



A Critical Analysis of Digital Agricultural Information Dissemination Systems in Tamil Nadu, India

DIVYA SURESH*

Keio University, Fujisawa, Kanagawa Prefecture, Japan

Email: divyas@keio.jp

RAJIB SHAW

Keio University, Fujisawa, Kanagawa Prefecture, Japan

Received 30 December 2024 Accepted 19 May 2025 (*Corresponding Author)

Abstract Agricultural information dissemination systems play a key role in farmers' decision-making. Recently, much emphasis has been placed on agricultural modernization facilitated by digitizing agricultural information services in Tamil Nadu's agricultural sector. Studies point to various facilitating and limiting factors related to the availability, accessibility, and adoption and use of digital agricultural information dissemination systems, including the provision of information related to extension and advisory services, weather-based agricultural advisory services, and market-based agricultural advisory services. The Uzhavan application (app), a key digital agricultural information dissemination system developed by the Tamil Nadu government in 2018, provides comprehensive market prices, subsidy schemes, and weather forecasts. However, it has had poor uptake and utilization, and only 18% of Tamil Nadu farmers have registered on the Uzhavan app. To address this, we examined the evolution and institutional frameworks of agricultural information dissemination systems (extension and advisory services, weather-based, and market-based agricultural advisory services), we analysed facilitating and hindering factors of different digital agricultural information dissemination systems, and we identified challenges facing the farmers in the study area. Primary data were collected through semi-structured interviews with 30 farmers in the Chengalpattu district of Tamil Nadu. We also obtained relevant secondary data from the literature for this study. The results showed a lack of ideal institutional design for disseminating digital agricultural information in equitable and affordable ways. Lack of awareness, lack of institutional trust, gender and socioeconomic gaps in access, lack of contextualized content, and costs of access were identified as challenges to accessing digital agricultural information. Therefore, in the future, it is necessary to identify and incorporate factors responsible for the equitable and affordable dissemination of digital agricultural information.

Keywords digital agriculture, information dissemination, tamil nadu, effectiveness, challenges

INTRODUCTION

Agricultural information is central to farmers' decision-making, from sowing to harvesting and selling. Agricultural information dissemination is the process of delivering research-based information grounded in scientific innovation through the various stages of the agricultural life cycle, such as information on high-yielding seeds, farming practices, and the timing of inputs. It was originally targeted to improve agricultural productivity and rural development in the country. (Krishna and Naik, 2020) Recently, objectives such as adaptation and mitigation have been added. Inefficient information dissemination decreased access to, or poor adoption and use of agricultural information may decrease agricultural productivity, affecting farmers' income. Information and Communication Technology (ICT) plays a vital role in disseminating information. The adoption of mobile internet technology has proved to increase agricultural productivity. (Karanasios and Slavova, 2018) However, the advantages of ICT are yet to be reaped to full benefit in the agricultural sector

of the Indian economy. In this context, this study aims to analyze the agricultural information dissemination systems and infrastructure in Tamil Nadu's agricultural sector.

Previous studies have identified enabling and constraining factors for farmers' adoption of digital agricultural information in the study area. Farm characteristics, including land ownership, farm size, and farm succession; operator characteristics, including age, education, income, farming as a main occupation, general ICT possession and usage, self-reliance, farming experience, knowledge and capacity; and type and level of interactions, including group communication, frequent contact with extension agents, and information-seeking behavior, were the key independent variables in these studies. (Kumar and Chandrasekaran, 2020; Kumar and Karthikeyan, 2020; Nandhini and Rohini, 2022) Some of the important constraining factors mentioned in the studies are a shortage of extension agents noted by a 1:1834 ratio of assistant agricultural officers to farmers, far exceeding the FAO recommended range of 1:500 (Blum and Szonyi, 2015). This shortage reflects the limitations of the reach, frequency, and effectiveness of agricultural advisory services. In addition, infrastructural issues such as low digital penetration or lack of ICT infrastructure, pilot project syndrome (short-term, donor-driven initiatives that lack sustainability), gender gap in accessing information, and provision of generic information limit the equity, scalability, and effectiveness of agricultural information delivery. (Saravanan, 2012; Kumar et al., 2020; Mathuabirami et al., 2019; Vincent and Raj, 2022) Technological and psychological attributes were not explored per our review. Other studies have focused on the impact assessment of digital agricultural information systems. The findings revealed that illiterate farmers benefit from advisories delivered in audio or visual formats, leading to a significantly higher adoption of recommended agricultural technologies (Rani et al., 2020; Prabha et al., 2017; Prasad et al., 2020).

OBJECTIVE

Therefore, the objectives of this study were to 1) analyze the facilitating and hindering factors for different digital agricultural information dissemination systems specific to extension and advisory services, weather-based agricultural advisory services, and market-based agricultural advisory services, and 2) identify the challenges facing farmers in the study area.

METHODOLOGY

Regarding objective 1, secondary data were collected by reviewing the literature, articles, and reports. The identified qualitative datasets were analyzed through a comparative analysis of digital agricultural information systems in Tamil Nadu, focusing on effectiveness, capacity gaps, and scope for improvement. For objective 3, no formal quantitative data were collected for this study, as the primary focus was on qualitative insights obtained through semi-structured interviews with 30 farmers.

Primary data were collected from a random sample of 30 farmers selected from the Kollammedu, Pin padhar kootam, and Pon vilaintha kalathur villages located in the Chengalpattu district of Tamil Nadu. The Chengalpattu district is expected to fall under high-risk agriculture in the near future (CCCDM Anna University, 2024). This district was purposefully selected for an in-depth understanding of the barriers that may be common across regions but may be likely to increase due to high-risk zones. The district has approximately 600 villages under its jurisdiction, which is a subset of the approximately 15,000 villages in Tamil Nadu (Village Survey, 2022). Ten farmers from each village were selected, targeting a representative subset of the population and minimizing selection bias. While all participants were engaged in farming, notable differences existed in their gender roles, digital literacy levels, and access to agricultural support systems.

The Uzhavan mobile application, a bilingual platform (English and Tamil) developed by the Tamil Nadu Department of Agriculture, is a key service promoted by the state government and a comprehensive digital agricultural information system. It exemplifies a centralized effort to deliver diverse agricultural services digitally and was chosen for this study. The app is freely available on Google Play and Apple App Store.

Face-to-face, semi-structured interviews were used to collect perceptions of the accessibility of digital agricultural information and the limiting factors for its usage. The data analysis focused on qualitative and thematic insights of the data. The first author conducted a thematic analysis to identify recurring patterns, and efforts were made to ensure reliability through iterative reviews. Thematic analysis was performed using a six-step approach, which includes familiarization with interview responses (initial notes and responses), coding (extracting from interview data), generating themes (translating codes into themes), reviewing themes (rechecking the themes for accuracy), naming themes (formulating easily understandable names), and finally distilling the results. (Braun and Clarke, 2006).

RESULTS AND DISCUSSION

Extension and Advisory Services

The agricultural extension system in Tamil Nadu evolved from community-based development in the 1950s to a technology-driven approach in the 21st century. Key changes include the introduction of the Intensive Agricultural Area Program during the Green Revolution in the 1960s, Integrated Crop Management and the Training and Visit system in the 1980s, and ICT-based interventions such as AGRISNET and Uzhavan in 2018. While the government has led many initiatives, private companies now play a significant role in providing customized agricultural advisory services using technology.

Agricultural Extension and Advisory services in Tamil Nadu, which encompass different techniques, such as ICT-based advisory interventions, participatory farm extension, and agribusiness modes of reinventing farm enterprises, have resulted in a lower success ratio than expected. The effectiveness and countermeasures from the literature are synthesized in Table 1.

Table 1 Summary of ICT-enabled extension and advisory services in Tamil Nadu

ICT intervention (initiating authority)	Features	Facilitating factor	Effectiveness	Barrier	Further action needed
Uzhavan App (TN Government)	One stop solution providing information on market prices, subsidy schemes, weather forecasts etc.	Mobile based application for farmer self-service in local language	Algorithm led AI has reduced searching time, increased the accessibility to agricultural officers and awareness about government schemes	Adoption depends on farmers smartphone literacy	Increase publicity to attract non-users Provision of timely updated information
TNAU Agritech (TN Government)	Web portal developed by Tamil Nadu agricultural university	Credibility and scientific rigor of information	Problem diagnosis through video conferencing	Limited digital access and literacy farmers in remote areas	Mobile optimization for wider outreach
Agrisnet (Central Government)	Web based information gathering and analytics mechanism mainly for extension workers	Departmental interface, life cycle-based crop planning and advisories	Generation of customizable report	Digital illiteracy limited farmers direct engagement with the platform	Capacity building of extension workers

Table 1 Continued...

ICT intervention (initiating authority)	Features	Facilitating factor	Effectiveness	Barrier	Further action needed
e-Velanmai (Central Government)	ICT based demand driven and participatory technology transfer model	Sustainable paid membership model (50 to 150 rupee based on land size)	Clarifies problem based and decision-based inquiries of the farmers	Limited awareness among beneficiaries	Increase field coordinators and improve to provide more comprehensive information
ATMA (Central Government)	Extension reforms	Institutional support (Tamil Nadu Agricultural universities, Krishi vigyan Kendras, etc) for implementation	259978 beneficiaries reached through exposure visit, training, demonstration, Kisan mela, and Farm schools	Repetition in choosing the beneficiaries	Improve inclusiveness by diversifying beneficiary selection.

Weather-based Agricultural Advisory Services

Climate change is affecting agriculture in Tamil Nadu, with rising temperatures and unpredictable rainfall patterns affecting crop production. This necessitates climate-smart agricultural practices, such as the use of climate-tolerant crops, improved water management, and accurate weather forecasting. The Agro Climate Research Centre at the Tamil Nadu Agricultural University provides essential weather forecasts and research to support these practices. The effectiveness and countermeasures of agrometeorological advisory systems from the literature have been synthesized for weather-based agricultural advisory services, as shown in Table 2.

Table 2 Summary of ICT-enabled weather-based agricultural advisory services in Tamil Nadu

ICT intervention (initiating authority)	Features	Facilitating factor	Effectiveness	Barrier	Further action needed
Gramin Krishi Mausam Sewa (Central Government & Indian meteorological department)	Weather forecasts, crop advisories, alerts on pests/diseases, rainfall, wind, humidity through SMS, web, radio and TV	Backed by IMD, wide dissemination networks	Provision of weather based agricultural advisories at block level	Generic, no voice support, low awareness	Promote the Gramin Krishi Mausam Sewa system, and also contextualization of information
Kisan (Central Government & Indian meteorological department)	SMS/voice advisories in regional languages (Tamil)	Centralized data system	Localized weather-based advisories	Only for farmers who register	Support increasing farmer registration
TNAU-AAS App (Tamil Nadu agricultural University)	Mobile app, SMS, web portal based advisory	Backed by TNAU; local weather data from 385 AWSs	Provision of location, time, stage specific advisories based on ten important weather parameters	Digital literacy and application complexity challenges	Increase coverage of advisories for different crops

Market-based Agricultural Advisory Services

A significant point in the evolution of the Agricultural Marketing Department is the establishment of the Domestic and Export Market Intelligence Cell (DEMIC) at TNAU in 2004. The objective of DEMIC is to disseminate timely information on the prices of agricultural commodities to support the decision-making of various stakeholders, such as farmers, traders, researchers, policymakers, and firms. The different media through which information is disseminated are radio, TV, newspapers, and the Agmarknet website.

The effectiveness and countermeasures from the literature have been synthesized for agri-marketing advisory services, as shown in Table 3.

Table 3 Summary of ICT-enabled agri-marketing services in Tamil Nadu

ICT intervention (initiating authority)	Features	Facilitating factor	Effectiveness	Barrier	Further action needed
Market led extension (e-NAM) (Central Government)	Online trading platform, access to inter-state trading	Digital payments and logistics integration support	Integrated with Agricultural Produce Market Committee to enable transparent price discovery	Digital literacy issues	Improve connectivity of mandi, onboarding of FPO
Agmarknet (Central Government)	Provides daily market prices	Helps farmers make informed crop marketing decisions	Trends for commodities across Indian markets	Lack awareness, rely on middlemen to these platforms	Increase promotion and training in using these system

Limiting Factors for the Usage of the Uzhavan App in the Chengalpattu District, Tamil Nadu

This section examines the challenges faced by farmers in the study area. Since the Uzhavan app was launched in May 2018 as a key platform for digital agricultural information, only 18% of Tamil Nadu farmers registered for it by August 2024. Chengalpattu district has one of the lowest numbers of farmer registrations compared to other districts in Tamil Nadu. Through semi-structured interviews with 30 farmers in the Chengalpattu district, factors limiting farmers from using the Uzhavan app were identified through thematic analysis, as shown in Table 4 and Figure 1.

The main themes identified from the interview analysis included barriers to digital information access, such as accessibility issues (lack of device availability, low digital literacy, and inability to afford), availability issues (lack of localized content, lack of awareness, and training programs), socio-cultural barriers (gender norms and caste-based exclusion), and lack of trust in extension and institutional support (infrequent contact with extension agents and increased reliance on fellow farmers). The study's findings cannot be representative or generalizable to the district or state, which is a limitation.

The interview results showed that over 80% of farmers felt that there were no effective subsidy selection mechanisms, and the same farmers were repeatedly chosen to receive subsidies, training, and other benefits, leading to disparities. However, this may be due to farmers' limited awareness or less promotional efforts by the government for the Uzhavan App. Subsidies, financial support, and other programs play key roles in making digital agricultural information more accessible, which can increase adoption. (Beach et al., 2025)

The Uzhavan app offers detailed information on subsidy schemes for various agricultural inputs and the subsidy amount, depending on whether farmers are small, marginal, or large-scale.

Table 4 Challenges in accessing the Uzhavan mobile app: farmer voices and thematic insights

Theme	Sub-theme	Representative quotes	Insight
Accessibility issue	Lack of device availability	“I don’t have a smartphone.” “My children use, and we rely on them if needed.”	Farmers lack personal devices, and generational technology gaps exist. Feature phones remain prevalent among farmers.
	Low digital literacy	“I don’t know how to use the app.” “I am afraid if I will do something else while using unknowingly.” “I feel it is complex”.	
	Inability to afford	“I can’t afford to buy an android phone.” “I use basic phone which is enough for my needs”.	
Availability issue	Lack of localized content	“I feel advisories are not specific to my farm”. “I feel advisories are not specific to the crop/stage”.	Generic information, lack of applicability to real time farming. Also, many farmers have no knowledge on the availability of such digital agricultural information system.
	Lack of awareness and training programs	“I think I have heard about Uzhavan app”. “I am not sure in what way it can be useful for a farmer.”	
Socio-cultural barriers	Gender norms	“Only men in my house go for training”. “Only my husband owns smartphone as I don’t know to use”.	Deep-rooted social norms limit participation of women and marginalized caste groups in accessing digital agricultural information.
	Caste-based exclusion	“We feel certain privileged farmers in the community are repeatedly selected for training and other programs”.	
Lack of trust in extension and institutional support	Infrequent contact to Extension Agents	“We hardly see them”. “They don’t visit us”. “They visit us may be once in a month”. “They do not have time to hear to our queries”.	Total number of extension agent to farmer ratio is 1:1834. It depends on the knowledge from the community.
	Increased reliance on fellow farmers	“We rely on fellow farmers the most trusted source of our information”. “I benefit from the advice of my neighbor farmer”.	

The subsidy selection process is based on a priority registration system, where farmers are given preference on a first-come, first-served basis. (Kungumaselvan et al., 2021) Also, in the study area, it was found that women farmers had less or no access to digital agricultural information, reflecting broader accessibility issues. NSSO (2021) data reveal the existence of a digital divide, with only 14.9% of rural households able to access a computer with Internet access, compared to 42% of urban households. Amidst this scenario, a further gender divide in mobile ownership exists, with 51.6% of rural women not owning mobile phones.

The lack of contextualized information (block-level information is provided) and the requirement to use an Android mobile phone (Uzhavan mobile app installation compatible) were other key barriers. Approximately 67% of farmers widely own older-feature (basic) mobile phones and use SMS and audio calls (Prabha and Arunachalam, 2021). The lack of contextualized information is also due to the difficulty in conducting adaptive research, caused by a shortage of extension manpower and vast diversity in agro-climatic zones, soils, cropping systems, and individual farmer profiles (Krishna and Naik, 2020). More than 90% of the farmers interviewed felt that they rarely met an extension agent, and even if they had, some felt that fellow farmers were more reliable sources of agricultural information. Extension agents are considered the key implementers of agricultural technology adoption in general and digital services in particular, creating awareness of different programs and providing a supporting role to farmers. These findings point to the lack of an ideal institutional design for disseminating digital agricultural information in affordable and equitable ways. An ideal institutional design emphasizes decentralization, increased autonomy, and contracting extension services to the private sector, community-based organizations, and non-governmental organizations (NGOs) (Birner and Anderson, 2007).

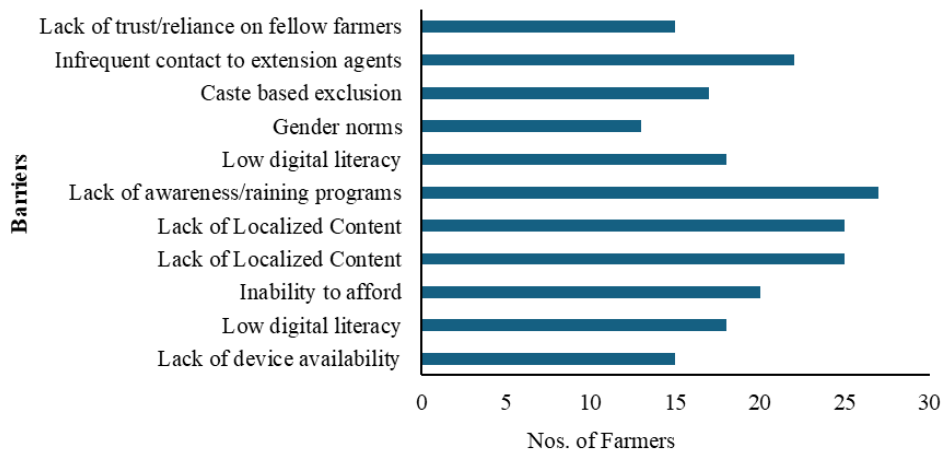


Fig. 1 Factors limiting access to digital agricultural information

CONCLUSION

This study provided a critical lens into the facilitating and hindering factors regarding farmers' access to digital agricultural information across extension, weather-based, and market advisory systems. It identified specific challenges that farmers faced in the study area, such as limited accessibility, lack of availability of contextual or localized information, sociocultural barriers, and a lack of trust in the extension system and institutional support. The reach and impact of Uzhavan applications have been limited by low farmer awareness, limited digital literacy, and infrastructural constraints such as the absence of offline functionality (access to information only with internet connectivity) and inaccessibility to farmers who rely on feature phones, reinforcing the digital divide. (Kumar et al., 2020) The findings emphasize the need for better contextualization of agricultural information. A unified agricultural data platform, such as the Agri-stack, has the potential to provide contextual local information through geo-tagged statistics (location-based data on farms and farmers), supporting the provision of farm-level agricultural advisories, and contributing to increased precision and relevance in the information delivered to farmers. However, technology alone cannot address deep-rooted structural gaps.

Importantly, this study highlights the absence of an inclusive institutional design that can ensure equitable, affordable, and trusted access to digital resources across the farming community. Addressing these multilayered challenges calls for policy interventions aimed at strengthening institutional trust, promoting user education, and designing content that aligns with the localized needs of farmers. Moving forward, research should focus on creating a robust and adaptive framework that supports inclusive and sustainable digital transformation in agriculture.

ACKNOWLEDGEMENTS

The first author is thankful to Japan Science and Technology (JST) for the scholarship supporting Ph.D. research and all the respondents.

REFERENCES

- Beach, R.H., Milliken, C., Franzen, K. and Lapidus, D. 2025. Meta-analysis of the impacts of digital information interventions on agricultural development. *Global Food Security*, 45, 100866, Retrieved from DOI <https://doi.org/10.1016/j.gfs.2025.100866>
- Birner, R. and Anderson, J.R. 2007. How to make agricultural extension demand-driven? The case of India's agricultural extension policy. International Food Policy Research Institute (IFPRI), Discussion Paper 00729, Retrieved from DOI <https://hdl.handle.net/10568/160252>

- Blum, M.L. and Szonyi, J. 2015. Investment requirements in extension to achieve zero hunger and adapt to climate change. Food and Agriculture Organization of the United Nations, Rome, Italy, Retrieved from URL <https://www.fao.org/4/ap795e/ap795e.pdf>
- Braun, V. and Clarke, V. 2006. Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3 (2), 77-101, Retrieved from DOI <https://doi.org/10.1191/1478088706QP0630A>
- CCCDM Anna University. 2024. Climate change assessment and adaptation plan of Tamil Nadu, Sustainable agriculture. Agri Report_CCCDM_Draft, Centre for Climate Change and Disaster Management, Anna University, Chennai, Retrieved from URL <https://www.annauniv.edu/cccdm/img/event/reports/draft/agri.pdf>
- Karanasios, S. and Slavova, M. 2018. Understanding the impacts of mobile technology on smallholder agriculture. In *Digital Technologies for Agricultural and Rural Development in the Global South*, 111-122, CABI Publishing, Retrieved from DOI <https://doi.org/10.1079/9781786393364.0111>
- Krishna, A. and Naik, G. 2020. Addressing the crisis in Indian agriculture through agricultural information delivery. *IIMB Management Review*, 32 (2), 217-229, Retrieved from DOI <https://doi.org/10.1016/J.IIMB.2020.09.004>
- Kumar, S.A. and Chandrasekaran, K. 2020. Analysis of persuading factors on utilization of Uzhavan App perceived by the extension officers in Tamil Nadu. *The Andhra Agricultural Journal*, 67 (Special II), 81-86, Retrieved from URL <https://www.researchgate.net/publication/356664537>
- Kumar, S.A. and Karthikeyan, C. 2020. Factors influencing the utilization of the Uzhavan App as perceived by the farmers in Tamil Nadu. *Madras Agricultural Journal*, 107 (4), 123-128, Retrieved from DOI <https://doi.org/10.29321/MAJ.10.000458>
- Kumar, S.A., Karthikeyan, C., Rajasekaran, R. and Selvi, R.P. 2020. Revealing the constraints faced by the “Uzhavan App” users in Tamil Nadu to operate Uzhavan Application (Farmers and Extension Officers) and suggestions to overcome the constraints. *International Journal of Current Microbiology and Applied Sciences*, 9 (11), 128-135, Retrieved from DOI <https://doi.org/10.20546/ijemas.2020.911.015>
- Kungumaselvan, T., Kanimozhi, R. and Sankar, E. 2021. UZHAVAN App, One-stop solution for farmers’ needs, 2 (1), Retrieved from URL www.aiasa.org.in
- Mathuabirami, V., Makokha, J. and Karthikeyan, C. 2019. Constraints faced by extension officers of Coimbatore district, Tamil Nadu in using Uzhavan app. *International Journal of Farm Sciences*, 9 (1), 126-130, Retrieved from DOI <https://doi.org/10.5958/2250-0499.2019.00030.2>
- Nandhini, S. and Rohini, A. 2022. A study on farmers’ perception about Uzhavan App in select districts of Tamil Nadu. *Asian Journal of Agricultural Extension, Economics & Sociology*, 40 (8), 171-178, Retrieved from DOI <https://doi.org/10.9734/AJAEES/2022/v40i830951>
- NSSO. 2021. Situation assessment of agricultural households and land and livestock holdings of households in rural India, 2019. NSS Report No. 587, National Sample Survey Office (NSSO), Ministry of Statistics & Programme Implementation, Government of India. Retrieved from PDF: https://mospi.gov.in/sites/default/files/publication_reports/Report_587m_0.pdf
- Prabha, D. and Arunachalam, R. 2021. Mobile SMS advisories, An analytical study among farmers. *Research Biotica*, 3 (1), 33-36. Retrieved from DOI <https://doi.org/10.54083/ResBio/3.1.2021.33-36>
- Prabha, D., Theodore, R.K. and Karthikeyan, C. 2017. Impact of e-Velanmai model of extension service in Tamil Nadu. *Madras Agricultural Journal*, 104 (3), 90-93, Retrieved from DOI <https://doi.org/10.29321/MAJ.01.000406>
- Prasad, S.A., Vijayashanthi, V.A., Manimekalai, R., Yogameenakshi, P. and Pirathap, P. 2020. Impact assessment on knowledge of weather-based agro-advisory services among farmers in Tiruvallur District, Tamil Nadu. *Current Journal of Applied Science and Technology*, 39 (36), 96-101, Retrieved from DOI <https://doi.org/10.9734/CJAST/2020/V39I3631077>
- Rani, S. Padma, Vidhyavathi, A. and Sabu, A. 2020. A study on performances of selected e-NAM linked regulated markets in Tamil Nadu. *International Research Journal of Agricultural Economics & Statistics*, 11 (2), 198-204. Retrieved from DOI <http://dx.doi.org/10.15740/HAS/IRJAES/11.2/198-204>
- Saravanan, R. 2012. ICTs for agricultural extension in India: Policy implications for developing countries. AAQUA Working Paper Series, Retrieved from URL https://saravananraj.in/wp-content/uploads/2020/04/45_AFITA_ICT-for-Agricultural-extension_India.pdf
- Village Survey. 2022. Tamil Nadu village information directory. The Indian Village Information Directory, based on Office of the Registrar General & Census Commissioner, India, Census 2011 Data, Retrieved from URL <https://vill.co.in/tamil-nadu/>
- Vincent, A. and Raj, S. 2022. Agricultural extension system: What works and what does not? Implications for Tamil Nadu. *Agricultural Research Journal*, 59 (4), 990-999, Retrieved from DOI <https://doi.org/10.5958/2395-146X.2022.00140.5>