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Impact of E-marketing and Digital Mandis on Agricultural Supply Chain

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Abstract

In India, agricultural supply chain has long been contrived by intermediaries, inefficiencies and market regulations under APMC framework. The APMC manage the market operations, sets the market fees, ensure fair practices and regulates the trader licenses. In 2024, the study examined the impact of e-marketing platforms and digital mandis on the Indian agricultural supply chain. The objective was to assess the digital interventions improved market transparency, farmers income and supply chain efficiency. With the help of digital platforms such as e-NAM, Kisan-Mandi, etc. are reformation of agricultural marketing by upgrading farmers income, enhancing the transparency, reducing transaction costs and fostering inclusive growth. Although, Information and Communication Technology (ICT) is supported by the advances of digital interventions foster financial inclusion, minimize the post-harvest losses and promote inclusive growth. This paper emphasizes the role of e-marketing platforms in revolution of agricultural marketing and orienting the India's agriculture with global supply chain practices and sustainability objectives.

Keywords: Farmer livelihoods, digital agriculture, e-NAM, supply chain modernization, transaction reduction cost, information communication and technology

Introduction

Agriculture is the primary source of livelihood and backbone of Indian commerce. The agriculture contributes around 18% to the national Gross Domestic Product. Although, employing nearly 42-45% of the workforce. The agriculture marketing system in India has traditionally been disintegrated, inefficient and heavily dependent on constrain markets regulated under the state-level Agricultural Produce Market Committee (APMC) Act. The contribution of agriculture to the country's total export is near 10%. After independence the agricultural marketing in India has grown outstandingly but some hindrance still exists such as stunted farmer literacy and existence of numerous channels which spends down the funds of both consumers and farmer and problems with the regulated market. However, the rise in agriculture isn't sufficient for economic development. The existence of a modern and efficient marketing system is important to ensure the timely availability of agricultural commodities at all market levels at competitive prices. (Haveripeth, 2014) ^[15]. Discussed the impact of state regulation of marketing about the agriculture commodities on the farmers interest and agricultural sector. The regulations of the market's result in diminishing the agrarian struggles about marketing their commodities. These supreme markets have discouraged the investment of the private sector in agricultural marketing. Indian farmers had the limited access to the resources, markets, literacy and multiple channels of the distribution proved financially

unfeasible to the farmers (Kalvakonula, 2015) ^[18]. Indian agriculture has stumbled with systemic post-harvest handling and inefficiencies and marketing. Information and communication technology improves the agricultural economic growth but requires more improvement. The information and communication technology aims in agriculture is sharing the agricultural information system to the farmers at all level.

The Indian agricultural marketing system is managed under framework of Agricultural Produce Market Committee (APMC) Act and it is established by the State Governments. As prescribed by the system, farmers required to sell their commodities through designated mandis within their states. Farmers often have the delayed payments, high transactions cost due to commissions, limited competition among buyers, handling charges and taxes. (Apr 2016) Government launched the e-NAM in 2016 with aim to incorporate State level mandis into unified electronic trading network. Mobile based advisory services and agriculture e-commerce platforms provide the demand forecasting, direct linkage to buyers and market intelligence. The cardinal aim of e-NAM, which is an online interconnected gateway for existing APMCs aimed at stimulating much-needed agriculture marketing reforms. It helps to farmers to achieve competitive and better prices for their agricultural commodities. Rajendran and Karthikesan (2014) ^[25] Secondary Agriculture and Policy required for internal and external trade for the XII Five Year plan 2012-2017 which

highlighted the main issues and concern in agricultural marketing. The need for refining the agricultural marketing system was concluded by him. Extension system should also include the distribution of knowledge on the various agricultural reforms which empowers the farmers. An agricultural marketing facilitated by food security and inclusive growth of the nation for developing and maintaining agricultural productivity.

E-marketing (from traditional to digital mandis)

Traditionally, farmers sold their agricultural commodities through village markets, commission agents, and physical agricultural mandis, which were frequently characterized by limited market access, dependency and exploitation by the middlemen, poor price realization, and a lack of transparency between farmers and traders. The long-term policy initiatives for marketing channels were linear and manual, dependent on physical infrastructure and seasonal trading, offering a little control to primary producer (farmers). However, with advent of information communication and technology (ICT) and rapid spread of internet and smartphone usage in rural India, is a paradigm shift began to take professional shape to an agriculture marketing system. (Yadav, J.P. and Sharma, A. 2017) ^[32]. E-marketing introduced more inclusive, efficient, and transparent system by directly linking farmers with buyers, wholesalers, processors, exporters, and even end consumers. Platforms like, e-NAM (Electronic National Agriculture Market), AgriBazaar, Kisan-Mandi and Bijak provide real-time information of commodity prices, demand forecasts,

weather updates, and logistical services, significantly reducing information asymmetry that plagued the traditional systems. (Acharya S. 2004) ^[1]. And digital platforms have enabled online payments, digital receipts, farm advisories, quality grading, and traceability of produce, thus modernizing supply chain from farm to fork. ZZThis digital transformation is not just enhancing market linkages but also fostering financial inclusion, reducing post-harvest losses, and ensuring better price discovery mechanisms. In essence, evolution from traditional to digital e-marketing is reshaping the agricultural marketing landscape, empowering farmers, and aligning the sector with modern trade and global standards. (Rajendran G. Karthikesan P. 2014) ^[25]. After independence the agricultural marketing in India has grown outstandingly but some hindrance still exists such as low farmer literacy and existence of numerous channels which drain the cash reserves of both consumers and farmer and problems with the regulated market. Limited access to agriculture commodities markets, less farmers price realization, limited access to the market information, long gestation period of infrastructure projects, lack of market infrastructure in agricultural market and licensing barrier. (Aggarwal, N.; Jain, S. and Narayanan, S. 2017) ^[4]. In India traditional mandis are physical markets which are regulated under the Agricultural Produce Market Committee (APMC) Acts for individual state. The few strengths of traditional mandis are establishing trust network between traders and farmers, standardized the market practices developed over the decades and physical inspection of agricultural commodities or produce before purchase.

Table 1: Following table depicts the comparison with additional dimensions between traditional and digital mandis:

Parameter	Traditional Mandis	Digital Mandis
Market access	Restricted to regional buyers and farmer must physically bring the commodities to nearest mandis.	Nationwide and international reach via online bidding & direct buyers-seller connections.
Payment speed	Several days to weeks due to manual processing.	Instant or within 24-48 hours via UPI, NEFT and etc.
Transaction time	Can take several hours or days due to physical handling and auction scheduling.	It takes minutes to few hours, online listing and instant bid closure.
Intermediary role	Multiple middlemen (commission agents, traders, transporters).	Reduce intermediary involvement it connects the farmers directly to buyers.
Quality assessment	Manual, subjective may vary by trader.	Standardized grading using the digital tools and AI image recognition or lab testing.
Geographical limitations	Under APMCs act the state level restrictions.	Unified markets (e-NAM) allow inter-state trade.
Cost to farmers	Market fees, commissions, transport costs, loading/unloading charges.	Lower transactions costs i.e. platform or service fees.
Market transparency	Prices influenced by trader and local dynamics.	Clear, publicly visible bidding and price data.
Traceability	Least record keeping, hard to trace the origin of produce.	Blockchain enabled its traceability.
Farmer empowerment	Bounded bargaining power, dependency on local traders.	Greater bargaining, power due to multiple buyer options.

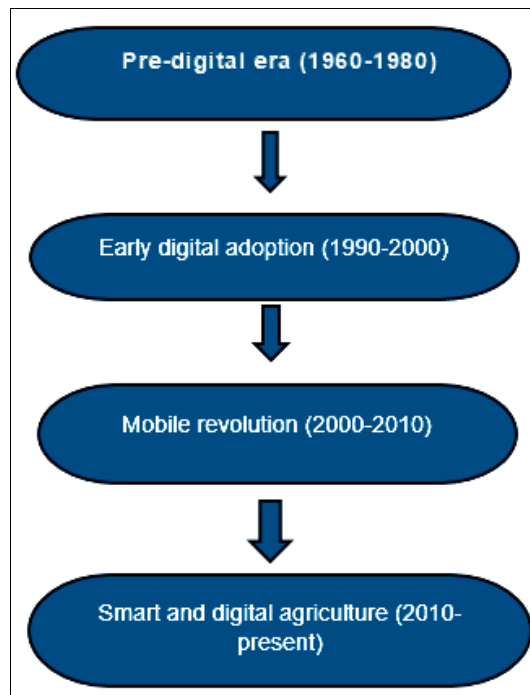
Chand, R. (2004) ^[33]

Role of ICT (Information Communication & Technology) in Agriculture

Information communication and technology can be utilized for providing accurate, relevant, timely information and services to the farmers for facilitating an environment for more remunerative agriculture. The digital agriculture describes emerging field focuses on enhancement of rural and agricultural development by improving information and communication process. (Munyua and Adera, 2009; Bhalekar et. al, 2015) ^[22, 7]. The e-agriculture disseminates the information through Decision Support System, Expert

System and Management Information System by infusing User Interface and Knowledge Management System. (Behera *et al*, 2015; Bhalekar et. al, 2015) ^[8, 7]. An Agriculture Information System is digitalized information system that contains all interrelated information which could really helpful for all the level farmers in the policy of decision making and managing information. Information and communication technology plays facilitating role by bridging the gap between farmers, policymakers, researchers and markets. Singh *et al* (2015) ^[9].

Evolution of ICT in Agriculture



In 21st century an agricultural sector is sustaining rapid transformation, largely driven by the improvements in ICT. From providing market price information and weather forecasts to respectable digital extension service and ICT revolutionizes that how farmers access knowledge and make decisions. (Munyua and Adera 2009) ^[22] Information and Communication Technology has emerged as powerful tool to improve productivity, reduce transaction cost, enhances transparency and empower farmers with timely information. The precision agriculture relies on ICT tools like drones, sensors, satellite imagery and GIS-based mapping and these technologies helps to monitor soil health, crop growth and water usage at micro levels (Pande and Deshmukh 2015) ^[24]. GPS-enabled tractors and the drones for irrigation, sowing^[24] and pesticides spraying. The digital platform connecting the Farmers directly with ICT which reduces the

middlemen dependency and providing real-time price and weather information. The mobile-based advisory platforms for dairy farmers and offering nutrition tips, health care and breeding. (Ramli *et al*, 2015) ^[26] ICT based supply chain platforms enables demand forecasting, cold chain monitoring and transport optimization. The digital applications are mainly used for disseminating knowledge and marketing of (agricultural commodities) goods and services.

National Agriculture Market (e-NAM) in India

National Commission on Farmers defines the agricultural marketing that it is the process to produce the marketable farm commodity and includes all parts of market structure of the system based on economic and technical consideration, both institutional and functional as well as pre-harvest and post-harvest operations like harvesting and storage. India's agricultural marketing system is adulterate by flaws like heavy sale of agricultural produce at village level just after harvest, poor packaging, lack of on-farm grading of produce, long marketing channels, non-transparent price discovery, lack of market information system, low market surplus and existence of different agriculture-marketing malpractices. The practices such as the grading, storage, shipping and distribution convey core that farmer's produce reach to end customer or an entity such as exporter in broad sense.

(Acharya, 2004) ^[1]. The importance of effective agricultural marketing for the overall developments has taken the different steps to address the issue as well as upgrade the country's agricultural marketing system. The traditional marketing system by establishing mechanism for the commodities grading, weighing, sale, standardization, market information, market charges in proportion and prompt payments without any deductions. The market regulations had influence in expression of greater pricing, better returns, providing amenities to farmers in vicinity of country more than 7000 regulated market and lower market charges. Following table depicts market component which can be reached across variety of times periods which helps to create integrated national market and e-NAM must be implemented.

Table 2: depicts market component which can be reached across variety of times periods which helps to create integrated national market and e-NAM must be implemented.

S. No.	Stages	Stage I	Stage II	Stage III
1.	Components	(0-2 years)	(3-6 years)	(7-12 years)
2.	Enabling environments	Legal (single, unified license)	Complete reforms	Facilitating role
3.	Infrastructure	Hardware/Software	Up-gradation of Mandis	Creation of physical delivery Centre's & collection centre
4.	Grades	Selected commodities	Comprehensive coverage	All commodities
5.	Functions	e-price discovery	Bank settlement, Net Worth Ratio (NWR)	MIS, promotion and demand creation
6.	Farmers participations	Individual/groups	Farmers groups/FPO	Producer company
7.	Skill development	Mass awareness	Specialized	As per global requirements
8.	Institution	Establishing national level agencies	Institutes for functions like training, research	
9.	Promotion	NAM portal	Product	Branding
10.	Finance and insurance	Direct payment	Payment and credit	Complete risk coverage
11.	Agri ecosystem	Post-harvest management	Sanitary and phytosanitary	Zero carbon footprint
12.	Focus	Regional	National	Global

(Machapathri *et al.*, 2023) ^[34]

(Acharya and Agarwal, 2011) ^[2]. A national e-market is the trading platform for the transparent sale transactions and the price discovery in regulated markets. The government of India has launched the electronic trading platforms for National Agriculture Market (e-NAM) on April 14, 2016. E-commerce could be breakthrough for interconnecting business if there is no market for the certain products locally. The legislation was heavily distorted in favour of commercializing cotton in India to secure the supply of cotton as the raw material to textile mills at low price. To encouraging, farmers the union government took the initiatives to market their commodities through the electronic national agricultural marketing and the motive of e-NAM is to recreate the trade in an agricultural marketing to support the traders and farmers. (Government of India, 2013; Mookherjee, 2016) ^[21]. The prospective of e-NAM is to enhance the farmers income and reduce the exploitation of middlemen. It will assist the farmers by lowering their marketing costs and shares of middlemen in consumers or farmer's rupees.

Reduction in Transaction Costs through e-marketing and Digital Mandis

The transaction costs concern with expenses used during, process of exchanging goods and services over an actual price of commodity itself. Transaction costs, most crucial factors in shaping efficiency and competitiveness of an agricultural marketing system. Historically in India, traditional agricultural marketing has revolved around regulated market yards (mandis) where farmers sell their agricultural commodities. Originally, these were depicted for protection of farmers from exploitation, gradually they have associated with a range of inefficiencies-like market fees, excessive intermediaries, transportation bottlenecks and restricted bargaining power for farmers. (Acharya, 2012) ^[3]. The farmer's income is eroded before it even reaches them and the transaction cost can account for 15-25% of the final consumer price. Some innovations are reducing the number of intermediaries, improving the transparency and enabling the digital payments and integrating logistics solutions. The initiatives like India's Electronic National Agricultural Market (e-NAM), private digital platforms like Ninja cart are helping to reduce the inefficiencies by leveraging information and communication technology. (Meena & Singh, 2020; World Bank, 2019) ^[20]. Reduction in transaction costs through e-marketing and digital mandis is spark for greater supply chain efficiency, improve market competition and enhance farmers income. The digital transactions are more secure and faster payments, reducing enforcement costs and eliminating handling charges. By adoption of digital supply chains ensures faster movement of perishable commodities and reducing post-harvest losses by 20-30% (Chand, 2017) ^[10]. Farmers had lack access to reliable information about demand trends, market prices and buyer requirements so, farmer must travel to market yards to discover the prevailing prices. (Barrett, 2008) ^[6]. The quality assessment in mandis is often manipulated by the intermediaries and they may not be paid fairly for the higher quality produce although enforcing timely settlement adds another hidden cost and payments are frequently delayed. (Goyal, 2010) ^[14]. The digital platforms provide the real-time data to the farmers

across multiple mandis and states which reduces the information asymmetry and allows farmers to choose most profitable market. These platforms often promote the collective marketing through farmer produce organizations (FPOs). Aggregation enables the lowering per-unit transport cost and bulk sales. The startups like Ninja-cart reducing waste and costs further optimizes farm-to-retail logistics, Agrostar delivering the agriculture inputs directly to the farmers by lowering farmer's search and transaction cost and DeHaat provide the services like advisory, input and marketing considerably reducing the farmer's marketing expenses. Some challenges like digital exclusion & literacy, lack of smartphones, infrastructure gaps remain and potential benefits are significant. (Reddy & Mishra, 2021) ^[27].

Role of Private Sector and Agri-Tech Startups in Digital Agri Market

By the combined efforts of private sector and agri-tech startups a rapid transformation in agricultural supply chain. As the public initiative such as e-NAM have provided the backbone for the digital mandis but the private sector has emerged the key for investment, innovation and inclusivity. By building the digital platforms, farm to fork supply chains and farmer centric apps private entities ensure that the consumes obtain the fresh produce, farmers receive better prices and the ecosystem benefits from the efficiency and transparency. (FAO, 2021). Agri-tech startups have filled the critical gaps in advisory services, last mile delivery, farmer empowerment and financial inclusion. The startups provide app-based platforms that act as virtual mandis, integrating input supply and output marketing. Logistics focused firms such as Ninja-cart developed farm to retail cold chains that minimize post-harvest losses and handling over 1,400 tons of fresh produce daily. And the companies like DeHaat leverage satellite data to offer precision farming recommendations. (Singh & Singla, 2020) ^[28]. These investments reduce reliance on government mandis while creating scalable digital infrastructure which improves the farmer market connectivity. ICT and Reliance Fresh the larger corporates have invested in procurement centres, grading facilities and warehouses to strengthen value chains. ICT e-Choupal launched in 2000, remains the landmark initiative. It provides the real time market information and procurement services, although it has empowered over 4 million farmers in 35,000 villages and it demonstrates the scalability of private digital interventions. Blockchain ensure the traceability and transparency in supply chain by reducing the fraud. (ITC Limited, 2022). The startups provide the warehouse receipt financing, enabling farmers to store produce and access the short-term loans. Although, fintech collaborations have allowed farmers to develop digital credit histories and improving their ability to access the institutional loans. Some private sector and startups use the AI-driven crop advisory tools to predict insect & pest attack and yield outcomes. (World Bank, 2019). Some challenges faced by the private sector and agri-startups like marginal farmers without smartphones remain excluded, digital exclusion, regulatory gaps, monopolization risks, large corporates may dominate the supply chains and limiting the farmer choice, farmer helps to hesitate to adopt the digital platforms due to online fraud and conflicts

between APMC laws and private platform restrict seamless adoption. The potential of digital first models to empower farmers, enhance food security and modernize the supply chains.

Economic and Social impact on Digital Marketing

The economic and social impacts of e-marketing and digital mandis are transformative, reducing the transactions costs and fostering the financial inclusion. The digital innovations are improving economics returns for the farmers but also it generates the substantial social impact in terms of gender empowerment, inclusivity, community development and financial literacy. The economic benefit for the digital mandis is the improvement in farmers' price realization. E-marketing platforms enabling the farmers to access the real-time information about demand and pricing across multiple markets and also brings the price transparency. E-NAM reported that 5-15% higher returns compared to the traditional mandis due to access to the wider market. (Machapathi & Katta, 2019) ^[19]. Reduction in middlemen costs enhanced the farmer's income stability. The cost associated with the transportation to distant mandis, post-harvest losses and commission fee reduced. The digital platforms connect the farmers with buyers across the states by breaking the geographical barriers of traditional mandis. The market expansion enhances the competitiveness and also creates the opportunities for the farmers to sell the perishable goods faster, reducing post-harvest losses. Financial records from the digital transactions helps the farmers access the crop loans, credit facilities and insurance schemes. As stated by NABARD (2022) the digital transactions enhanced the creditworthiness of small holders and enable them to borrow on better terms.

E-marketing platforms led the shift of rural areas from traditional agriculture based-labour to agriculture services and it boosts the rural employment diversity. Farmers are using mobile apps, smartphones and vernacular-language interfaces. The rural internet penetration shows how digital platforms reshaping the rural society (over 40% by 2022 according to IAMAI). The mobile apps provide the access to information without traveling to distant mandis although enabling women to participate more actively. The initiative like Kisan-Konnect provide platforms where the women led FPOs market their produce directly. E-marketing platforms fostering the community-level development by working together with self-help groups (SHGs), NGOs and cooperatives and it promotes collective growth. Digital mandis reduces the food wastage by improving linking producers with buyers and logistics coordination. Socially, they strengthen the community development, empower marginalized groups and bridge the digital divide.

Conclusion

Farmers' ability to obtain fair pricing was hampered by their reliance on middlemen (intermediaries), ineffective marketing routes, and state-controlled APMC mandis. These platforms give farmers more access to markets, faster payments, and more stable incomes by reducing their reliance on middlemen. The climax of modernizing the agricultural supply chain and tackling systemic issues is the emergence of e-marketing platforms and digital mandis. This review analysis the effects on supply chains, digital

interventions, rural development, and farmers' consequences. Financial inclusion and farmer empowerment are two more significant effects. In the past, farmers had no access to trustworthy information and were reliant on the local dealers.

Digital platforms ensure the faster payments- mitigating the cycle of debt and dependency, often within 24-48 hours. Digital transaction enhances farmers ability to access credit facilities, institutional loans, insurance and strengthening their long-term financial resilience. ICT bridges knowledge gap between researchers, policymakers and farmers, although creating an ecosystem of decision-making and sustainable agricultural growth. ICT secures the profitable markets and adopts modern production practices for farmers. The private sector and agri-tech startups have been instrumental in accelerating the transformation. While the government initiatives provide backbone and extend the services ranging from logistics to advisory and financial linkages. The agricultural supply chain, digital platforms have reduced the inefficiencies, losses and streamlined operations. The economic and social impacts of e-marketing and digital mandis are profound that reduction of intermediaries and transaction costs improves the income stability and economically farmers report 5-15% higher returns compared to traditional sales due to wider market access. E-marketing platforms foster the community-level development, enhance women's participation, and promote the collective marketing through Farmer Producer Organizations (FPOs). These changes contribute not only to improve livelihoods but also broader the rural empowerment and inclusive growth. The digital divide continues to limit participation for small and marginal farmers who had lack internet access, digital skills and smartphones. At the end, integrating the advanced technologies like IoT, AI and blockchain into agricultural marketing will enable India to align with the global supply chain standards and sustainability goals.

References

1. Acharya S. Agricultural marketing in India. State of the Indian Farmer: A Millennium Study. Vol. 17. New Delhi: Academic Foundation and Department of Agriculture and Cooperation, Ministry of Agriculture, Government of India; 2004. p. 1-238.
2. Acharya SS, Agarwal NL. Agricultural marketing in India. 5th ed. New Delhi: Oxford & IBH Publishing Company Pvt Ltd; 2011. p. 1-512.
3. Acharya SS. Agricultural marketing in India: evolution and emerging issues. New Delhi: Academic Foundation; 2012. p. 1-312.
4. Aggarwal N, Jain S, Narayanan S. The long road to transformation of agricultural markets in India: lessons from Karnataka. *Econ Polit Wkly*. 2017;52(41):47-55.
5. Amarendra Reddy A. Electronic national agricultural markets: the way forward. *Curr Sci*. 2018;115(5):826-837.
6. Barrett CB. Smallholder market participation: concepts and evidence from eastern and southern Africa. *Food Policy*. 2008;33(4):299-317.
7. Bhalekar P, Ingle S, Pathak K. The study of some ICT projects in agriculture for rural development of India. *Int J Comput Appl*. 2015;118(12):1-5.

8. Behera BS, Das TK, Jishnu KJ, Behera RA, Behera AC, Jena S. E-governance mediated agriculture for sustainable life in India. *Procedia Comput Sci.* 2015;48:623-629.
9. Singh KM, Kumar A, Singh RKP. Role of information and communication technologies in Indian agriculture: an overview. *SSRN Electron J.* 2015;1-25.
10. Chand R. Doubling farmers' income: rationale, strategy, prospects and action plan. NITI Policy Paper 1/2017. New Delhi: NITI Aayog, Government of India; 2017. p. 1-64.
11. Food and Agriculture Organization of the United Nations. Digital agriculture and the role of the private sector. Rome: FAO; 2021. p. 1-48.
12. Food and Agriculture Organization of the United Nations. The gender gap in agriculture: digitally empowered women farmers. Rome: FAO; 2018. p. 1-36.
13. Government of India. Final report of the committee of state ministers in-charge of agricultural marketing reforms. New Delhi: Ministry of Agriculture, Department of Agriculture and Co-operation; 2013. p. 1-112.
14. Goyal A. Information, direct access to farmers, and rural market performance in central India. *Am Econ J Appl Econ.* 2010;2(3):22-45.
15. Haveripeth KD. A critical study of law relating to agricultural produce marketing in India [PhD thesis]. Dharwad: Karnataka University; 2014. p. 1-298.
16. Internet and Mobile Association of India. Internet in rural India 2022. New Delhi: IAMAI; 2022. p. 1-56.
17. ITC Limited. ITC e-Choupal: impact assessment report. Kolkata: ITC Ltd; 2022. p. 1-44.
18. Kalvakonalu VS. Agricultural productions and marketing system in India. *Int J Econ Bus Manag.* 2015;1(1):6-10.
19. Machapathri P, Katta A. National Agriculture Market (e-NAM) in India: a step toward improving the efficiency of India's agricultural supply chain. In: Sharma S, Rawat AK, editors. Doubling farmers' incomes: issues, strategies and recommendations. 2019; (5): p. 71-72.
20. Meena MS, Singh R. e-NAM: impact on agricultural marketing efficiency in India. *J Agribus Dev Emerg Econ.* 2020;10(4):509-525.
21. Mookherjee D. Agriculture: a revolution waiting to happen beyond the mandis. *Business Today.* 2016 Apr 17;34-38.
22. Munyua H, Adera E. Emerging ICTs and their potential in revitalizing small-scale agriculture. *Agric Inf Worldw.* 2009;2(1):3-9.
23. National Bank for Agriculture and Rural Development. Annual report on rural financial inclusion. Mumbai: NABARD; 2022. p. 1-168.
24. Pande N, Deshmukh P. ICT: a path towards rural empowerment through telecommunication, e-governance, and e-agriculture. *IBMRD's J Manag Res.* 2015;4(2):47-54.
25. Rajendran G, Karthikesan P. Agricultural marketing in India – an overview. *Asia Pac J Res.* 2014;1(17):1-8.
26. Ramli SA, Samah BA, Hassan MS, Omar SZ, Bolong J, Shaffril HAM. Potential benefits of ICT for youth agro-based entrepreneurs in Malaysia. *J Appl Sci.* 2015;15(3):411-417.
27. Reddy AA, Mishra D. Digital technologies in Indian agriculture: enhancing farm productivity and farmer income. *Agric Econ Res Rev.* 2021;34(1):1-12.
28. Singh S, Singla N. Digital agriculture in India: role of agriculture-tech startups and private sector. *Indian J Agric Econ.* 2020;75(3):475-490.
29. Singh V, Sankhwar S, Pandey D. The role of information communication technology (ICT) in agriculture. *Glob J Multidiscip Stud.* 2015;3(4):1-8.
30. World Bank. Enabling the business of agriculture: private sector role in agricultural markets. Washington (DC): World Bank; 2019. p. 1-92.
31. World Bank. Karnataka's unified market platform: lessons for India's agricultural marketing reforms. Washington (DC): World Bank Group; 2019. p. 1-68.
32. Yadav A, Sharma J. National agriculture market: the game changer for Indian farming community. *Int J Sci Res Manag.* 2017;5(7):5810-5815.
33. Chand R, Kumar P. Determinants of capital formation and agriculture growth: Some new explorations. *Economic and Political Weekly.* 2004 Dec 25:5611-5616.
34. Machapathri P, Meera SN, Awasthi HK. Perception of farmers about E-NAM and digital marketing applications. *Guj. J. Ext. Edu.* 2023;36(2):76-82.