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Impact of Digital Platforms on Transforming Indian Agro-Logistics

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Abstract **– In the agricultural industry, time is a factor that determines the quality of various raw commodities. It is important to transport the harvested products to a cold storage facility or, alternatively, to the end user directly via wholesale distributors. Crops lose some of their nutritional content and end up costing more to store in cold storage, which drives up prices. Therefore, the crops should be sold as soon as feasible. This can only come to fruition if the logistic infrastructure is modernized and capable of managing the urgent need to move agricultural products. In a well-functioning logistics system, innovation is crucial. At the same time, the agro-industry is struggling with innovation. Multiple publications have detailed the factors that, when combined, make logistics innovation work. While the Indian agro-logistics industry is making strides, it still has a long way to go before it can fully use its infrastructure, reduce its environmental effect, and empower its farmers. These challenges are diagnosed and a transformation plan is proposed in this study. Potentially fruitful avenues for infrastructure development, digital platform acceptance, and precision agricultural adoption are highlighted. Nevertheless, it is imperative to address environmental problems, close the digital gap, and provide fair market access and revenue for farmers.**

Keywords **– Agro-logistics, Digital Platforms, Artificial Intelligence, Supply Chain, Smart Agriculture, Sustainabili--ty.**

I. INTRODUCTION

To a great extent it is true that the world is surviving today on two critical sectors - Logistics and Information Technology (IT). This is applicable for both social and economic scenarios worldwide. In order to survive, people/business, either their requirements should reach them or they should reach their requirements. Either ways it involves the movement of the requirements. In other words, the requirements translates into things - raw materials for businesses, food/shelter/clothes for people or any other thing that is required by them for their respective survival strategy. At the same time, it is also important for them to get to know about the availability of these requirements - where/how/when? This is all about information sharing - personally or publicly. In today's scenario information sharing is associated with information technology. Apart from the need, another way people get to know about their requirements is through various channels. Businesses communicate information about their products/services through one/all of these channels. Once the requirement is known, people/businesses go all their way out to get it. The above illustration indicates the movement of materials/ products and information from one place to another or from one person to another. In this way, logistics and IT are interconnected. This is a macroscopic view of the flow of materials/products and information. When both the industries are seen from within, a lot of interdependency can be seen. In the logistics sector, it is critical to have right information about the product/service being moved from one place. When it is said , the right information, it means - the type of the product/service, source, destination, quantity, value, risk involved, storage requirement, estimation of time/effort/money, etc. It is not always easy to get this information as there is a need for coordination of more than one organization. This is where the IT has got a role to play in the sector.

The Indian economy's ability to expand and develop sustainably depends on agriculture and related sectors.

Through many backward and forward connections, it not only satisfies the 1.3 billion Indians' dietary and nutritional needs, but it also makes a substantial contribution to production, employment, and demand creation (GoI, 2016). Increases in global food production over the last 30 years have not been adequate to alleviate hunger for about 800 million people in Sub-Saharan Africa, South and Southeast Asia, and the Caribbean (FAO, 2015). Global food production has to treble by 2050 to accommodate population and economic expansion, and a significant chunk of that increase has to come from Africa and Asia (Alexandratos et al., 2012). The average holding size of large farmers in India is 17.37 hectares, but the average holding size of small and marginal farmers is just 0.38 hectares. According to Dev (2017), these farmers aren't making enough money or employment from their crop cultivation. In addition to producing 60% of India's food grains, small and marginal holding farmers tend to 49% of the country's rice, 40% of its wheat, 29% of its coarse cereals, and 27% of its pulses (Agricultural census, 2014). These farmers also produce over 50% of India's fruits and vegetables. The public extension system is limited in its ability to meet the growing demand for speedier delivery of input, services, and information among farmers (Mukherjee et al., 2012). Millions of small and marginal farmers work in agriculture, and many of them lack access to resources and modern technology because they are uneducated (Yadav et al, 2015). According to Meera et al. (2004), information and communication technology (ICT) has become a useful instrument for bringing about significant changes in society. Information and communication technology (ICT) has become an essential resource for farmers' knowledge transfer, allowing them to access up-to-date and pertinent data on agricultural methods, disease and pest management, and market prospects. The Indian government and several agricultural organisations have launched programmes like mKisan, the Rice Knowledge Management Portal (RKMP), and Agropedia to aid in the dissemination of crucial agricultural data. These platforms provide farmers with the necessary information to make well-informed choices, which in turn boosts their production and ensures their sustainability. Artificial intelligence (AI) greatly increases the efficiency of agro-logistics by improving timeliness, optimising routes, and providing precise product information. Reduced travel time and fuel costs are possible thanks to AI-driven logistic systems that can find the shortest routes from farms to clients. Additionally, they predict the length of farmer-customer corridors by analysing past data and real-time feedback, which reduces packing time. In order to keep the supply chain running smoothly and without interruptions, AI-powered devices keep an eye on various pieces of equipment.

One of the most significant industries on the globe is agriculture. In developing countries like India, agriculture accounts for around 15% of GDP and is a major source of income for the national economy. Ajaz et al. (2021); Sahni et al. (2021) lists a few of the few nations whose GDP is mostly reliant on agriculture, including Sierra Leone (60% of GDP), the Central African Republic (39.6%), and others. Farmers had a lot of challenges in the early 1900s maintaining the quality of their harvests and vegetables before putting them on the market. This results in decreased food product quality and total losses for farmers. Farmers' lives are very challenging since they spend a significant amount of money in farming and only get 60-70% of their investment back (Markets and Markets, 2020). Since smart farming was introduced, the food industry has grown quickly. According to a worldwide trend, increased investment by major companies in the agriculture sector has been prompted by contemporary smart logistics (Anderson & Katz, 1998; Garg et al., 2021). This makes modernising the agricultural process via the use of new technologies and agricultural industrialization necessary. The agricultural process has several sub processes, starting with crop production and concluding with the delivery of finished goods to customers (Yang et al., 2021). Transportation from the base to storage, storage, loading and

unloading, packaging, and distribution make up the fundamental phases of logistics. These days, it is thought to shorten the duration of the storage phase while working with agricultural products like crops and vegetables. The primary goals of the logistic system are to improve agricultural product quality, production, and food safety. The extensive use of pesticides, herbicides, and synthetic fertilizers has drastically decreased soil fertility. All crops are growing at slower rates as a consequence of the declining quality of the soil. This means that more chemical pesticides, herbicides, and fertilizers are needed. Among the many difficulties faced by farmers engaged in smart agriculture are prompt product delivery to the market, little waste, and product quality on par with harvesting. Unequal agricultural product distribution is another major problem that results in a mismatch between supply and demand. This research aims to examine how digital platforms have revolutionized agro-logistics in India. The research intends to emphasize how technology interventions are improving the agricultural supply chain's efficiency, lowering prices, and overall quality and dependability by analyzing several interventions, such as ICT, AI, and CSA. For rural people in India to experience sustainable development, economic growth, and food security, this transition is vital.

II. Analyzing the Value Chain in Agriculture

The fundamental and most important step in designing an agricultural value-chain, as outlined in the article by Boehlje et al. (1999), is to examine the activities that add value during production and distribution; these actions are what give the final products their desirable qualities that customers buy. Next, we have the governance system, incentive systems to reward performance, product-flow, cash-flow, and information-flow. In order to build upon the wealth of information that farmers already possess, Kumar et al. (2011) stressed the significance of knowledge transfer and the need of accurately modelling it to meet their unique requirements. If we want Indian farmers to trust and rely on these technology models, we need to make sure that the information we provide them is straightforward and to the point, taking into account the many linguistic, cultural, and other obstacles they may face. In addition, it is crucial to think about when it is appropriate to transfer information based on its nature, such as during production or when new financial needs arise, and to make sure that the information is accurate and that there are clear steps and guidelines for implementing it. Production, accumulation, post-harvest processing, and transportation or distribution are the four main aspects that Neven (2014) emphasised in his study as essential components of an agricultural value chain. The three main economic functions that he used to categorise the value-chain were input delivery, financial access, and service delivery. Many parts of the agricultural subsystems do not work together as well as Kumar et al. (2016) pointed out in their article. If that chasm can be filled, the whole agricultural value chain will benefit from increased structure and profitability.

According to Mattern et al. (2017), digital value-chain finance has replaced traditional value-chain financing for farmers and other participants in the agricultural value-chain. This type of financing allows members of the value-chain to access insurance, working capital, and investment financing, all of which contribute to their growth. Among these steps are initiatives to increase the yields of crops and animals, guarantee farmers' incomes via price support, encourage a wider variety of crops, strengthen the foundations of markets, and encourage investments in infrastructure through the Agriculture Infrastructure Fund. Among the value-chain solutions offered by Agri-startups, Shukla et al. (2018) noted that the majority use big data, AI, and the internet of things. According to the research conducted by Jouanjean (2019), digital technologies are continually

conveying information across the agricultural value chain. This information is informed to all parties involved about the practices that are now in place as well as the potential actions that may be taken based on the projections that are suggested by data. Things like transportation, target markets, likely pricing points, herd management, farming, and so on might fall into this category. At their study, (Mikahilov et al. 2019) emphasised that at any given moment, new technical possibilities might cause a fundamental shift in the dynamic structure of any given value-chain. Taking this into account, the agribusiness value-chain for agriculture was split into three parts: before-the-farm, inside-the-farm, and after-the-farm. The majority of agtechs (about 77%) were determined to be addressing farm-related concerns out of the three distinct groups. While only 9% of agtechs were concerned with pre-farm operations, 14% were primarily concerned with solutions after the farm. In his work, Nagesh (2019) emphasised how information and communication technologies (ICTs) raise farmers' agency via access to information and how they become more integrated into the value chain as a whole. Additionally, there is less risk associated with market, pricing, weather, and technological factors. Immediate action is required to strengthen tech-enabled agriculture value-chains to facilitate game-changing agricultural innovations, with a focus on smallholder farmers, according to a paper by Chandra et al. (2020). The article by Denis et al. (2020) highlighted the potential of digital supply chain twins made possible by the massive amounts of data collected from farmers' fields. These twins would allow for the management of production, storage, warehousing, transportation, and marketing through data analytics. Users would have access to personalised mathematical algorithms that could help them maximise profits, optimise inventory, identify food patterns, and optimise inputs and processes both in and out o According to the research by Madan et al. (2020), the majority of investments in the Indian Agritech industry are going towards supply chain tech and output market linkage. Financial services and quality management and traceability are two more sectors that investors are interested in. In their article, Ravi Kumar et al. (2021) emphasised how, with the onset of the Coronavirus pandemic, digitalization of agricultural value-chains has become an essential step in order to link the many participants in these chains. With the help of services like digital payments, consumers will be able to engage with their farmers on a more personal level, leading to a more sustainable and future-focused agricultural model.

III. Digital Initiatives for Better Information Access and Knowledge Management in Agriculture

By making it easier for farmers to share and receive information, digital platforms are revolutionizing Indian agro-logistics. Access to timely and relevant information on effective agricultural practices, pest and disease control, and new market opportunities is crucial for farmers' success. Information and communication technologies (ICTs), according to Kumar et al. (2017), are essential in providing farmers with this information so they may exchange and advance their skills within the agricultural community. Knowledge is often considered the fourth production factor, alongside labor, land, and capital, and it holds particular importance in the agrarian sector (AFAAS, 2011). A platform for obtaining, storing, retrieving, merging, manipulating, visualizing, researching, sharing, and using agricultural information is provided by the Agriculture information Management System. Various portals within this system allow users to interact and collaborate, facilitating shared learning and application of information (Malekmohammadi, 2009).

Several knowledge management initiatives have made a significant impact on farming communities. Initiativ-

-es such as Agropedia, Rice Knowledge Management Portal (RKMP), and the DKMA of ICAR, along with expert systems like Agridaksh of IASRI, have been well-received by users. Other initiatives, including the Krishi Vigyan Kendra Knowledge Network Portal, launched on July 8, 2016, provide regular monitoring and advisories to farmers. The mKisan Portal delivers advisory services to 9 million farmers, while the Farmers' Portal offers a one-stop-shop for information related to agriculture, animal husbandry, and fisheries, streamlining the process for Indian farmers.

Among the ICRISAT projects aimed at meeting the information demands are:

- KrishiVani: an advice system based on voice messages.
- Krishi Gyan Sagar: Piloted a data-driven information system.
- ISABELA (Imagery for Smallholders Activating Business Enterprises and Leveraging Agriculture): precise delineation of land borders is achieved via the use of satellite pictures.
- Farmers are given access to climate data via mobile devices.
- Sowing Application: Farmers get vital information on sowing via a mobile app, which is based on meteorological data and forecast models.
- ICRISAT-incubated ICT-based agri-start-ups start developing software to assist FPOs throughout the country.
- Pest and disease identification app: PEAT Gmbh's Plantix mobile app is tailored to ICRISAT's mandated crops and allows farmers to use their phones to detect pests and diseases and get preventative actions.

IV. Transforming Indian Agro-Logistics: The Impact of Digital Platforms and Artificial Intelligence

The impact of digital platforms on transforming Indian agro-logistics is further enhanced by the integration of Artificial Intelligence (AI). NASSCOM predicts that by 2022, 46% of the Indian workforce will be engaged in new or radically altered jobs due to advancements in technology. To encourage innovation and promote economic development, the Indian government has launched initiatives like Digital India, Start Up India, and Make in India. With the publication of a discussion paper on the National Strategy for Artificial Intelligence, the National Institution for Transforming India (NITI) Aayog) has established the National Programme on AI to direct research and development in new and emerging technologies, acknowledging the importance of AI. An active artificial intelligence (AI) ecosystem in India is the goal of NITI Aayog's three-pronged strategy, which involves bringing together specialists, stakeholders, and the general public to create a distinct "AI for All" brand. While AI has been existing for around half a century, the present century has seen significant improvements in both its influence and its advanced nature. Artificial intelligence (AI) is a cutting-edge technology that encompasses a concise advanced theory, various device kinds, needs-based growth, and real-time applications. It has human-like qualities in the following areas: (i) visual image processing for intelligence; (ii) real-time speech recognition; (iii) application in computerised robotics; and (iv) natural language processing. A look at Figure 1 reveals how AI has progressed. The first AIs appeared in the 20th century, but their widespread deployment didn't occur until far beyond 2010. The progression from simple, memory-less apps to

increasingly complex, memory-aware ones is a hallmark of AI's development over the years [34, 35]. Artificial intelligence (AI) is a subfield of software engineering that aims to create a system that can mimic human intelligence in terms of both thought and behaviour. The smart agriculture industry is seeing a surge in demand for smart logistic systems at the moment. The sections below elaborate on the smart logistic system.

V. SMART LOGISTIC FOR SMART AGRICULTURE SECTOR

Incorporate information and communication technology (ICT) tools like sensors, GPS, and data analytics platforms to connect the various logistical operations. The AI system requires several technologies to gather various types of information. By analyzing historical data to mimic human behavior methods, the AI system can make judgements on its own. Without human involvement, AI systems calculate the best conditions for moving commodities from farmers to consumers by considering routes, prices, and dangers (Musau, 2015; Wang et al., 2021). AI-powered platforms that enable intelligent agricultural logistics have the potential to revolutionize the business in a variety of different ways.

The first benefit of logistic systems driven by AI is its ability to optimize routes. These systems can figure out the shortest ways to get from fields to businesses or consumers. Both journey time and fuel expenses are drastically cut with this optimization. Additionally, AI can improve the timing of logistics operations by analyzing historical data and incorporating real-time feedback from farmers. Overall packing time is reduced because to this capability's precise duration prediction of farmer-customer corridors. Artificial intelligence also improves product information management by giving receiving businesses exact product data like weight, amount, and packaging size. Companies may use this data to improve the efficiency of their labor, storage, and equipment operations. Furthermore, AI-based logistic systems can monitor machinery to detect potential supply blockages caused by poorly maintained equipment. They may regain command of the interrupted supply chain and keep product quality high by sharing pertinent data with nearby logistic systems. Overall, integrating AI into the various phases of the smart agricultural logistic system streamlines the development of the system's topology. In addition to cutting costs and increasing efficiency, this all-encompassing method strengthens the supply chain's quality and dependability. Helping AI systems best satisfy requirements is the responsibility of machine learning, a subfield of AI (Poniman & Sneddon, 2015; Gracia et al., 2018). Figure 1 shows several AI subsets generated by machine learning and logistic architecture implementations. A typical strategy for individuals to minimize costs and increase profits is to take their businesses with them. Every day, companies utilize a wide variety of apps. Chatbots have shown to be an asset in the procurement process. Another AI system uses historical data to simulate human cognitive activity in order to arrive at its own conclusions. To avoid human error in calculating the most efficient routes, pricing, risks, and optimal situations for carrying products from farmers to consumers, artificial intelligence systems have been developed.

5.1. *Smart Logistics Corridor Architecture for Farmers and Customers*

Artificial intelligence paves the way for a better logistical supply model. As shown in Figure 2, AI has the potential to construct the following design. It requires six stages in all. "Farmer side" denotes the first stage. We consider the farmer's information, location, commodity kind, and service time required in this case. Computing the data collected from the farmer's point of view is the second stage. To ensure that every component of the architecture has access to accurate data, the data is made available to the website and cloud. Step 3 involves

storing data locally, whereas Step 4 involves storing data globally. The local data could be useful for both local businesses and customers. The whole dataset is required for the logistic team and the company to detect system issues. Improving system coordination is its secondary role. Stage 5 consists of details from the client's point of view. The customer, who can be an end-user or a business sector, receives information on the commodity's quality inspection, delivery networks, and anticipated arrival time. Stage 6 focuses on feedback. We are always looking for comments to help us improve our service. Giving the system some basic data allows it to easily identify the deterioration level and do its part to fix it. If you follow the six rules of contemporary architecture, you may enjoy a top-notch event to the fullest. With all these procedures covered, the logistic system can work effectively and deliver a fair quantity of cash. Now we'll determine the details by evaluating publically available facts. There will also be a time, quality, and cost comparison between the AI and non-AI systems. Many companies that use AI are making a big splash in the farming industry. A robot called See & Spray was developed by the Californian Company Blue River Technology in response to the issue of herbicide resistance. This autonomous machine uses computer vision to precisely target weeds on cotton plants before spraying them. Strawberry farmers no longer require 30 human laborers when they use Harvest CROO Robotics to harvest 8 acres of land in a single day. The Berlin-based company PEAT created Plantix, a deep learning tool that utilizes machine vision to identify potential soil defects and nutrient deficiencies. In order to provide thorough evaluations of vineyard health, Sky Squirrel Technologies Inc. analyses grapevine leaves using computer vision and drones. Based in Colorado, Where employs machine learning algorithms and satellite data to assess weather, agricultural sustainability, and pest and disease. These AI-driven initiatives and businesses are revolutionizing Indian agriculture in several ways, including increased productivity, sustainability, and farmer profitability.

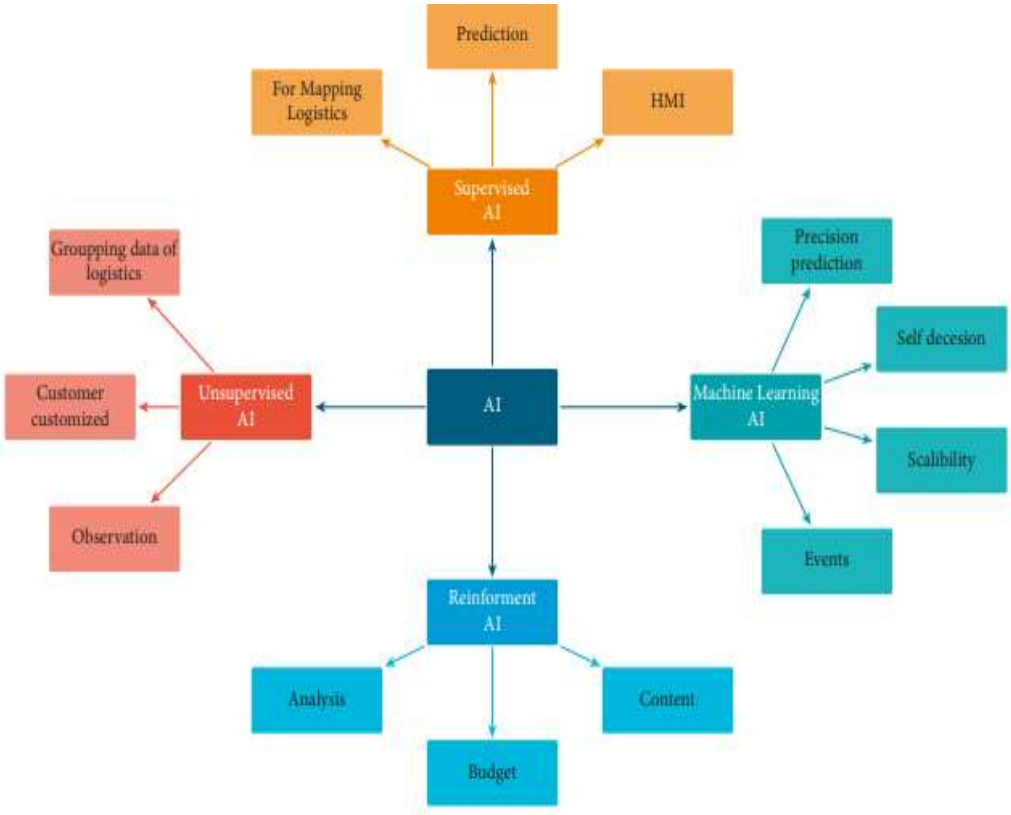

Fig. 1. Applications of the AI system across several logistical domains.

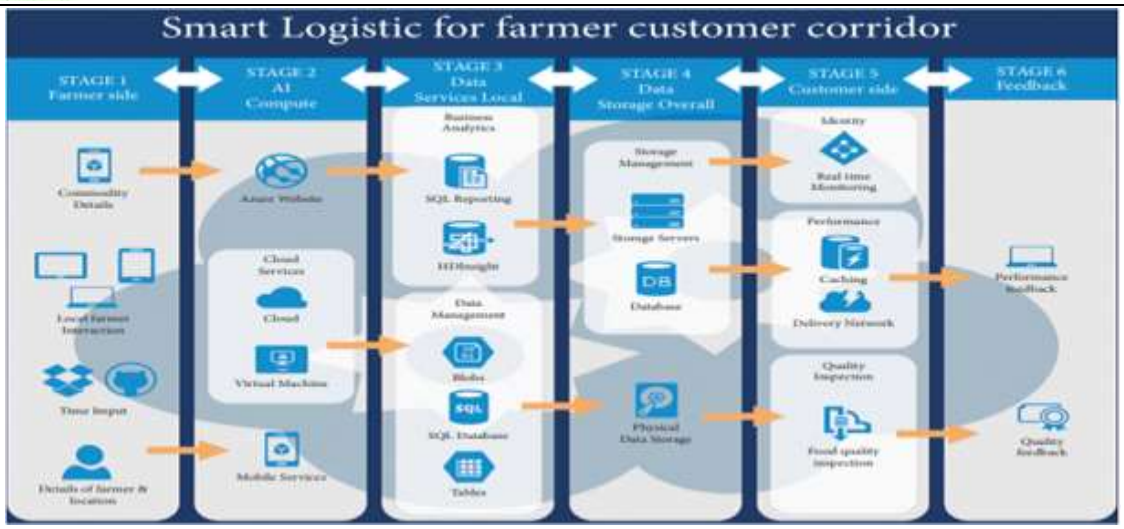

Fig. 2. AI-based smart logistic architecture for farmer-customer corridor.

VI. Supply-Side Drivers in Agriculture

There is a possibility that India might become a "global agricultural hub" for nations who are looking to outsource their agriculture due to severe weather, lack of labor, and restricted land, according to CENTEGRO and CCFI. Marine production is enhanced by India's extensive coastline, many interior water bodies, diverse crop varieties, huge animal base, and high agricultural output. Bringing the Green Revolution to Eastern India (BGREI) is one such initiative that is working to increase agricultural output. The Indian government signed contracts to ship half a million metric tons of new-season basmati rice to markets in Europe and the Middle East in November 2023(IBEF, 2024).

6.1. *Policy Support*

New to the PM Matsya Sampada Yojana is a sub-scheme that aims to spend Rs. 6,000 crore (about $729 million) to help small businesses, fish dealers, and fishermen. The goal of this project is to increase market penetration and streamline the value chain. Among India's most heavily irrigated crops are wheat and rice. Through an all-encompassing strategy for source production, distribution, administration, field application, and extension activities, PMKSY seeks to increase water usage efficiency and expand irrigation coverage. Solar-powered irrigation and other climate-friendly agricultural methods are gaining traction. Government measures have significantly buoyed the agriculture and allied sectors over the past several years. Among these steps are initiatives to increase the yields of crops and animals, guarantee farmers' incomes via price support, encourage a wider variety of crops, strengthen the foundations of markets, and encourage investments in infrastructure through the Agriculture Infrastructure Fund (IBEF, 2024).

6.2. *Economic Growth and Sectoral Development*

The demand for food goods has increased due to the strong expansion in per capita income. In response to shifting consumer preferences, a more mobile workforce, and the near-freedom of essential inputs, India's food processing industry has emerged as a promising new development area. The industry is being bolstered by government support and an increase in export potential. Already the largest in the world, India's food processing industry is expected to reach $535 billion by 2025–26, creating nine million employment by 2024. State

sponsorship, a revitalized retail sector, rising disposable income, and the pandemic have all contributed to the expansion of these industries. Forecasts indicate that India's per capita income would more than double from $2,450 in FY23 to $4,100 in FY30, an increase of about 70%.

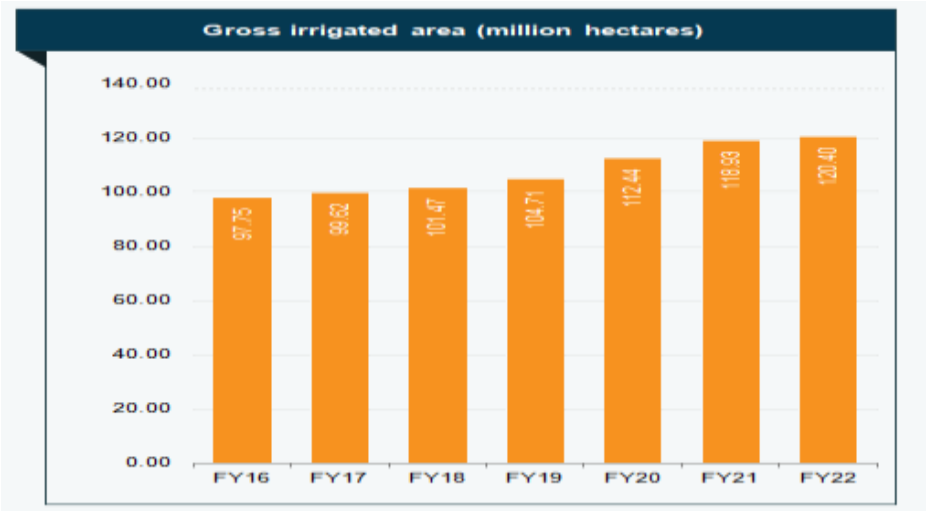

Fig. 3. Gross Irrigated Area.

Thus, Figures 3 and 4, mentioned in the context of a research paper, are a set of non-computational icons provided as examples to illustrate the concepts discussed in the given study. The input is not based on any particular external database or resource. Their use is to bring out features connected with the studied issue and the relationships between the observed aspects to facilitate analysis and interpretation of the results.

Figure 3 here Presents Trends of Gross Irrigated Area.

This figure probably enshrines a presumed or estimated growth of the gross irrigated area in India. It seeks to depict a positive relationship between the degree of increase in the coverage of irrigation and agricultural yields. The particular figures and general slope of the trend line are chosen for demonstrating and explaining the role of irrigation development in the Indian agricultural conditions only.

However, it has constantly been growing and by the year 2015, it was $4, 976 at current prices as illustrated in figure 4 below:

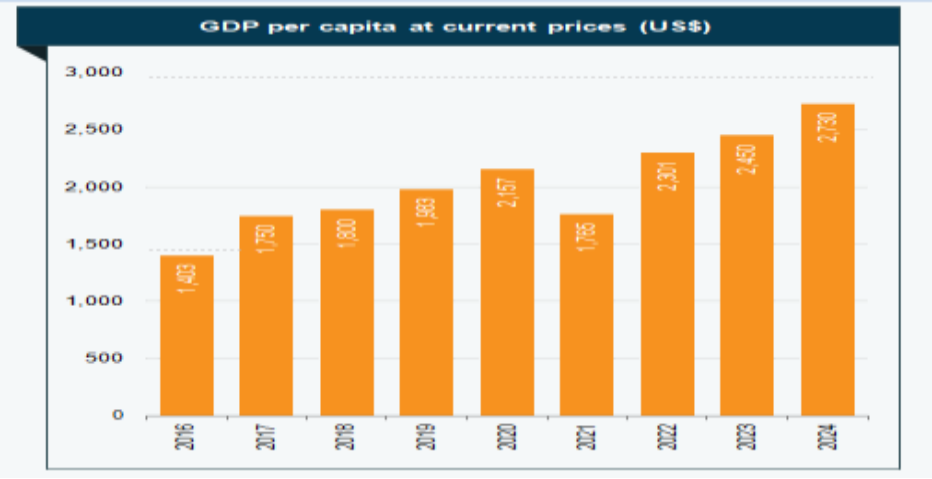

Fig. 4. GDP per capita at current prices.

Further, Figure 4 gives an indication of the flow of the trend of GDP per capita in India. It helps to visualize the concept of economic growth and how it can or might affect the consumers' demand and ability to purchase goods. The coordinates and the regression line are examples; they are used to contribute to the discussion about the association between economic development and the agriculture sector.

The incorporation of illustrations is a standard technique in research papers so as to make data and various concepts easy to understand. To the same point, these numbers are not intended to provide accurate estimates of actual data, but are envisaged as graphic representations which help to grasp the vital tendencies and connections connected with the investigation. In this context, figures 3 and 4 are meant to help the reader to develop a more clear and synoptic avenue through which to navigate through the narrative and arguments of the paper thereby helping to enhance one's understanding about the effects of digital platforms in transforming Indian agro-logistics.

6.3. *Supply Chain Infrastructure*

Integrated supply chains that are driven by digital technology are essential for improving the productivity of India's agro-logistics sector. These sophisticated supply chains give more options for consumers while lowering costs and inventories, increasing product value, extending resources, speeding up time to market, and increasing price for sellers. To increase interactions among farmers, processors, distributors, and retailers, the Indian government has engaged numerous stakeholders to build a successful supply chain. The supply chain and overall productivity may be streamlined with this collaborative approach.

By 2025, the processed food industry in India is expected to reach $958 billion, a growth rate of 12% CAGR. This expansion is greatly aided by the government's emphasis on building supply chain-related infrastructure, such as cold storage facilities, slaughterhouses, and food parks. By ensuring that perishable commodities are properly transported and kept, these infrastructures help to cut down on waste and raise the calibre of goods that are sold.

Considering the significance of agriculture in India, efforts are being made by the public and commercial sectors to enhance the production and efficiency of Indian agriculture. Farming as a Service (FaaS) is an innovative method that provides cost-effective technological solutions for productive farming. Small farmers can now more easily adopt innovative agricultural practices thanks to FaaS, which changes fixed expenses for farmers into variable costs. These services, which fall into three main categories and are all essential to various phases of the agricultural value chain, are offered on a subscription or pay-per-use basis. Farmers may increase their profitability and production by using FaaS (IBEF, 2024).

India has a great chance to establish itself as a major agricultural powerhouse worldwide. The Crop Care Federation of India (CCFI) and the Centre for Environment and Agriculture (CENTEGRO) claim that India is well situated to assist nations looking to outsource their agricultural needs because of its severe climate, labour scarcity, and small landmass. Furthermore, there is a great deal of opportunity in the agri-input sectors, which include nutrients and seeds for plant development. A major part of the global agricultural industry is expected to be played by India in the near future, particularly with the 27th WAIPA World Investment Conference scheduled for December 2023 in New Delhi.

The Indian government has started a number of programmes to help and modernise the agro-logistics industr-

-y. India's agricultural exports are being diversified via the implementation of strategic initiatives by the Agricultural and Processed Food items Export Development Authority (APEDA), which is concentrating on items such as fresh fruits, vegetables, processed foods, and animal products. Ensuring IT access across the country is the goal of digital projects like the National e-Governance Plan in Agriculture (NeGP-A) and the building of Digital Public Infrastructure (DPI). Test results may be recorded and shown on a map using the updated Soil Health Card website, which is linked to a Geographic Information System (GIS). Samples are collected through a mobile application. The government intended to introduce Kisan Drones in 2022 for fertilizer and pesticide spraying, land record digitalization, and crop evaluation.

In summary, the agricultural environment is changing as a result of the integration of digital platforms in India's agro-logistics industry, which is being aided by strong supply chain infrastructure, creative farm management services, and aggressive government efforts. These developments are establishing India as a possible worldwide centre for agriculture in addition to increasing production and efficiency (IBEF, 2024).

VII. Conclusion

The study was set to determine the effects of Digital platforms on every aspect of India’s agro-logistics and more specifically, the viability of using digital platforms in the farmer-customer channel. Due to the exploratory nature of the subject matter in the study, only qualitative data was used and the study therefore only employed the qualitative research approach.

The findings pointed to the short life expectancy of agricultural produce and the vital importance of product handling, marketing, and distribution to meet customers’ expectations. Application of smart logistics systems through the use of artificial intelligence can help reduce post-harvest losses through accurate prediction of the times to harvest, proper positioning of storage and distribution facilities and even choice of the appropriate transport routes.

The research also highlighted the extent of change brought by the digital technologies on the contemporary industries including agriculture. The application of AI contributes to optimization of its operational performan--ce, and demand forecasting, which results in an increased ability to generate revenue, while at the same time decreasing costs. AI-based smart warehouses are highly important in today’s supply chain network as they help in the effective and efficient flow of data and inventory.

The study also re-affirmed the need to take market factors into consideration so that there can be a moderation of the demand and its counterpart-s supply. The opening up of the agricultural sector as well as its orientation towards market requirements can influence farmers to grow crops that are demanded both in the global and domestic markets. The last two components are the democratization of knowledge through the process of digitization, which means that all data and information must be contextually appropriate to the region.

Thus, the study found that the use of Digital platform and AI in Indian Agro-Logistics has a very viable future for improving operation efficiency, cost cutting, and quality control of products in the chain of supply. The application of the mentioned technologies is likely to result in delivering more sustainable, knowledge-based, and market-orientated agriculture production.

Subsequent studies should aim at investigating the effective convergence strategies, identify optimal agricult-

-ural contexts for nutrition, and safeguard the food and nutritional security of the rural people. In this case, they should focus on the utilization of technology in the climate-smart agriculture practice, as well as smart ways of introducing technology into the practice. The effectiveness of the mentioned strategies will help increase economic profit and sustainable growth in agriculture in India.

REFERENCES

[1] African Forum for Agricultural Advisory Services (AFAAS) (2011). Concept and learning framework for the African Forum for Agricultural Advisory Services (AFAAS). AFAAS, Kampala, Uganda and FARA, Accra, Ghana.
[2] Agarwal, B. (2010). Rethinking agricultural production collectivities. Economic and Political Weekly, 45(9), 64-78.
[3] Agricultural Census. (2010-11). Retrieved from http://agcensus.nic.in/document/agcensus2010/agcen2010rep.htm.
[4] Alexandratos, N., & Bruinsma, J. (2012). World agriculture towards 2030/2050: The 2012 revision (ESA Working Paper No. 12-03). FAO, Rome, Italy.
[5] Anderson, E., & Katz, P.B. (1998). The dynamics of store brands. Marketing Science, 17(4), 379-400
[6] Bachaspati, S., & Pathak, H. (2018). Impact of e-NAM on arrival & prices of major commodities: A case study of Bhatapara APMC in Chhattisgarh. Journal of Pharmacognosy and Phytochemistry, 7(4), 3301-3304.
[7] Boehlje, M., Hofing, S., & Schroeder, R. (1999). Value chains in the agricultural industries. Retrieved from https://www.researchgate.net/publication/228592704_Value_chains_in_the_agricultural_industries
[8] Challinor, A.J., Watson, J., Lobell, D.B., Howden, S.M., Smith, D.R., & Chhetri, N. (2014). A meta-analysis of crop yield under climate change and adaptation. Nature Climate Change, 4, 287-291.
[9] Chandra, S., Ganesh-Kumar, A., & Seyoum, T. (2020). Tech-enabled agricultural value chains: The next frontier for smallholder farmers. Retrieved from https://www.weforum.org/agenda/2020/09/tech-enabled-agricultural-value-chains-the-next-frontier-for-smallholder-farmers/
[10] Denis, N., Dilda, V., Kalouche, R., & Sabah, R. (2020). Agriculture supply-chain optimization and value creation. Retrieved from https://www.mckinsey.com/industries/agriculture/our-insights/agriculture-supply-chain-optimization-and-value-creation
[11] Dev, M. (2017). Small farmers in India: Challenges and opportunities. Retrieved March 2017, from IGIDR Working Paper: http://www.igidr.ac.in/pdf/publication/WP-2012-014.pdf.
[12] Food and Agriculture Organization (FAO) (2015). The state of food insecurity in the world 2015: Strengthening the enabling environment for food security and nutrition. FAO, Rome, Italy.
[13] Food and Agriculture Organization (FAO). (2017). Information and communication technology (ICT) in agriculture. Retrieved from http://www.fao.org/3/i7961e/i7961e.pdf
[14] Garg, S., Sinha, P., Kar, A.K., & Mani, M. (2021). Impact of COVID-19 on logistics in India: Challenges and opportunities. Journal of Advances in Management Research, 18(3), 371-393.
[15] Government of India. (2016). State of Indian agriculture, 2015-16. Retrieved from http://eands.dacnet.nic.in/PDF/State_of_Indian_Agriculture, 2015-16.pdf.
[16] Government of India. (2016a). Agricultural statistics at a glance. Ministry of Agriculture and Farmers Welfare, New Delhi.
[17] IBEF (India Brand Equity Foundation). (2024). Agriculture and food processing. Retrieved from https://www.ibef.org/industry/agriculture-india.aspx
[18] International Fund for Agricultural Development. (2004). IFAD recommendations for eliminating rural poverty and achieving food security, 36th World Farmers' Congress, 29th May-4th June 2004. Washington DC.
[19] Jouanjean, M.A. (2019). Digital opportunities for trade in the agriculture and food sectors. OECD Food, Agriculture and Fisheries Papers, 122. OECD Publishing, Paris.
[20] Khatri-Chhetri, A., Aggarwal, P.K., Joshi, P.K., & Vyas, S. (2017). Farmers' prioritization of climate-smart agriculture (CSA) technologies. Agricultural Systems, 151, 184-191.
[21] Kumar, S.J.A. (2011). Information and communication technologies (ICTs) and farmers' decision-making across the agricultural supply chain. International Journal of Information Management, 31. Retrieved from https://www.researchgate.net/publication/273242368_Role_of_Information_and_Communication_Technologies_in_Indian_Agriculture_An_Overview
[22] Kumar, S., & Sharma, A. (2016). Agricultural value chains in India: Prospects and challenges. CUTS International. Retrieved from http://www.cutscitee.org/pdf/Agricultural_Value_Chains_in_India_Prospects_and_Challenges.pdf
[23] Kumar, S., Sangeetha, V., Singh, P., Burman, R.R., Bhowmik, A., & Kumar, S.A. (2017). Constraints faced by farmers in utilizing rice-related information through Rice Knowledge Management Portal (RKMP). Indian Journal of Extension Education, 53(1), 84-89.
[24] Madan, S., & Suri, T. (2020). Agritech in India: Emerging trends in 2020. Retrieved from https://inc42.com/resources/agritech-in-india-emerging-trends-in-2020/
[25] Malekmohammadi, I. (2009). Interpretive perspective of knowledge management stance in agricultural knowledge information system to fostering research/extension linkage. American Journal of Agricultural and Biological Sciences, 4(3), 230-241.
[26] Mattern, M., & Ramirez, R. (2017). Digitizing value chain finance for smallholder farmers CGAP. Retrieved from https://www.cgap.org/sites/default/files/Focus-Note-Digitizing-Value-Chain-Finance-Apr-2017.pdf
[27] Meera, S.N., Jhamtani, A., & Rao, D.U.M. (2004). Information and communication technology in agricultural development: A comparative analysis of three projects from India. Agricultural Research and Extension Network (Network Paper No. 135, pp. 13).
[28] Mikhailov, A., Camboim, G.F., & Reichert, F. (2019). Identifying how digital technologies are being applied in agribusiness value-chains. Retrieved from https://www.researchgate.net/publication/345958657_Identifying_how_digital_technologies_are_being_applied_in_agribusiness_value_chains
[29] Ministry of Agriculture. (2010-11). All India report on number and area of operational holdings. Agriculture Census, New Delhi: Ministry of Agriculture.
[30] Mukherjee, A., Bahal, R., Roy Burman, R., & Dubey, S. K. (2012). Conceptual convergence of pluralistic extension at Aligarh District of Uttar Pradesh. Journal of Community Mobilization and Sustainable Development, 7(1&2), 85-94.
[31] Mukherjee, A., Singh, P., Ray, M., Satyapriya, & Burman, R. R. (2018). Enhancing farmers income through farmers' producers companies in India: Status and roadmap. Indian Journal of Agricultural Sciences, 88(8), 1151-1161.
[32] Musau, G. M. (2015). The impact of ICT on the performance of logistics firms in Kenya. The Strategic Journal of Business & Change Management, 2(2), 384-408.
[33] Nagesh, K. (2019). The role of ICT in agriculture. International Journal of Current Microbiology and Applied Sciences, 8(04), 2219-2229.

[34] National Bank for Agriculture and Rural Development. (2018). All India rural financial inclusion survey 2016-17. Mumbai: National Bank for Agriculture and Rural Development.
[35] Neven, D. (2014). Developing sustainable food value chains. Rome: Food and Agriculture Organization of the United Nations.
[36] Poniman, & Sneddon, J. (2015). The implementation of artificial intelligence in logistics industry: A case study in warehouse activities. International Journal of Logistics Systems and Management, 21(3), 303-326.
[37] Ravi Kumar, K.N., & Babu, S.C. (2021). Value chain management under COVID-19: Responses and lessons from grape production in India. Journal of Social and Economic Development. https://doi.org/10.1007/s40847-020-00138-6.
[38] Reddy, A. (2018). Electronic national agricultural markets: The way forward. Current Science, 115(5).
[39] Saidu, A., Clarkson, A.M., Adamu, S.H., Mohammed, M., & Jibo, I. (2017). Application of ICT in agriculture: Opportunities and challenges in developing countries. International Journal of Computer Science and Mathematical Theory, 3(1). Retrieved from https://iiardpub.org/get/IJCSMT/VOL.%203%20NO.%201%202017/Application%20of%20ICT.pdf
[40] Sahni, N., Cao, Y., & Shanker, R. (2021). Industry 4.0 and artificial intelligence in agriculture: A bibliometric analysis. Journal of Cleaner Production, 326, 129400.
[41] Shukla, A., & Datt, G. (2018). Agritech in India: Ripe for disruption. Retrieved from https://www.mckinsey.com/industries/agriculture /our-insights/agritech-in-india-ripe-for-disruption
[42] Small Farmers Agribusiness Consortium. (2014). Krishi sutra 2: Success stories of farmer producer organisations. Small Farmers Agribusiness Consortium, New Delhi. Retrieved from http://sfacindia.com/PDFs/Krishi-Sutra(Version2).pdf.
[43] Wang, J., Chao, L., & Wang, X. (2021). Artificial intelligence in logistics and supply chain management: Theory and applications. International Journal of Production Research, 59(22), 6891-6910.
[44] Williamson, O. E. (1985). The economic institutions of capitalism. Free Press, New York, USA.
[45] Yang, Y., Zheng, B., Guo, W., & Liu, Y. (2021). Intelligent logistics for agricultural products: A bibliometric analysis and future research directions. Computers and Electronics in Agriculture, 185, 106141.
[46] Yadav, K., Rasheed Sulaiman, V., Yaduraju, N., Balaji, V., & Prabhakar, T. (2015). ICTs in knowledge management: The case of the Agropedia platform for Indian agriculture. Knowledge Management for Development Journal, 11(2).

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