

# Whatsapp for Dairy Farmers as an Effective ICTs Tool : A Review

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## Abstract

Farming is not considered as profitable occupation even though India has an Agrarian economy. An attempt has been made to explain the astounding difference in the productivity of the agriculture and livestock products depends not only on socio-economic profile characteristics but also major part of it depends on the awareness and recent information that the farmers collect from extension personnel, village level workers and from other farmers. Under Indian context due to less number of extension agents despite of consistent efforts has been made by the Government, in strengthening the extension set up but a gap still exists. Therefore, social media has emerged as an effective information delivery tool because of its high media richness, high penetration level which could surely boost the scope of traditional extension system. This article observes that it seems pertinent to rely on social media like Whatsapp as there is the dire need to decrease the knowledge gap amongst the marginal farmers by providing easy access to information and platform for discussion which can be done by involving social media in their farming practices for collecting a pool of knowledge easily at one place.

**Keywords:** Indian Farmers, Information Source, Agricultural Extension, Social media, Whatsapp

In an era where information is considered as a valuable resource, like land, labor and capital still dearth of information has been a critical concern for farmers of India. As the majority of small and marginal farmers in the developing countries remain ignorant to both traditional and new media. Around 80% of the farmers are small and marginal (Census 2012) and do not have access to a wide range of information and knowledge, which could improvise their livelihoods and developmental pattern. Moreover, knowledge generated by the researchers or institutions at the top level and its delivery to the grass root level is the major concern

caused by poor infrastructure and mechanism of delivering the information. The average ratio of workers to farmer is 1:5000, due to which extension personnel cannot reach each and every household and are not able to tackle the problem of individual farmers (Ragasa *et al.* 2013). The risk is further put on the line by the very limited scope and coverage of livestock extension information

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delivery as NSSO (2005) surveyed has shown that in India only 5.1 percent of the farmer households were capable to access any kind information related to animal husbandry whereas 40.4 percent of the Indian households are accessing information related to modern technology for crop farming and according to NSSO (2014) only 8% of the household were receiving information from the veterinary institution in the year of 2013. As a consequence of which, despite being World's largest milk producing nation, India's dairy farmers are still lagging behind due to high cost of delivering information in person plus coverage of quality of information provided to marginalized farmers is uneven which gradually leads to lack of knowledge that detracts the growth of dairy sector. It has become requisite for the Government of India to apply some new interventions like Atmanirbhar Bharat, Digital India for achieving higher production and growth rate towards execution of economic reforms. Attaining the dream of "Digital India" is impossible without thinking of a way out to reach up to grass root level because eventually, responsibility of food security and agricultural development of the Nation relies upon farmers who are needed to be prioritized. Discussions about enhancement of information delivery system and how to make agriculture as remunerative occupation, has emerged as a new milestone for the development of Indian farmers. This has also raised questions about the feasibility of social media like Whatsapp as desired information delivery tool which can esteem Indian farmers magnificently. This paper deals with the role of social media to empower dairy farmers.

### **Use of Social Media as source of agricultural information**

It is not very difficult to analyze the fact that according to today's scenario Social media has piqued curiosity of not only the teenagers and youngsters but also gained the popularity irrespective of gender, age, religion and geographic area. People all over the globe are entering in to the world of social media. So why not agriculture and allied sector should use it as for their own benefits, reach of extension personnel in rural area can increase manifold if social media is accepted open handedly and can deliver vast amount of information to rural communities and farmers. Social media came

out as a key part of the outreach strategy of many organizations. Over the last few years it has been seen, Government, commercial, Non Government profit organizations have been setting up a presence on social media websites to better engage their constituents (Dadashzade, 2010). Social media allow user to personally and informally interact, create, share, retrieve, and exchange information and ideas in any form text, pictures, audio, video, etc. that can be discussed upon, archived, and used by anyone in virtual communities and networks and it can also provide participation, openness, community, connectedness, conversation in one platform (Bhattacharjee and Saravanan, 2016). Previous to social media there were several media like newspaper, television, radio, and many more whose popularity decreases once a newer media enters and serves the better function from previous one, this concept shows the theory of functional equivalency how one media develop and then downfall of same media bring the emergence of the other media (Neuman, 2010), there is no doubt today, that we are witnessing the huge shift in the media. Large proportion of population is shifting from old media towards smart phone and social media ([www.ifla.org](http://www.ifla.org)). In January 2020 Worldwide, there were 3.80 billion social media users which is 9% more (321 million new users) since last year. Nearly 60% of the populations are already the internet user in the world (Digital report January 2020). Therefore the above statistics had proven the huge potential of the social media in the development of agriculture and allied sector by extension personnel to reach out to the people, farmers and youth which will lead to high impact in development.

### **Different types of social media for dairy farmers**

Kaplan & Haenlein, (2010) explained different type of social media platforms in their study, with the slight modification and addition to the newer platforms classification is done on the basis of their function and brief description of most frequently used social media platforms by farmers are given below:—

- ◆ *Social networking sites*: These platforms are used to build social and personal interaction with friend, colleague and peer. They are the most

popular social media platform and having the highest reach. Farmer can use these sites for promotion of the product and can post the activity about the farms and farm products with customers, friends organization and to the groups There are example, some familiar ones are -Google, Face-book

- ♦ *Professional networking site:* These platform increase the scope of scientific discussion amongst expert of the field and peers also increases networking among professionals. Most famous professional networking site is LinkedIn, launched in 2003 and till today millions of people using it. It targets professionals and promotes itself as a way to find business contacts and jobs.
- ♦ *Content communities:* It share specific type of the content in a very interesting way. It is having high media richness. You tube is one of the best example of this as it provide the online video sharing platform which is user generated and also offers wide variety of corporate videos. Many educational and informational channels related to farming are maintained by individuals or experts to favor farmers and farming community. The most influencing farming you tube channel farming leader, Haryana formed by Darshan Singh in 2017.Podcast and slide share also come under content communities.
- ♦ *Socially integrated for messaging:* This platform has recently gained most of the popularity because of its group messaging option. Contents can be created and send to an individual and also to the group. Whatsapp is the most easily accessible and preferred socially integrated messaging platform, user can not only send text messages but also can send images, video and audio messages to each other. This media provides suitable platform to all the agriculture including livestock stakeholders for discussion and for getting information quickly.

### **Social media for Agriculture and allied sector's development**

Social media as a tools of development have a potential to break down the rigid social and professional hierarchical structures that curbs

reform in agricultural extension services (Abdul *et al.* 2011). It basically provide common platform to farmers, researcher and extension worker which can mirror the prior existed dynamics of social relationships among rural communities by encouraging peer discussions and learning (Pimmer and Tulenko, 2015). For improving agricultural extension provision to improve accountability and increase transparency in organizational performance most important aspect that is considered are Demand-driven and participatory approaches so it is essential to digitalize the agricultural production, processing and marketing information into web-based resources to increase outreach and use.

According to (Stanley 2013) the value of social media for the agricultural industry lies in the value of social capital bringing more trust, transparency, engagement, and authenticity to the supply chain. Trust and credibility on the media is utmost requirement which could be improved gradually by the maximizing use of respective media also by making farmers familiar and comfortable towards their use. Social media being source of information and entertainment can also play a vital role to transform attitude and interest which seems very important in context of poor and marginal farmer. Among various extension methods, use of social media is useful in creating awareness and stimulates large number of audience thus, founded as a best and suitable way to endow. Subsequently, in today's world of digitalization with the decrease in the price of smart phones it has actually taken as the boon for bridging the rural digital divide and accepted as a most accessible device for staying in contact as an when required. Those days were gone when communication and information delivery can be done only through face to face interaction with extension personnel's or by visiting institutions and research centre. Now a day, Social media (facebook, Whatsapp) acknowledged as one of the good extension tools which emerged out of communication revolution with the traits of being highly cost effective, user friendly and participative in nature. At present storyline its efficacy is much better than ICT tools as it can make clear understanding of implementation of information timely and easy to handle as not much techniques and infrastructures are required.

## **Whatsapp as an information delivery tool and discussion platform for dairy farming**

Whatsapp, which is one of the most popular social media platforms by having 2 billion of active users at present in all over the World is founded by (Koum & Acton Digital, 2020). This tool is simpler and easy to use, has low internet data requirements, and is increasingly popular in rural India. Thus, it has a strong potential to be a viable agricultural extension tool for extension based institution in general and extension educators, in particular, to reach out to the Whatsapp using farming clientele. In this platform of instant messaging Text, pictures, audio and even video, can be send with end to end type encryption. Currently, Whatsapp is in every Smartphone and preferred because of zero cost communication facilities. It does not require any extra cost except the cost of internet connectivity. The pervasiveness of Whatsapp messenger showed that it handled more than ten billion messages per day at one period of time (Olanof, 2012). There is the need of user participation and feedback in the great extent in agricultural extension activities for that social media tools such as Whatsapp could be best platform (Andres, 2013).

Several challenges faced by the dairy farmers like as the work load, labor efficiency. They find extreme difficulty in sparing time to meet agricultural extension agents for consultations; therefore new approaches needed to be adopted for enhancing and keeping the track of communication and discussion level. Farmer use discussion method to enhance their knowledge and to decreases their uncertainties. The fetch of information is not only from resource person to farmer but also in between the farmers. At nearby scenario, online discussion groups are becoming increasingly popular as social media usage levels continue to increase (Galvin, 2014). Often, unpredictable problem leave the farmers clueless and in confused state which exceed to the timely intervention need to the ill animal as a result farmer faces many animal loss. At that time Whatsapp shows lot of advantages over other conventional and older media like instant messaging with two way communication at personal level, bottom up strategy, individual can create their own content and can disseminate it from many to many, create open chains of distribution of information through text video message pictures and even

audios. What's App was the most downloaded non-gaming app worldwide for November 2020 with approximately to 58 million installs. The countries with the largest number of Whatsapp installs were India at 30 percent, followed by Nigeria at 10 percent (Sensortower.com). From the above statistics it can be inferred that popularity of Whatsapp under Indian context is quite high even for the rural people. This clearly ensure that there is a sore need to fill the gap by exploring alternatives for extension delivery system among which social media act as a exemplary tool for delivering information at the door step in a handy way with high accuracy and impressive speed.

### **Successful stories of using Whatsapp by and for farmers**

Diverse examples have been set under Indian context in last previous years by farmer community forming a Whatsapp group like—

1. **Pashu Palan (Animal husbandry)**- This group is formed among the farmers of Utar Pradesh group, Maharashtra, Rajasthan, Madhya Pradesh, Haryana and Gujarat and were administered by Veterinarians. The information provided to the farmers was related to Livestock Breeding, health management and feeding (Kamal, 2013 and Vora, 2015).

2. **“India’s dairy farmers” Whatsapp group of farmers-Madhya Pradesh** (<http://www.factoraily.com>)

It was started by Anand Vajpayee of Indore, who has more than 50 buffaloes. The admin of the group is Sarvoday Patidar, a 25-year-old engineer-turned-dairy farmer based in Khandwa district of Madhya Pradesh. Besides some veterinary doctors, it comprises 200 cattle-rearers from Madhya Pradesh, Uttar Pradesh, Haryana and Punjab. While some are large dairy farm owners, many operate at medium and small scale.

3. **Shetkari Shetkari Mitra (farmers’ friend) Whatsapp group** <https://www.mssrf.org/content/maharashtra-farmers-‘whatsapp’-agri-information>

It is a Whatsapp group in Yavatmal, Maharashtra created by M.S. Swaminathan Research Foundation’s village resource centre on the year 2016. They started with 130 members in the group; farmers with android phones were oriented to its application

for agriculture so that maximum farmers can be favored from this instant messaging platform. It was formed to share information on agriculture, marketing, and animal husbandry and government schemes also information regarding crop damage, new irrigation techniques, crop rotation, pesticide application, preventing crop diseases, increasing yield and care of domestic livestock were being shared. The farmers regularly send their queries on the group and receive proper advisory on a single click. This service of the VRC clubbing technology as well as timely information has been greatly beneficial to the farming community in the region.

#### 4. **Hoy Amhi Shetkari (HAS-Yes, we are farmers) Maharashtra** ([www.economicstimes.indiatimes.com](http://www.economicstimes.indiatimes.com))

This group was formed by AnkushChormule and Amol Patil in (2012) and today they manage to run 70 what's app group which are handle by 15 administrator. There were 60,000 farmers are associated with HAS what's app group at present scenario. They share latest technique with the farmers in the group, update with the upcoming schemes and also tell farmers about insect and pests. Invasion of fall army worm which was harmful for the maize crop was first explained to the farmer through this group. Later they open the face-book page in 2015 followed by there you tube channel later for the farmers.

#### 5. **"Baliraja" what's app group of Farmers Pune** (<http://www.networkedindia.com> 2019)

This group connected hundreds of farmers from various villages. It was created by the Anil Bandawane on August (2015) so that farmer can seek information and advice regarding their problem by connecting to an expert from what's app group. They started learning new practices and technology with the help of the experts. Use of fertilizers and pesticides, weather updates & how to grow exotic veggies like broccoli are some practices which is learned by farmers through what' s app group interaction.

### **Researches on use of social media by dairy farmers**

In Past several years after introduction of social media and with its consistent evolution several researches being conducted in the use of social media in different sectors. Obvious reasons to

this is to find and prove its advantages over other traditional media's in different geographical, socio-economic conditions and also for bringing forward the application of social media in agricultural and livestock sector for different purposes like information shairing, knowledge gaining, communication purpose, marketing purpose and many more. According to Morris (2017) stated that social media provides ample of new marketing opportunities for farmers who can engage in direct selling and micro branding. The simplicity of the supply chain through social media keeps the farmer headstrong and gave them voice by providing networking opportunity.

According to Roche *et al.* (2020) study insight into the communication preference of Canadian dairy producer and their engagement in social media 94% of respondent commonly used the online search engine. Social media platform like you-tube face-book and twitter were most commonly used platform. 80% of the twitter user inferred that the herd management information were being shared online among all social media platform, which has high level of interactivity thus, as a result they considered that social media platform have highest interactivity level regarding herd health.

After the intervention of socially integrated messaging platform like Whatsapp many researches being conducted to see the approach and feasibility of this social media platform Thus, it has been observed (Rose *et al.* 2020) that Whatsapp is an enthralling tool In mitigating communication challenges. It put forward a chance to share information on one platform among different groups and facilitating collective action in cross cutting approach projects. About 51% reduction in project monitoring cost, collapsing reporting hierarchies reduces the delay of information, thereby saving time and communication challenges. An assumption that social media is largely beneficial as a source of agricultural information and that it is also cheap and convenient is believed by the majority of farmers. They also have a positive attitude towards the use of social media in seeking agricultural information. Although, sometime they seems to be discouraged by the perceived technical difficulties in accessing the information but continuous use of any technology will enhance their ease of use gradually with time (Kuria, 2014).

## Theories and Model on Use of social media for dairy farmers

They are several different types of model and theories in the social media research to identify socio- psychological behavior of social media user and other stakeholders. According to (Ngai 2015) some of them are explained below:—

- ♦ *Technology Acceptance Model TAM Model* : The Technology Acceptance Model (TAM) proposed by Fred Davis (1989) provides a framework to analyze the adoption of Social Media. It is an information system theory that deals how user accept and use any new technology. Behavior intention plays major role in letting people accept and use the technology. The model uses two factors to determine take up of new technology, which are the perceived usefulness (PU) of the technology and the perceived ease of use (PEOU).
- ♦ *Theory of Reasoned Action (TRA)*: It is a theory developed by Ajzen and Fishbein in 1980 which predicted people's behavior depend upon its intention and which is based upon a summation of the relative weights of their attitudes and subjective norms. This theory, which resembles the situation where people voluntarily participate and engage in social media activities, is nicely explained in Hsu and Lin (2008).
- ♦ *Theory of Planned behavior (TPB)*: It is an extension of TRA, which was developed by Ajzen (1985). TPB suggests that perceived behavior control is employed to moderate the effects of attitudes and subjective norms on behavior. In social media research, Chang and Zhu (2011) used TPB model to predict users' behavior from intention to action in social networking sites adoption. Under this study TPB model helps to predict the intention of adoption of pre adopter and post adopters.
- ♦ *Social Loafing Theory*: It is often used together with social ties in social media studies. The term "social loafing theory" was first coined by Latané, Williams, and Harkins (1979) to reflect the fact that people exert less individual effort while performing in groups than when alone. Social media are considered as a medium for collective efforts in which the degree of

individual contribution can be minimal. Shiue *et al.* (2010) adopted this theory to study users' group cohesion in online communities. It can be viewed as a behavioral obstacle that creates a negative attitude towards group cohesiveness.

- ♦ *Social capital theory*: Social capital is defined as the networks of strong personal relationships that are developed over time and provide the basis for trust, cooperation, and collective action in communities. The social capital theory suggests that the social network of relationships possessed by an individual strongly influences the extent to which interpersonal knowledge sharing occurs (Chang & Chuang, 2011).
- ♦ *Uses and Gratifications Theory (UGT)*: It is an approach to understand why and how people actively seek out specific media to satisfy specific needs. It intends to evaluate the effectiveness of social media for media and communication purposes. It is theory of mass communication (Eighmey & McCord, 1998) which has received considerable attention in social media research, particularly in investigating how to satisfy customers' needs, such as in the studies by Chen (2010). Korhan & Ersoy (2016) tried to identify the factor which makes social media application appealing and effective and also there usability an functionality perspective was calculated through uses and gratification perspective, under which Whatsapp came out as a comparatively more dominant from other social media platforms.
- ♦ *Unified Theory of Acceptance and Use of Technology (UTAUT) model*: It was developed by Venkatesh, Morris, Davis, & Davis, in 2003 and was used as the foundation to identify factors related to farmers' use and acceptance of social media for marketing purposes. Alternative objective of UTAUT was to measure and compare perceptions and attitudes of the use of social media as a strategy to promote local competitiveness in farmers' communities. Moreno-Ortiz (2018) stated that the growth of local food systems has been induced by farmers, rural communities, and some governmental institution. In some regions, a local food system requires increasing farmer's knowledge about how to sell their products in local and external

marketplaces using marketing strategies through the Internet at low costs. Ultimately, this study can contribute how UTAUT model explain the usage behavior of social media of farmers which is important for the development and success of any extension program.

Any new technology adoption is not only depends upon economic reasoning, but also the beliefs about a technology play a crucial role in decision making. Thus, the study (Michael *et al.* 2019) stated that the key attitudinal components of the TAM model are perceived ease of use and perceived usefulness, which both positively influence the intention to use herd management smart phone apps and will ultimately lead to a positive effect on the actual usage behavior. Apart from above there are several other theories and models like Task technology fit model, social exchange theory, Media richness theory and many more. Acceptance and adoption of social media is not any new research topic. From last many years several researches are being conducted in similar like concepts and it is obviously understandable that the factors which affect the social media acceptance from various perspectives are needed to be examined. According to Al-Qaysi *et al.* (2020) some preferred model is taken out after the analysis has been made on 122 articles in between 2009-2018. The TAM and UTAUT model were considered as the most extensively used informational system model in studying the social media acceptance and adoption studies and the U&G theory and the social constructivism theory were considered as the most widely used educational theories in social media.

### **Agriculture Extension and Technology Transfer through social integrated messaging platform**

Agricultural extension, involves the entire set of institution that support people who are involved in agricultural and allied sectors production and facilitate their efforts to solve problems; link to markets and other players in the agricultural value chain; and obtain technologies information, and skills, to improve their livelihoods (Birner *et al.* 2009). In context of Agricultural extension, sharing of agricultural information with farmers is of key importance. There are several measures taken by the extension system of India for the sustainable growth of development in agriculture but every

technologies and media having their own limitation. Thus, there is the demand of the tool with minimum limitation and more of advantages from the other medium. M-Kisan portal/ Kisan call centre is used by the agriculture extension system to address the queries of farmers through telephonic call, mostly very general response given by the scientist in response to farmers problem and after providing solution no concern is been shown to the adoption and utilization of information, these ICT tools need large infrastructural availability also and even then such services have been reported to be of lesser practical nature. All of these limitations can be overcome through the use of Whatsapp by the farmer community including resource person to it. The use of Whatsapp seems inevitable to accomplish the task of technology transfer on account of coverage, speed and instant reply to problems, rather than travelling long distances to farmers' fields, extension agents are increasingly using either mobiles or a combination of phone calls, text, videos, and the internet (Devenand, 2019). This will reduce transaction costs and interacting with farmers becomes more frequent and also approach will be more problem solving.

### **CONCLUSION**

From delving into the above viewpoint it sound admissible and imperative to rely on social media approach for sustainable agriculture development and for strengthening the extension system by reaching out to the grass root farmers with high interactivity at personal level. Whatsapp has emerged as an efficient medium because of having huge popularity base globally and in developing countries. Its use will gradually decrease the knowledge gap and will lead to community development & rapid technology transfer as it is being most cost and time effective, user friendly and adequately participatory. Many researchers have revealed that this medium is labor efficient method of communicating with a discussion group facilitator and other group members which collectively generate information pool and effectively utilized for information dissemination from many to many, information sharing, bottom to top communication, catering to knowledge and solving problem as soon as possible. It is also found that SMS messages, pictures, audio, videos and

media articles can all share information among the group members and educate them as a result. This all can be done through one media i.e. Whatsapp. It can be used to contact their advisor and discussion group members during busy periods on the farm. If applied precisely Whatsapp will go a long way in bridging information gap between farmers and researcher and also enriched the grass-root level with information which paved the way towards livelihood, knowledge empowerment, sustainable agriculture growth and economic development all one together.

## REFERENCES

- Abdul, S.S., Lin, C.W., Scholl, J., Fernandez, L.L., Jian, W.S., Hsu, M.H. and Li, Y.C. 2011. Facebook use leads to health-care reform in Taiwan. *The Lancet*, **377**: 83.
- Al-Qaysi, N., Mohamad-Nordin, N. and Al-Emran, M. 2020. A systematic review of social media acceptance from the perspective of educational and information systems theories and models. *Journal of Educational Computing Research*, **57**(8): 2085-2109.
- Andres, D. and Woodard, J. 2013. *Social media handbook for agricultural development practitioners*, USAID Washington D.C. United State, pp. 200.
- Bhattacharjee, S. and Saravanan, R. 2016. *Social media: Shaping the future of agricultural extension and advisory services*. Global Forum of Rural Advisory Services (GFRAS) interest group on ICT4RAS discussion paper, GFRAS: Lindau, Switzerland 9.
- Birner, R., Davis, K., Pender, J., Nkonya, E., Anandajayasekeram, P., Ekboir, J. and Cohen, M. 2009. From best practice to best fit: a framework for designing and analyzing pluralistic agricultural advisory services worldwide. *Journal of Agricultural Education and Extension*, **15**(4): 341-355.
- Census of India, 2011. Census of India 2011: Report on Post Enumeration Survey. Registrar General & Census Commissioner, New Delhi.
- Chan-Olmsted, S.M., Cho, M. and Lee, S. 2013. User perceptions of social media: A comparative study of perceived characteristics and user profiles by social media. *Online Journal of Communication and Media Technologies*, **3**(4): 149-178.
- Chang, H.H. and Chuang, S.S. 2011. Social capital and individual motivations on knowledge sharing: Participant involvement as amoderator. *Information & Management*, **48**(1): 9-18.
- Chang, Y.P. and Zhu, D.H. 2011. Understanding social networking sites adoption in China: A comparison of pre-adoption and post-adoption. *Computers in Human Behavior*, **27**(5): 1840-1848.
- Dadashzadeh, M. 2010. Social media in government: From e-Government to e-Governance. *Journal of Business & Economic Research*, **8**: 81-86.
- Davis, F.D. 1989. Perceived usefulness, perceived ease of use, and user acceptance of information technology, *MIS Quarterly*, **13**(3): 319-340.
- Devanand, I.I. and Kamala, I.M. 2019. Innovative Extension Approach for Sustainable Agricultural Development: WhatsApp Groups for Farming Solution. *Current Journal of Applied Science and Technology*, **1**(8): 12-16.
- Eighmey, J. and McCord, L. 1998. Adding value in the information age: Uses and gratifications of sites on the World Wide Web. *Journal of Business Research*, **41**(3): 187-194.
- Galvin, A. 2014. *Social Media as an Aid to Agricultural Extension and Education Services*. Dublin: UCD. (www.sensortower.com/reports 2019).
- Hsu, C.L. and Lin, J.C.C. 2008. Acceptance of blog usage: The roles of technology acceptance, social influence and knowledge sharing motivation. *Information & Management*, **45**(1): 65-74.
- Kamal, K.S. 2014. Agro officer using whatsapp to connect with farmers, *Hindustan Times*, Gurdaspur, October 9, Punjab, India. <http://www.hindustantimes.com/punjab/agroofficer-using-whatsapp-to-connect-with-farmers/story-2OFvrDU3pvmPFXpBupwytO.html>.
- Korhan, O. and Ersoy, M. 2016. Usability and functionality factors of the social network site application users from the perspective of uses and gratification theory. *Quality & Quantity*, **50**(4): 1799-1816.
- Kuria, C.W. 2014. *Use of social media as a source of agricultural information by small holder farmers; a case study of lower Kabete, Kiambu County*. Doctoral dissertation, University of Nairobi.
- Michels, M., Bonke, V. and Mushoff, O. 2019. *Adoption of herd management smartphone apps in German dairy farming*, pp. 22-30.
- Moreno-Ortiz, C.A. 2018. Using the Unified Theory of Acceptance and Use Technology to Determine Factors that Affect the Acceptance and Use of Social Media to Advertise and Promote Agri-products in Farmer' Communities in North Mississippi. Mississippi State University.
- National Sample Survey Organization, 2005. Situation Assessment Survey of Farmers on Access to Modern Technology for Farming-59<sup>th</sup> Round. Report No. 499, published by Ministry of Statistics and Programme Implementation, Government of India, New Delhi.
- Neuman, W.R. 2010. Theories of media evolution. In W.R. Neuman (Ed.), *Media, technology, and society: Theories of media evolution*. Ann Arbor: University of Michigan Press.
- Ngai, E.W., Tao, S.S. and Moon, K.K. 2015. Social media research: Theories, constructs, and conceptual frameworks. *International Journal of Information Management*, **35**(1): 33-44.
- NSSO, 2014. Key Indicators of Situation of Agricultural Households in India, NSS 70<sup>th</sup> Round, Ministry of Statistics and Programme Implementation Ministry of

- Statistics and Programme Implementation, GOI, New Delhi.
- Olanof, D. 2012. *WhatsApp hits new record with 10 billion total messages in one day*. The Next Web, pp. 70.
- Pimmer, C. and Tulenko, K. 2015. The convergence of mobile and social media: Affordances and constraints of mobile networked communication for health workers in low and middle income countries. *Mobile Media & Communication*, 4(2): 252269.
- Ragasa, C., Ulimwengu, J., Randriamamonjy, J. and Badibanga, T. 2013. *Assessment of the capacity, incentives, and performance of agricultural extension agents in Western Democratic Republic of Congo*, pp. 1283.
- Roche, S.M., Renaud, D.L., Genore, R., Bauman, C.A., Croyle, S., Barkema, H.W. and Kelton, D.F. 2020. Communication preferences and social media engagement among Canadian dairy producers. *Journal of Dairy Science*, 103(12): 12128-12139.
- Stanley, S. 2013. *"Harnessing social media in agriculture"*, a report for the Nuffield Farming Scholarship Trust, Lincoln.
- Vora, R. 2015. WhatsApp turns a trading platform for Gujarat farmers, Business Line, April 29, Ahmedabad, Gujarat, India. <http://timesofindia.indiatimes.com/home/sundaytimes/WhatsApp-The-other-Kisan-channel/articleshow/48637478.cms>.
- Wyn, M. and Penri, J. 2017. "Social media, an entrepreneurial opportunity for agriculturebased enterprises", *Journal of Small Business and Enterprise Development*, <https://doi.org/10.1108/JSBED-01-2017-0018>.

