https://doi.org/10.33472/AFJBS.6.6.2024.7522-7532

AFJBS

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

# Advancing Food Quality: Exploring Modelling Techniques with Artificial Intelligence and Machine Learning

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**Article Info**

Volume 6, Issue 6, July 2024

Received: 03 June 2024

Accepted: 31 June 2024

Published: 25 July 2024

*doi: 10.33472/AFJBS.6.6.2024.7522-7532*

**ABSTRACT:**

Artificial Intelligence (AI) and Machine Learning (ML) have changed a variety of industries, including food. This study investigates sophisticated modeling techniques using AI and ML to improve food quality, from farm to fork. AI-driven predictive analytics and machine learning algorithms are used to monitor and control different phases of food production, processing, and distribution. Precision agriculture uses AI models to optimize planting, irrigation, and harvesting, resulting in greater crop yield and quality. During processing, ML techniques such as image recognition and spectroscopic analysis are employed to detect pollutants and assess food quality in real time, assuring safety and standard compliance. Predictive models are used in packaging and storage to anticipate shelf life and identify spoiling, minimizing waste while maintaining quality. AI-powered supply chain management solutions streamline logistics, guaranteeing that consumers receive fresh, high-quality food. Case studies of successful AI and machine learning deployments in diverse food businesses are presented, revealing the actual benefits and potential limitations of these technologies. The study finishes by discussing ethical implications, data privacy concerns, and the need for legislative frameworks to enable the responsible use of AI and machine learning in food quality development. This comprehensive assessment highlights AI and ML's transformative potential in enhancing food quality, safety, and sustainability, and advocates for their widespread use and continual innovation in the food industry.

**Keywords**: Food Quality, Artificial Intelligence, Machine Learning, Case Studies and Practical Implementations



## 1. Introduction

The accelerated development of AI and ML has created new opportunities in a variety of industries, including the food business. Ensuring high food quality from production to consumption is a multifaceted task that includes farming, processing, packaging, storage, and distribution. Historically, ensuring food quality has relied on manual inspections, established methods, and regular testing. However, these strategies frequently fall short of addressing the dynamic and complex character of food quality management. AI and ML provide significant tools for improving these processes through automation, accuracy, and predictive capabilities [1]. In agriculture, AI-powered precision farming techniques optimize planting, irrigation, and harvesting, resulting in increased agricultural yields and quality. Sensors and IoT devices provide real-time data on soil conditions, weather, and crop health, which ML models use to generate actionable insights. ML algorithms improve quality control during food processing by detecting pollutants and assessing food qualities quickly and accurately using image recognition and spectroscopy [2]. These technologies ensure that food items meet both safety requirements and consumer expectations. AI and ML also play an important role in packing and storage by forecasting shelf life and recognizing spoiling concerns, so decreasing food waste and ensuring high-quality food reaches consumers. AI-powered supply chain systems optimize logistics, regulating transit conditions to keep products fresh and high-quality. The amalgamation of IoT and AI systems allows for continuous monitoring and data collecting, which improves food quality management methods [3]. This study attempts to provide a complete overview of the AI and ML modeling techniques that are being used to improve food quality. It investigates the use of these technologies at various levels of the food supply chain, provides case studies of successful implementations, and considers the practical benefits and potential obstacles [4]. It also discusses ethical concerns, data privacy issues, and the need for strong regulatory frameworks to oversee the responsible application of AI and ML in the food business. By emphasizing these technologies' transformational potential, this article urges for their widespread adoption and ongoing innovation to ensure food quality, safety, and sustainability.

## AI Components in the Food Industry

### a. Natural Language Processing (NLP)

In the food business, NLP improves food safety and quality control by automating customer service and communication. NLP algorithms scan customer reviews and feedback to reveal consumer preferences and areas for development. Sentiment research can reveal the general opinion of a product, allowing businesses to tailor their offerings accordingly [5]. NLP-powered chatbots and virtual assistants may handle customer inquiries, reservations, and orders, hence boosting service efficiency and satisfaction. NLP also helps to process vast numbers of regulatory papers, ensuring that food safety regulations are met. Furthermore, NLP-powered systems may translate menus and labels, making information more accessible to a broad client base [6]. The capacity to extract essential information from unstructured language streamlines operations, improves transparency, and fosters stronger customer relationships.

### b. Machine Learning (ML)

Machine learning is critical for optimizing numerous operations in the food business. ML models predict demand, allowing firms to effectively manage inventories and decrease waste. These models use historical sales data, seasonal trends, and external factors like as weather to effectively predict future demand [7]. In food processing, machine learning algorithms monitor production lines to detect irregularities and assure constant quality. Predictive maintenance models discover equipment flaws before they cause downtime, allowing for continued operations. Personalized marketing strategies use ML to recommend products based on individual consumer behavior and preferences [8]. Furthermore, ML helps with food safety by evaluating data from sensors and inspections to identify potential risks. ML models grow over time by continuously learning from new data, providing increasingly accurate predictions and suggestions that promote efficiency and innovation in the food industry.

**c. Robotics**

Robotics in the food business improves productivity, accuracy, and safety across a variety of tasks. Robots are employed to plant, harvest, and sort crops, eliminating manual work and improving output. Automated systems can manage delicate activities like selecting fruit without causing damage, resulting in higher-quality produce. In food processing plants, robotic arms conduct repetitive jobs with precision and speed, lowering the danger of human error [9]. AI-enabled robots may also manage inventories, move products throughout warehouses, and optimize storage space. Collaborative robots (cobots) work alongside humans, assisting with activities that require both human dexterity and robotic precision. Furthermore, robots boost worker safety by taking on dangerous duties like handling hot or toxic material [10]. The integration of robotics in the food sector results in more efficient operations, lower prices, and higher product quality.

**d. Computer Vision**

Computer vision technology has transformed quality control and automation in the food business. Computer vision systems use cameras and AI algorithms to evaluate food products on production lines, detecting faults, pollutants, and irregularities in real time. This technology ensures that only quality-approved products reach consumers, reducing waste and recalls [11]. In agriculture, drones outfitted with computer vision monitor crop health, detecting pests or nutritional deficits early on, allowing for prompt action. Automated sorting systems use computer vision to classify fruits and vegetables based on size, color, and maturity, thereby increasing sorting efficiency. In the retail industry, computer vision enables automated checkout systems that recognize objects and execute transactions without human intervention [12]. Furthermore, shelf-monitoring systems employ computer vision to track inventory levels and ensure shelves are supplied, which improves store operations. The precision and speed of computer vision applications provide considerable gains in quality assurance and operational efficiency in the food industry.

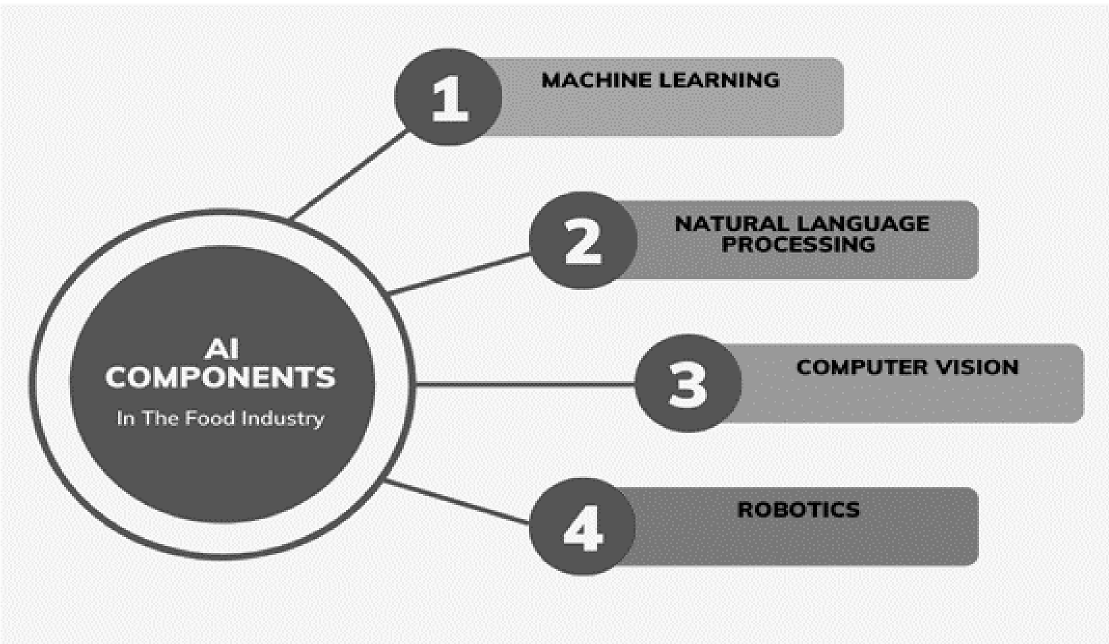


Fig 1: Source - LinkedIn [35]

**e. Other AI Techniques in the Food Industry**

Soft computing techniques like fuzzy logic, evolutionary algorithms, neural networks, and expert systems are transforming the food business by providing complex solutions that outperform traditional hard computing approaches. Fuzzy logic systems excel in managing agricultural uncertainties by enabling flexible decision-making based on imprecise data. For example, in precision agriculture, fuzzy logic controllers can change irrigation levels based on soil moisture content, temperature variations, and crop growth phases, providing efficient water utilization without the need for precise measurements [13]. Genetic algorithms, inspired by natural evolution, help to optimize different elements of food production. These algorithms assess numerous variables at the same time to determine the optimum component combinations for meals that maximize flavor, decrease expense, and meet nutritional requirements [14]. They also manage production schedules and logistics throughout the supply chain, assuring optimal resource allocation and timely food delivery to consumers. Neural networks, a key component of artificial intelligence, excel at predictive analytics and pattern recognition tasks. In agriculture, neural networks examine large datasets of weather patterns, soil conditions, and historical crop yields to forecast future outcomes like harvest volumes and pest infestations [15]. This predictive power allows farmers to make proactive decisions, such as altering planting schedules or implementing targeted pest management strategies, which increases production while decreasing environmental impact. Expert systems apply specific knowledge and rules obtained from human experts to make informed decisions in specific domains of food production [16]. These AI-powered systems combine a knowledge base with an inference engine to monitor and regulate crucial operations, maintaining constant quality and safety requirements. For example, in food processing facilities, expert systems can monitor parameters such as temperature control during fermentation or packing to ensure that products match regulatory standards and consumer expectations [17]. Collectively, these soft computing solutions help food producers manage the complexity of modern agriculture more effectively. By integrating AI and machine learning capabilities, the food industry may improve operational efficiency, improve product quality and safety, and encourage sustainable practices from farm to table. As these technologies advance, their application in food production shows promise in tackling global concerns such as food security, environmental sustainability, and resource efficiency in a constantly changing world.

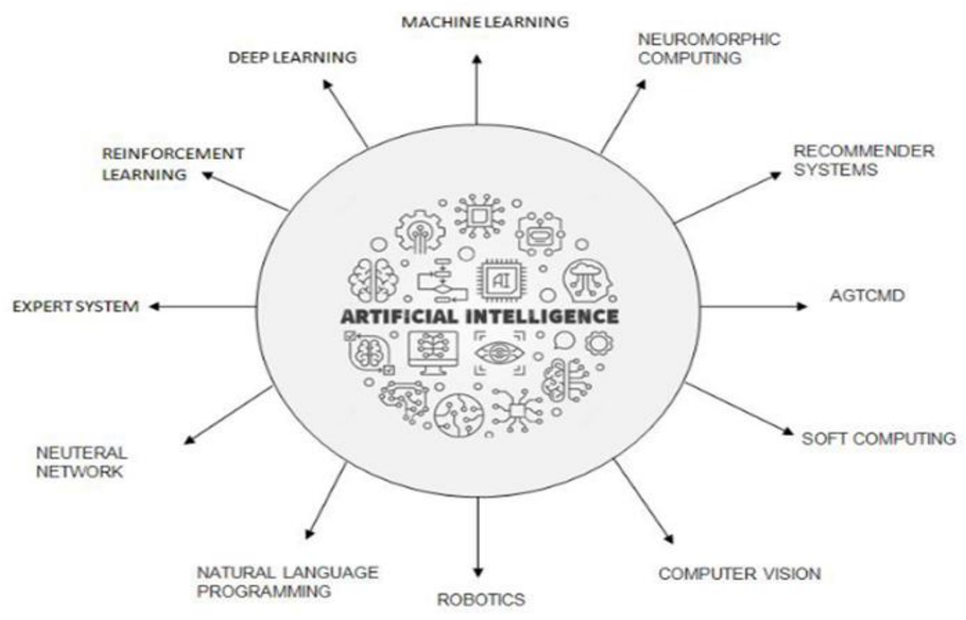


Fig 2: Source - Felix instrument [36]

**Applications in the Food Industry:**

Expert systems in the food business play important roles in a variety of disciplines. They monitor food safety parameters and provide real-time alerts and recommendations to avoid contamination and deterioration, assuring customer safety. Also, expert systems contribute to quality control by detecting deviations from conventional production processes, assuring consistent product quality and regulatory compliance [18]. In recipe formulation, these systems examine aspects such as ingredient availability, economic limits, and nutritional requirements to recommend ideal alterations, increasing the efficiency and creativity of food manufacturing operations. Collectively, expert systems improve operational efficiency, maintain quality standards, and foster innovation in the ever-changing landscape of food processing and preparation.

**AI Techniques in Food Industry**

In recent years, there has been a lot of interest in the use of AI and machine learning in the food business. AI and machine learning help to improve food quality at numerous phases, from agricultural production to consumption. The assessment also discusses the benefits, difficulties, and potential future directions of these technologies in the food industry.

**a. Precision Agriculture**

Precision agriculture is one of the first and most significant applications of AI and machine learning in the food business. Precision agriculture is the use of technology to maximize agricultural yield and manage farm resources more efficiently. Researchers have created numerous machine learning algorithms to predict crop yields, maintain soil health, and improve irrigation operations. The work by [19] used deep learning algorithms to examine satellite photos and weather data, resulting in highly accurate crop yield predictions. Similarly, [20] created ML models that use soil sensor data to prescribe exact irrigation schedules, thereby increasing water use efficiency and crop quality.

**b. Food Processing and Quality Control**

Artificial intelligence and machine learning have considerably improved food processing and quality control by allowing for real-time monitoring and decision-making. In food processing plants, machine learning algorithms scan images from cameras and sensors to detect contaminants and evaluate food quality. The study [21] demonstrated the use of hyperspectral imaging and machine learning to identify foreign objects in food products on production lines. This technology assures that only high-quality items reach customers, lowering the likelihood of foodborne illnesses and recalls. Furthermore, AI-driven spectroscopic techniques have been used to determine the chemical makeup of food. The study by [22] used near-infrared spectroscopy and ML models to identify the freshness and quality of beef products. This method enables quick and non-destructive testing while delivering real-time input to processing facilities.

**c. Packaging and Storage**

Artificial intelligence and machine learning technology have also been used to improve food packaging and storage. Predictive analytics methods predict the shelf life of perishable foods, which helps to reduce food waste. According to the study, [23] built an ML model that predicts the shelf life of dairy products based on temperature, humidity, and microbial activity. Food companies can improve inventory management and save waste by anticipating rotting accurately. Furthermore, IoT devices with sensors collect data on storage conditions, which AI algorithms analyze to provide the best surroundings for food preservation. [24] developed a smart storage system that employs artificial intelligence to monitor temperature and humidity in real time, altering conditions to improve the shelf life of fruits and vegetables. This technique not only preserves food quality, but also reduces energy consumption by optimizing storage conditions.

**d. Supply Chain Management**

The incorporation of AI and machine learning into supply chain management has transformed food distribution operations. AI-powered algorithms optimize transportation routes, ensuring that food goods arrive quickly and in good condition. As [25], ML algorithms were used to anticipate the best shipping routes and schedules for perishable commodities, hence avoiding spoiling and retaining freshness. Furthermore, blockchain technology, when integrated with AI, improves traceability and transparency throughout the food supply chain. [26] investigated the use of blockchain and AI to trace food products' journeys from farm to fork, ensuring authenticity and lowering the risk of fraud. This integrated strategy increases consumer trust and allows for faster responses to food safety issues.

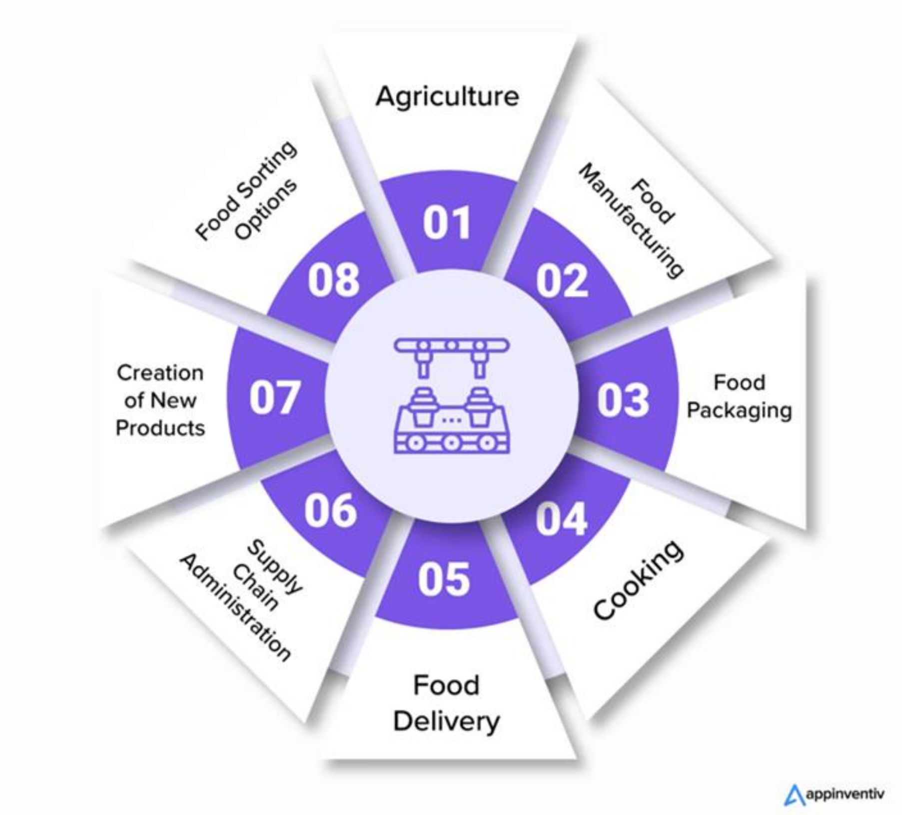


Fig 3: appinventiv.com [37]

**Case Studies and Practical Implementations**

The "See & Spray" system developed by Blue River Technology is an excellent illustration of AI's impact on agriculture. The system uses computer vision and machine learning to identify weeds and selectively apply pesticides where they are needed. This precision decreases pesticide use, lowers farmer expenses, and promotes better crop development, demonstrating AI's potential to increase agricultural efficiency and sustainability [27]. Similarly, IBM's "Food Trust" blockchain network highlights the benefits of AI and blockchain in improving food traceability and safety. Companies such as Walmart and Nestlé use this technology to trace the movement of food products across the supply chain. AI analyzes data from numerous points along the supply chain to identify possible difficulties and optimize logistics, guaranteeing that food items are authentic, safe, and of high quality, which benefits both customers and producers. Several case studies demonstrate the effective use of AI and machine learning in the food business [28]. Blue River Technology's "See & Spray" program drastically reduces chemical consumption while improving crop health through targeted herbicide spraying. IBM's "Food Trust" blockchain network improves food traceability and safety, which is utilized by Walmart and Nestlé to verify product quality. Additionally, TOMRA Food and Impact Vision employ AI-powered systems for food quality assessment, detecting contaminants and quality defects, and providing data for process optimization [29]. IBM Watson's predictive models for food spoilage help retailers optimize inventory management and reduce food waste. Cargill's AI systems monitor food safety and traceability, enabling rapid recalls and proactive risk management. Hungry Root and Innit offer personalized nutrition recommendations using AI, creating customized meal plans and controlling smart kitchen appliances. Walmart and Nestlé use artificial intelligence to optimize their supply chains, with an emphasis on demand forecasting, inventory management, and sustainability [30]. IBM Food Trust detects food fraud using blockchain and AI, ensuring transparency and consumer trust throughout the food supply chain. These examples demonstrate AI and machine learning's dramatic impact on agriculture and the food sector, resulting in increased efficiency, safety, and sustainability.

**Benefits and Challenges of Usage of AI and ML in Food Industry**

**a. Benefits**

The integration of AI and ML in the food business provides various advantages, including increased efficiency, improved food safety, sustainability, and consumer trust. To begin, AI and ML streamline numerous operations in the food supply chain, decreasing human labor and increasing operational efficiency. Automated systems can handle vast amounts of data rapidly and correctly, allowing for speedier decision-making and response times. Second, AI and ML greatly improve food safety by allowing for real-time monitoring and quality control. The ability to detect contaminants and assess food quality in real-time lowers the danger of foodborne diseases and recalls, protecting customers' health [31]. Third, AI-powered precision agriculture and smart storage systems encourage sustainable practices by maximizing resource utilization and minimizing waste. These technologies serve to reduce the environmental impact of food production and delivery, hence promoting long-term sustainability [32]. Finally, integrating AI and blockchain into the supply chain improves traceability and transparency, boosting consumer trust in food goods. Customers can obtain extensive information on the origin and route of their food, ensuring its authenticity and quality.

**b. Challenges**

Implementing AI and machine learning systems in the food business involves a number of obstacles. For starters, the initial expenses of technology and infrastructure investments might be too expensive for small and medium-sized businesses possibly limiting uptake, particularly in developing countries. Second, the necessity for specialized skills in designing and maintaining AI and ML systems is a challenge, as experienced workers are frequently in short supply in particular places [33]. Third, dealing with significant amounts of sensitive data in AI-powered food supply chains raises worries about data privacy and security. Ensuring strong data protection procedures is critical for preserving consumer trust and meeting regulatory requirements. Finally, ethical considerations such as transparency, accountability, and fairness in the use of AI emphasize the significance of adopting ethical principles and regulatory frameworks [34]. Addressing these issues is critical to realizing the full promise of AI and ML while minimizing dangers in the food business.

## 2. Conclusion

This literature review examines the disruptive impact of AI and ML on the food industry, ranging from precision agriculture to supply chain management. The successful case studies and practical implementations demonstrate how these technologies can significantly improve food quality, safety, and sustainability. However, resolving the issues of cost, skill, data protection, and ethical considerations is critical for the widespread adoption and long-term success of AI and ML in the food industry. With sustained study, innovation, and collaboration, AI and machine learning have the potential to change the food business, assuring a safer, more efficient, and sustainable food supply in the future.

**Limitation and Future Scope**

Modelling techniques based on AI and ML have made major advances in improving food quality, however they have limitations and future research potential. Current constraints include the difficulty of effectively simulating real-world food systems due to natural process variability and unpredictability. Future study could look into how AI models can customize food quality assessments to specific dietary demands and health goals, potentially transforming personalized nutrition advice and product development. Finally, future studies and implementations will require addressing ethical problems such as fairness in AI algorithms and guaranteeing equitable access to the advantages of AI-driven food quality improvements.

## 3. Reference

1. M.-M., Janet, Nele, V., & Juan, T.-C., et al. (2021). Understanding smallholder farmers' intention to adopt agricultural apps: The role of mastery approach and innovation hubs in Mexico. Agronomy, 11, 194-2.
2. Koffi, C. K., Lourme-Ruiz, A., Bouquet, E., et al. (2020). The contributions of wild tree resources to food and nutrition security in sub-Saharan African drylands: A review of the pathways and beneficiaries. International Forestry Review, 22(1), 64-82.
3. Gowri Shankar, Dr. V. Purna Kumari,et.al. (2024). Revolution Agri-Food Systems: Leveraging Digital Innovations for Equitable Sustainability and Resilience. 6 (8), 520-530. doi: 10.33472/AFJBS.6.8.2024.520-530.
4. P Nagpal, Avinash Pawar, Sanjay. H.M. (2024). Sustainable Entrepreneurship: Balancing Push and Pull Factors for Customer Loyalty In Organic Product Marketing. 6 (9), 1134-1144. doi: 10.33472/AFJBS.6.9.2024.1134-1144.
5. Sadeghfam, S., Daneshfaraz, R., Khatibi, R., & Minaei, O. (2019). Experimental studies on scour of supercritical flow jets in upstream of screens and modelling scouring dimensions using artificial intelligence to combine multiple models (AIMM). Journal of Hydroinformatics, 21(5), 893-907.
6. BK Kumari, VM Sundari, C Praseeda, et.al (2023), Analytics-Based Performance Influential Factors Prediction for Sustainable Growth of Organization, Employee Psychological Engagement, Work Satisfaction, Training and Development. Journal for ReAttach Therapy and Developmental Diversities 6 (8s), 76-82.
7. Phaiju, P. (2019). Towards food security through artificial neural network. Journal of Science and Engineering, 6, 71-77.
8. P. Nagpal, A. Pawar and S. H. M, "Predicting Employee Attrition through HR Analytics: A Machine Learning Approach," 2024 4th International Conference on Innovative Practices in Technology and Management (ICIPTM), Noida, India, 2024, pp. 1-4, doi: 10.1109/ICIPTM59628.2024.10563285.

9. Namita Rajput, Gourab Das, Kumar Shivam,et, al (2023). An inclusive systematic investigation of human resource management practice in harnessing human capital, Materials Today: Proceedings, 80 (3),2023, 3686- 3690, ISSN 2214-7853, https://doi.org/10.1016/j.matpr.2021.07.362
10. P Nagpal, Arulmoli, et.al. (2024). Determinants Of Women Entrepreneur Motivational Factors Towards Marketing Organic Products, 6 (10), 687-699. doi: 10.33472/AFJBS.6.10.2024.687-699
11. Lakshmi, J.Divya, Pooja Nagpal, et al., (2021). Stress and Behavioral Analysis of Employees using Statistical & Correlation Methods. International Journal of Aquatic Science 12(01), 275-281. ISSN: 2008- 8019 2021
12. P Nagpal, C. Vinotha, et.al. (2024). Machine Learning and Ai in Marketing–Connecting Computing Power to Human Insights. International Journal of Intelligent Systems and Applications in Engineering, 12(21s), 548–561. https://ijisae.org/index.php/IJISAE/article/view/5451
13. G. Gokulkumari, M. Ravichand, et,al. (2023). "Analyze the political preference of a common man by using data mining and machine learning," 2023 International Conference on Computer Communication and Informatics (ICCCI), Coimbatore, India. doi: 10.1109/ICCCI56745.2023.10128472.
14. Boissard, P., Martin, V., & Moisan, S. (2008). A cognitive vision approach to early pest detection in greenhouse crops. Computers and Electronics in Agriculture, 62(2), 81-93. https://doi.org/10.1016/j.compag.2007.11.009
15. Pooja Nagpal (2022) Online Business Issues and Strategies to overcome it- Indian Perspective. SJCC Management Research Review. Vol 12 (1) pp 1-10. June 2022, Print ISSN 2249-4359. DOI: 10.35737/sjccmrr/v12/il/2022/151
16. F. A. Syed, N. Bargavi, A. Sharma, A.et.al . (2022). "Recent Management Trends Involved with the Internet of Things in Indian Automotive Components Manufacturing Industries," 2022 5th International Conference on Contemporary Computing and Informatics (IC3I), Uttar Pradesh, India. pp. 1035-1041, doi: 10.1109/IC3I56241.2022.10072565.
17. Janet, M.-M., Nele, V., Juan, T.-C., et al. (2021). Understanding smallholder farmers' intention to adopt agricultural apps: The role of mastery approach and innovation hubs in Mexico. Agronomy, 11, 194-2.
18. Olan, F., Liu, S., Suklan, J., Jayawickrama, U., & Arakpogun, E. O. (2021). The role of artificial intelligence networks in sustainable supply chain finance for food and drink industry. International Journal of Production Research, 59(16), 1915510. https://doi.org/10.1080/00207543.2021.1915510
19. Pooja Nagpal (2023). The Impact of High Performance Work System and Engagement. Business Review" Vol17 (1) pp 57-64, ISSN 0973- 9076
20. Barzegar, M., Zare, D., & Stroshine, R. L. (2015). An integrated energy and quality approach to optimization of green peas drying in a hot air infrared-assisted vibratory bed dryer. Journal of Food Engineering, 166, 302-315. https://doi.org/10.1016/j.jfoodeng.2015.06.026
21. Sharma, S., & Patil, S. V. (2015). Key indicators of rice production and consumption, correlation between them and supply-demand prediction. International Journal of Productivity and Performance Management, 64(8), 1113-1137. https://doi.org/10.1108/ijppm-06-2014-0088
22. P Nagpal., Kiran Kumar., A.C. & Ravindra., H. V. (2020). Does Training and Development Impacts – Employee Engagement? Test Engineering and Management, the Mattingley Publishing Co., Inc. 83. 19407 – 19411. ISSN: 0193-4120.

23. P. William, A. Shrivastava, H. Chauhan, P. Nagpal.(2022). "Framework for Intelligent Smart City Deployment via Artificial Intelligence Software Networking," 2022 3rd International Conference on Intelligent Engineering and Management (ICIEM), pp. 455-460, doi: 10.1109/ICIEM54221.2022.9853119.
24. Koffi, C. K., Lourme-Ruiz, A., Bouquet, E., et al. (2020). The contributions of wild tree resources to food and nutrition security in sub-Saharan African drylands: A review of the pathways and beneficiaries. International Forestry Review, 22(1), 64-82. https://doi.org/10.1505/146554820828671490
25. P Nagpal (2023). The Transformative Influence of Artificial Intelligence (AI) on Financial Organizations World Wide. 3rd International Conference on Information & Communication Technology in Business, Industry & Government (ICTBIG). Symbiosis University of Applied Science, Indore.
26. S. H. Abbas, S. Sanyal,et.al. (2023). "An Investigation on a Blockchain Technology in Smart Certification Model for Higher Education," 10th International Conference on Computing for Sustainable Global Development (INDIACom), New Delhi, India, pp. 1277-1281.
27. Pooja Nagpal & Senthil Kumar. (2017). A study on drivers and outcomes of employee engagement – A review of literature approach. Asia Pacific Journal of Research.4 (1) 56-62. ISSN -2320-5504. Online E ISSN – 2347-4793.
28. Spanaki, K., Karafili, E., Sivarajah, U., Despoudi, S., & Irani, Z. (2021). Artificial intelligence and food security: Swarm intelligence of AgriTech drones for smart AgriFood operations. Production Planning & Control, 1-19. https://doi.org/10.1080/09537287.2021.1882688
29. Madhusudhan R. Urs & P Nagpal (2019). A study on Determinants and Outcomes of Job Crafting in an Organization; Journal of Emerging Technologies and Innovative Research, 7, (15). 145-151. ISSN: 2349-5162
30. Pooja Nagpal., Senthil Kumar., & Ravindra. H V. (2019). The Road Ahead of HR-AI to boost Employee Engagement; Journal of Emerging Technologies and Innovative Research, 7,(15), 180-183. ISSN: 2349-5162
31. Withanage, D. P., & Damayanthi, B. W. R. (2019). Factors influencing the youths' interest in agricultural entrepreneurship in Sri Lanka. Agricultural Entrepreneurship, 9(12), 32-40.
32. Fayeeza Khanum & P Nagpal.(2019). A Study on Corporate Entrepreneurship Drivers and its Outcome. Journal of Emerging Technologies and Innovative Research, 7, (15), 152- 158. ISSN: 2349-5162.
33. Rady, A., Ekramirad, N., Adedeji, A. A., Li, M., & Alimardani, R. (2017). Hyperspectral imaging for detection of codling moth infestation in GoldRush apples. Postharvest Biology and Technology, 129, 37-44. https://doi.org/10.1016/j.postharvbio.2017.03.007
34. Amin, M. D., Syed, B., & McCluskey, J. J. (2021). Predicting access to healthful food retailers with machine learning. Food Policy, 99, Article 101985. https://doi.org/10.1016/j.foodpol.2020.101985
35. https://www.linkedin.com/pulse/ai-food-industry-what-benefits-challenges-applications-binmile/
36. https://felixinstruments.com/blog/how-ai-analytics-is-transforming-fruit-quality-control-and-monitoring/
37. https://appinventiv.com/blog/ai-in-food-industry/