens x in the clique $\phi_j(u, n)$. The inference process introduces a start tag, y_0 , and an end tag, $n_v + 1$; the probability score for a given sequence of predictions, $n = \{n_1, \dots, n_v\}$, is defined as

$$A(u, n) = \sum_{z=0}^v S_{n_z, n_{z+1}} + \sum_{z=1}^v K_z, n_z \quad (16)$$

The probability of a given sequence, y , can be written as

$$k(u|n) = \frac{e^{A(u, n)}}{\sum_{n' \in n} e^{A(u, n')}} \quad (17)$$

Maximum likelihood of the probability distribution, represented as, is the objective function.

$$\ln k(n|u) = A(u, n) - \ln \sum_{n' \in n} e^{A(u, n')} \quad (18)$$

The possibility of training sequences being right is maximized at the highest possible level during training. The highest score among these factors determines the order in which tags are output.

$$n^* = \arg \max_{n' \in n} A(u, n') \quad (19)$$

Forward and backward inference, which is based on dynamic programming, can be used to efficiently compute

(18) and (19) because they only represent binary interactions among the output labels.

The entities are broken down in both forward and backward directions using a form of CRF called bidirectional CRF (BI-CRF). The input tokens $u = \{u_1, \dots, u_v\}$ are read and labeled in the original direction (left to right) in forward parsing (CRFA), while in backward parsing (CRFB) the order is reversed (right to left), $u = \{u_1, \dots, u_v\}$ with its labels $n = \{n_1, \dots, n_v\}$. When calculating the final probability values, CRFF and CRFB scores are added together. As a result, below is the best possible order of tags for the output:

$$n^* = \arg \max_{n' \in n} [S_A(u, n') + S_B(u, n')] \quad (20)$$

IV. RESULT AND DISCUSSION

Because of the profound impact culture has on management practices, tailoring your approach to a certain culture is essential. A growing corpus of research suggests that cultural differences have major implications for HRM strategy development and implementation. The purpose of this publication is to provide HR practitioners in Serbia, foreign organizations with a presence in the country, and any other country or organizational setting with cultural parallels with insight into the impact of national culture on HRM practices and processes.

TABLE I. COMPARITIVE EXPERIMENTAL RESULT

MODEL	ACCURACY	RECALL	F1-SCORE
SVM	0.9622	0.9577	0.9764
CNN	0.9483	0.9349	0.9549
ELM	0.9178	0.9075	0.9202

Table 1 show that the F1 value of the algorithm presented in the system is much higher than those of the other two algorithms and lower than that of the classic statistical method. The best performance of the method is 0.9764, with an F1 value of 0.9202 for huge amounts of data and an increase to 0.9549 for the more prevalent BiLSTM.

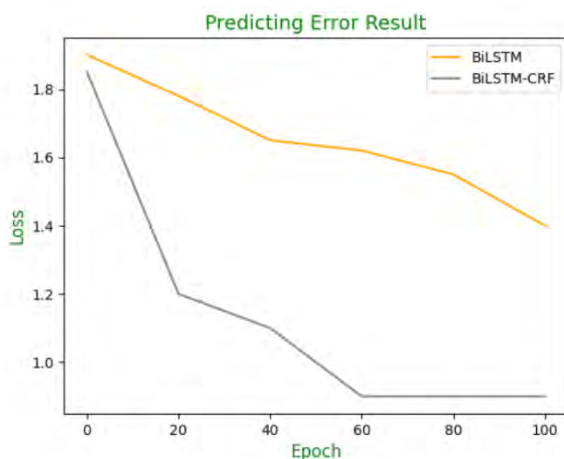


Fig. 1. Predicting Error Result of the models

The BiLSTM-CRF training error trend is depicted in Figure 1. The network-trained output values are very close to the optimal values, as can be observed.

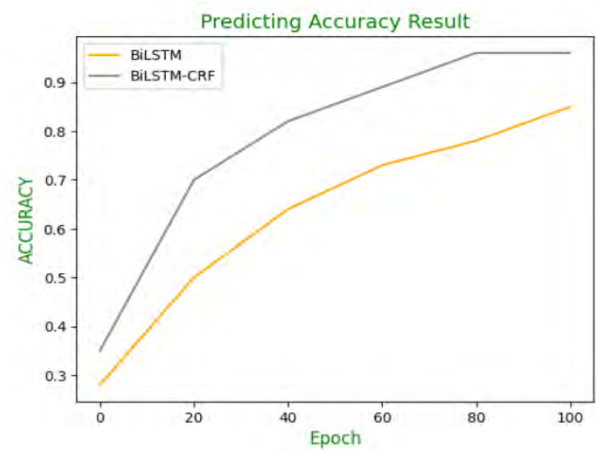


Fig. 2. Predicting Error Result of the models

Figure 2 displays the obtained data. The resulting value of $R = 0.9622$ suggests that our model has been trained successfully.

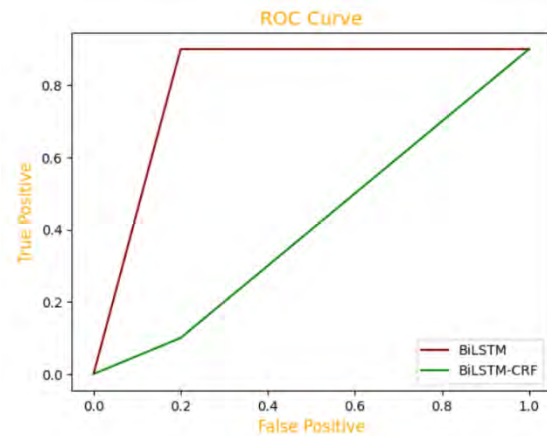


Fig. 3. ROC Curve

The ROC curves of the BiLSTM-CRF and the suggested approach are displayed in Figure 3. The figure shows that the AUC increases to 96.22 percent when BiLSTM-CRF is used. This shows that the proposed strategy performs better than the baseline when identifying outliers in the dataset.

V. CONCLUSION

Human resource management (HRM) encompasses a wide range of activities fundamental to every project-based firm, all of which have an impact on the way in which employees are hired, developed, and ultimately treated. Researchers and theorists develop knowledge in particular ways through publishing their findings in books and journals, affecting the framing of HRM arguments in the academic and practitioner literatures. Organizations that rely on projects as their primary form of work design are not adequately addressed in the existing literature on human resource management (HRM), which is largely framed in terms of large, stable organizations. In preparing data, normalization procedures are used. Features are extracted using principal component analysis. The BiLSTM-CRF methodology is employed in this class. The proposed system provide an assessment of

the suggested approach in comparison to the BiLSTM and the CRF, two of its primary competitors. The recommended method has an impressively high success rate of about 96.22 percent, well surpassing that of the two competing methods.

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Visual Communication

The Power of the Lens

*Dr. Shivendu Kumar Rai
Mr. Karan Singh*



Contents

S.NO	Paper Title and Author Name	Page No.
1	Preface	iii
2	About the book	v
3	The History Of Photography: A Visual Journey <i>Ms. Aastha Tandon, Mr. Karan Singh, Assistant Professor</i>	1
4	Digital Photography Trends <i>Ms. Gauri Joshi, Assistant Professor</i>	16
5	Cross Media Photography based on Visual Communication Design <i>Ms. Adity Agrawal, Assistant Professor</i>	44
6	Visual Communication Design and Image Processing <i>Ms. Surbhi Agrawal, Assistant Professor</i>	59
7	Photography and Ethics <i>Mr. Neeraj Singh Mehta, Mr. Karan Singh, Assistant Professor, Dr. Shivendu Kumar Rai, Assistant Professor</i>	75
8	The Art of Storytelling Through Photography <i>Ms. Rebecca Mary Reji, Mr. Karan Singh, Assistant Professor</i>	88
9	Exploring the Art of Night Photography: Capturing Powerful Impressions <i>Ms. Navyasha, Mr. Karan Singh, Assistant Professor</i>	95

S.NO	Paper Title and Author Name	Page No
10	The Fine Line Between Transparency and Sensitivity <i>Ms. Himanshi Kochar, Mr. Karan Singh, Assistant Professor</i>	108
11	Photography and Painting: Two Different Expressions of Art <i>Mr. Himanshu Sharma, Mr. Karan Singh, Assistant Professor</i>	119
12	The Rise of Digital Photography: How It Changed Photography Techniques <i>Ms. Sneha Shrivastava, Mr. Karan Singh, Assistant Professor</i>	132
13	Ethical Visual Storytelling: A Toolkit for Protecting the Dignity of Subjects <i>Ms. Prerna Singh, Mr. Karan Singh, Assistant Professor</i>	143
14	The Impact of Digital Photography in Photography Methods <i>Ms. Iram Parveen, Mr. Karan Singh, Assistant Professor</i>	155
15	Photography in the 1800s: A Changing Visual Landscape <i>Ms. Sakshi Shukla, Mr. Karan Singh, Assistant Professor</i>	165
16	The World Through a Photographer's Lens <i>Ms. Garima, Mr. Karan Singh, Assistant Professor</i>	179
17	The Latest Trends in Wedding Photography <i>Mr. Kenneth Macknight, Mr. Karan Singh, Assistant Professor</i>	195
18	The Pandemic Through the Lens of Photojournalism <i>Mr. Joy Atul Kerketta, Mr. Karan Singh, Assistant Professor</i>	207

19	The Power of Visual Storytelling in a Digital Age <i>Mr. Khushal Malhotra, Mr. Karan Singh, Assistant Professor</i>	217
20	Photography: A Powerful Tool for social media <i>Ms. Tanishka Sharma, Mr. Karan Singh, Assistant Professor</i>	238
21	Reflexive Photography in Encouraging Tourism <i>Mr. Ravi Kumar, Assistant Professor</i>	245
22	Culture Through the Lens <i>Ms. Riya Nandal, Mr. Karan Singh, Assistant Professor</i>	258
23	Fashion And Visual Communication: The Art of Conveying Style <i>Ms. Akanksha Kumawat, Ms. Yashasvi Rajawat , Assistant Professor Assistant Professor</i>	268

Visual Communication

The Power of the Lens



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