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Do short messages service (SMS) increases the profitability of vegetable farmers?

Jeevan Lamichhane[1], Krishna Prasad Timsina[2], Yuba Raj Bhusal[3], Surya Prasad Adhikari[2] and Sanjiv Subedi[2]

[1]Planning Division, Nepal Agricultural Research Council
[2]National Agricultural Policy Research Centre, Nepal Agricultural Research Council
[3]National Potato Research Centre, Nepal Agricultural Research Council
*Corresponding author's email: jeevanlamichhane7@gmail.com

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ABSTRACT
Timely unavailability of information can lead to inefficiencies in production, commercialization which in turn can affect farmers' revenue and wellbeing. Nepal Agricultural Research Council sent short messages regularly on weekly basis and in case when the shocks arise. The objective of this study is to assess the impact of phone based short message service (SMS) on the profitability of the vegetable farmers. We conduct propensity score matching by taking 156 farmers who followed the SMS and 103 farmers as control for the study. We found average effect on the profit of the vegetable farmers. Compared to the control group, treated farmers were also found to increase their knowledge attributes. Improvement over the existing SMS is needed for increasing the magnitude of the impact.

Keywords: SMS, short message service, farmer, profit, vegetable

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INTRODUCTION

The difference between potential yield and yield at farmer's field is still high (Timsina et al 2023). Different kinds of shocks in different time alter the productivity of the crops. Though the agro-technology is emerging in a fast pace, there is great challenge in making this information accessible (FAO 2019). Some other challenges farmer faces are lack of timely, reliable and updated information, inadequate extension services, pest outbreaks and lack of knowledge to identify counterfeit inputs particularly seeds and fertilizers (Tadesse and Bahiigwa 2015). Price and market information system is not abundant as expected by the farmers (Mitra and Sarkar 2003). To address these challenges, a wide variety of information services is needed that should be available and accessible to all farmers. The agricultural extension system has limited reach even after many years of its setup (Jaisi et al 2022). Extension system is resource intensive, have limited outreach particularly for small and

marginal farmers located in remote places (Ghimire et al 2017). Extension workers have shown to be biased in favor of progressive farmers, may be because it is easier to reach them. Nepal is using the traditional information disseminating methods (Bhattarai et al 2024). Many small farmers depend upon the small vendor and the input supplier as a source of the information (Birthal et al 2015). Sometimes there is a caste based and gender-based discrimination too. Farmers are more reliant to their own experience, competence and other community member. The geographical setting of the country is such that it is almost impossible to reach each and every farmer. In this context, effective information disseminating medium. The penetration of the mobile is high even among the farmers. It is easier to send information to many farmers at the same time. Mobile Phone technology in Nepal has almost full connectivity and coverage (Nepal Telecom 2023).

Nepal Agricultural Research Council(NARC) has adopted a novel approach to disseminate agricultural information to the farmers in Nepal. This service is called NARC SMS. Short Message Service (SMS) is the process of sending technical information and other advisory services to the large number of the farmers at once with the use of the mobile phones. Every week SMS services are sent to 2500 farmers. Sending message may bring innovative ways of making specific information available to the farmers, however some of the resources poor farmers may not be able to get it. It is easy, quick and cost effective method of sending the information at the appropriate time and for the targeted group. Vegetable production is important source of cash generation for the farmers that contributes 14.46% in the national GDP of the country (MoALD 2079/80). This study aims to provide empirical evidence on the question whether the information sent to the farmers through SMS makes a difference in the profit of the vegetable farmers.

Conceptual framework of the study

The advantage of using SMS for providing technical information is mainly for reducing the dissemination cost for the extension agents and search costs for the farmers. This is actually by improving the timeliness, reliability and quality of the information or by removing barriers to information. Farmers can learn with the information provided on different technologies through the SMS which affects the social and psychological dimensions that influences the knowledge level and motivation. The gains in Knowledge motivate the farmers and the extension agent as well. This in turns improve the productivity and welfare of the farming community. Weather information helps with farm operations in particularly informing about the unfavorable circumstances. Advisories through SMS assist farmers to choose a more appropriate technology (choice of variety, pesticide, fertilizer and management practices).

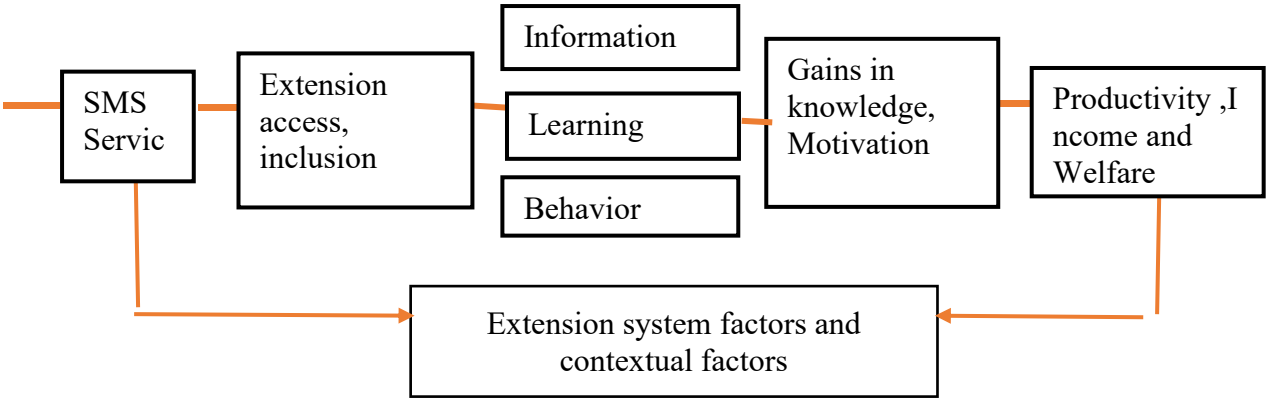


Figure 1. Conceptual framework of the study

MATERIALS AND METHODS

Study Area

The respondents of the study were the vegetable growing farmers within the list of SMS recipient. The sampling frame comprised of the farmers from different districts of seven provinces of the country. The required number of sample could not be found in single province, so we included the farmers from all the provinces. We excluded all the farmers who were receiving the messages from other sources. Care was taken to prevent the contamination of the farmers those using SMS and not.

Sampling and Data collection

Multistage sampling was selected for choosing the sample. First we select the province, districts and the respondents. The sample size taken as treated and control for each of the province in the following way (Koshi province:14&8; Madhesh province:29 &17; Bagmati province:33 & 26; Gandaki province: 25&13; Lumbini province: 27&22; Karnali province:12 &7; Sudurpaschim province:16 & 10. Thus the total number of sample was 259 with 156 treated and 103 control.

We obtained the list of recipients from National Agricultural Technology Information Centre, NARC. Form this list, we differentiated number of farmers who were engaged in vegetable cultivation by contacting each farmers in the. Each of the farmer are provided 4 messages per week. Control group were those who do not use the SMS after receiving it. It is because some of the farmers simply refuse the service. Treated group were those who uses the instructions of the SMS and control were those who did not use the instructions of the SMS provided. Table3 has explained the SMS use pattern of the farmers. Despite the kinds of crop grown by the farmer, all of the farmers receive the same text messages. Data for analysis comes from our surveys conducted by semi structured questionnaire. Conducting face to face interview was not economically feasible all the time, so data were also collected through telephonic interviews. Before collecting the data, for making the instrument clear to farmers, we pre-tested the Questionnaire with 10 farmers with very similar socioeconomic conditions and made necessary correction in the questionnaire.

Explanation of the intervention

The intervention was the SMS-based agro-advisory services for the vegetable growing farmers. The content offering of SMS services are as:

a) Weather forecast: Probability of rainfall, precipitation, relative humidity, high temperature, low temperature, likelihood of the fog appearance, favorable weather condition for the appearance of diseases and pests are frequently informed through the message services.
b) Crop Advisory tips: Through the SMS services, NARC provides a package of practices for any technology it generates. Regarding the vegetable production technology, it has been sending message frequently various practices in the text form.
c) Commodity News: Every farmer receives News about the variety released, new technology generated through the SMS services.
d) Market Information: Farmers regularly gets price and quantity updates for a commodity nearest to his location. Besides, most frequently the farmers are provided with the market information to make them alert about the market situation.

NARC depend on the two sources of information for this intervention. Our source of information comes from the Agro-Advisory Bulletin by the National Agricultural Environment Research Centre. The agro-advisory bulletin is prepared by the multidisciplinary team consisting of different experts. From the Bulletin, we extract the information that are related to the package of practices of vegetable production. The weather information comes from the Department of Hydrology and Meteorology (DHM) which provides a weekly report with weather forecasts including minimum and maximum temperature, probability of rainfall, droughts, floods, frost and fog alerts.

Methods of data analysis

Descriptive statistics

Mean, standard deviation, minimum value, maximum value, t-test and mean difference were used for comparing the socioeconomic variables.

Table 1. Explanation of the socioeconomic variables (independent variables)

S.N.	Variables	Unit	Explanation
Covariates			
1	Age	Years	Age of the Household Head
2	Family size	Number	Number of family size
3	Sex	Male -1, Female-0	Sex of the Household Head
4	No of schooling years	Years	Number of years of schooling of the household head
5	Area	Kattha	Area of cultivation
6	Contact to extension service	Frequent- frequent or frequency?	Visit of the household head
7	Types of business	Commercial =1, Semi Commercial=2 Home Consumption=3	Scale of Business of the farmer
8	Status of fertilizer	Recommended =1 More than Recommended=2 Less than Recommended=3	Level of the Fertilizer use in the household
9	Access to mobile	Yes=1 No=0	Whether household head have access to mobile or not?
Outcome variable			
10	Logprofit (ha)	Ln value	Profit per hectare expressed in logarithm value

Propensity score matching

A propensity score is the probability that a unit with certain characteristics will be assigned to the treatment group (as opposed to the control group). The scores can be used to reduce or eliminate selection bias in observational studies by balancing covariates (the characteristics of participants) between treated and control groups. When the covariates are balanced, it become much easier to match participants with multiple characteristics. It creates sets of participants for treatment and control groups. A matched set consists of at least one participant in the treatment group and one in the control group with similar propensity scores.

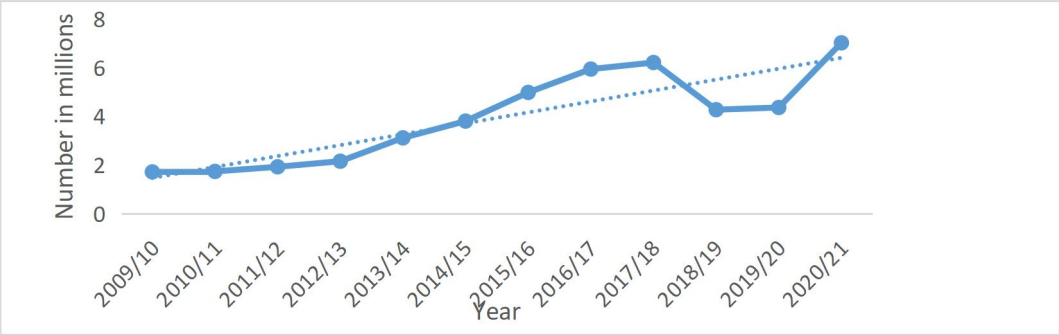
Normality of the dependent variables was tested before data analysis. The effect of SMS on knowledge level of the farmers was measured with T-Test. Balancing property was a checked

before the analysis. Outlier were removed before the analysis. Data was analyzed with the help of MS-Excel and STATA-16.

RESULTS

Import of the mobile phone

The use of the mobile phone in the country is increasing. The affordability to use the cell phone is in increasing trend. The access to the mobile phone have increased noticeably. These trends are affecting the performance and contribution of the extension services to productivity and the welfare. Fig 2 clearly states that the import of the mobile phone is increasing dramatically over the past decades. Thus sending the text messages through the mobile phone seems to be quick, effective way for the transfer of the technology.



Source: Trade and Export promotion Centre, 2022, Nepal

Figure 2. Import of the mobile phone

Socio-economics characteristics of the respondents

Table 2 explains the summary statistics for the socioeconomic variables. For each of the variable in both the treated and control group mean, standard deviation, minimum value, maximum value and mean difference is calculated.

Table 2. Characteristics of the socioeconomics variable in the study sites

Socio-Economic Variables	Control				Treated				Overall				Mean difference
	Mean	SD	Min	Max	Mean	SD	Min	Max	Mean	SD	Min	Max	
Age	45.51	9.65	26	71	44.88	10.76	22	76	45.14	10.32	22	76	0.63
Family size	7.17	5.47	2	50	6.56	3.77	1	22	6.8	4.52	1	50	0.601
Sex	0.7	0.46	0	1	0.79	0.41	0	1	0.75	0.43	0	1	-0.089
No of schooling years	8.26	4.35	0	18	11.18	3.78	0	20	10.02	4.25	0	20	-2.917***
Area (Katha)	4.59	7.55	1	50	10.1	12.71	1	100	7.91	11.27	1	100	-5.510***
Contact to extension service	0.83	0.37	0	1	0.85	0.36	0	1	0.84	0.37	0	1	-0.011
Types of business	2.19	0.77	1	3	1.76	0.81	1	3	1.93	0.82	1	3	0.433***
Status of fertilizer	2.42	0.91	1	3	1.99	0.97	1	3	2.16	0.97	1	3	0.424***
Access to mobile	0.98	0.14	0	1	1	0	1	1	0.99	0.09	0	1	-0.019*

There are only a few significant differences across the treated and control group indicating that the samples are comparable. Number of schooling years, Area of the farmers allocated for farming, types of farming, status of fertilizers and access to mobile are statistically significant. All the farmers in both the group have access to the mobile phone. The average number of the visit of the extension personnel is 2 in a year.

Pattern of SMS use by the farmers in the study sites

The pattern of SMS use refers how farmers perceived and use the short message service (SMS) received in the use of the agricultural production. Understanding this pattern is crucial where SMS is frequently used for the information dissemination and engagement. The pattern of the SMS use can affect the productivity and profitability. Table 3 shows the pattern of SMS use. 90 farmers do not care about the SMS whereas 13 farmers read SMS but do not follow at all. While 156 farmers read the provided SMS and follow the instructions.

Table 3. Pattern of SMS Use

Pattern of SMS Use	Treated	Control
Always read SMS and follow	123	-
Read SMS, followed and found provided information work to some extent	33	-
Do not care about SMS	-	90
Read SMS but do not follow at all	-	13
Total	**156**	**103**

Test for normality and grouping of the propensity scores for checking balancing property

Fig 3 shows the normal distribution for the log transformed outcome variable profit. It shows the variable is normally distributed. The concept of blocking is to improve the matching process by grouping individuals with similar propensity scores in blocks. In each of the block mean propensity score is not different for the control and the treated group. The balancing property is satisfied, it indicates that the distribution of covariates is similar between the treated and control units, thereby reducing the potential for confounding bias in estimating the treatment effect.

Table 4. Blocking of the propensity score

Inferior of block of p-score	Control	Treated	Total
.1219183	7	4	11
.2	34	9	43
.4	34	34	68
.6	19	51	70
.8	6	57	63

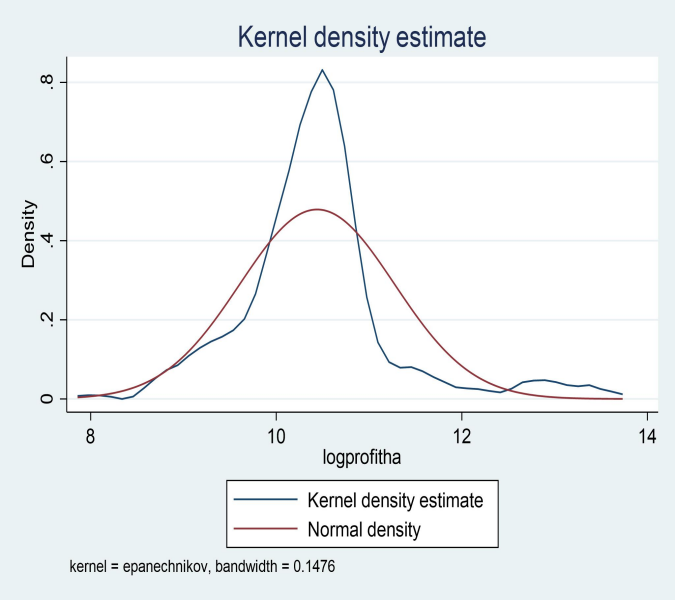


Figure 3. Normality of the outcome variable

Region of the common support

The overlapping of the two-propensity score in the fig 4 and 5 shows that that there are units of both the treated and control variable have the valid scores for the comparison. Units outside the region are excluded from the matching process for having no comparable counterparts. The graph also shows the outlier for the propensity score of the untreated (control) which has been removed before the analysis.

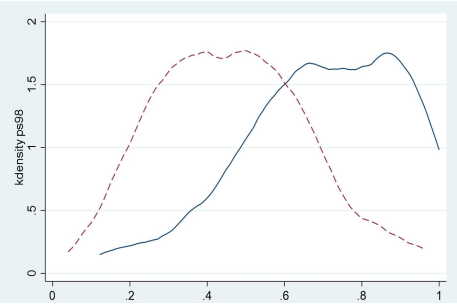


Figure 4. Overlapping region of the propensity scores

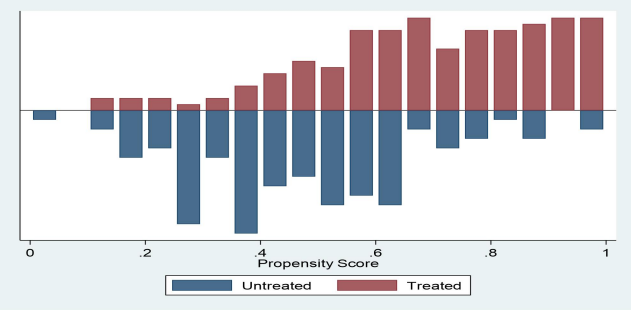


Figure 5. Overlapping region in graphical form

Effect on the Knowledge level

We estimate the effects of the SMS on a range of outcomes related to the knowledge and overall management of the crops. As shown in the table 5, except for the knowledge on the nutritional level, SMS shows all other knowledge attributes to be significant. This tests a theory of change which holds that extension generates knowledge, which leads to increased adoption and subsequently boosts yields.

Table 5. Effect on the knowledge level by the use of SMS

Knowledge attributes	Mean difference	p-value	std-error
SMS increases the knowledge of vegetable production technology	-.936	0.000	0.020
Knowledge on the nutritional level increased	-.153	0.098	0.111
Spillover effect on the neighbor's knowledge	-.961	0.000	0.018
Timely management of the various inputs	-.952	0.000	0.018
SMS helps in the overall management of the crops	-.994	0.000	0.006

Average treatment effect on the treated (ATT)

Table 6 shows the effect of the SMS before matching and after matching. The treatment appears to have a statistically positive effect, as the treated group's outcome (10.77) is higher than the control group's outcome (10.046) with a T-statistic of 5.19. We can say that the difference in the profit is not by the chance. This implies that the treatment is associated with an increase in the outcome by approximately 5.398 thousand per hectare (antilog value of 0.73224281) on average for the treated group.

Table 6. Average treatment effect

Variable	Sample	Treated	Controls	Difference	S.E	T-stat
Log profit (ha)	Unmatched	10.7789556	9.83697416	.941981429	.96409066	9.77
	ATT	10.7789556	10.0467128	.73224281	.141191645	5.19

DISCUSSION

The impact of the Phone based SMS on the Profitability, Productivity and other variables are mixed type. Tambo et al (2019) concludes that ICT-based extension campaigns significantly increases the farmers' knowledge about FAW and increases the adoption of agricultural technologies and practices for the management of the pest. Study done by Blessing and Julius in 2010 showed that the use of the information and communication technology is proved to be helpful in subsahara African countries in improving the quality of services by making reliable, faster and dependable. A study done by Nicole Hildebrandt et al (2020) in Ghana showed that Esoko price alert service SMS-based market information found to increase awareness of market prices substantially increased, particularly in distant urban markets which increases knowledge of farmers marketing decisions, leading to economic outcomes. A study done by Spielman et al (2021) suggests that not all the ICT enabled extension services are equally effective in improving adoption, productivity or welfare Economics. Marcel Faf champs and Bart Minten conducted randomized controlled experiment in 100 villages of Maharastra, India to find out the impact of the phone-based SMS on price received and weather information. The result showed that there was no statistically significant average effect on the treatment. Their study also showed the heterogenous effect of the SMS where the young farmers appear to be affected more by the treatment. Nekassone et al (2014) report that most studies improved price integration but incase at the farm level mixed results are found. Another study done by Adriana Camacho and Emily Conover in randomized controlled experiment with 500 farmers in 2019 showed that no significant improvement in the welfare had been achieved. Rather farmers are able to gain information on the new technology. A study was done by Sharma et al (2021) in India to find out the improvement on the Uptake of Agromet advisory services showed that positive and significant impact of SMS Agri-met advisories on the farmers' compliance with advisory for the treatment group.

CONCLUSION

In this paper, we tested if access to information through the text message bring changes in the profitability of the vegetable farmers. The knowledge level of the farmers is found to increase with the uptake of the message service. Results showed that the intervention had effect on the treated group. The knowledge level of the farmers is found to increase with the uptake of the message service. The treatment is found to increase the profit of the farmers. It is advised to use the message services. The future implementation of message service implementation should consider the following points to increase the magnitude of the impact.

The existing push based message system has the risk of seeing it as the Spam. Short Message Service is not suitable for illiterate farmers and is also limited to the content. Thus alternative models such as pull message service and voice-based services coupled with local settings is necessary for making the service more effective. Although some of the farmers have shifted to another occupation, they are getting the text message. Few of the farmers are found of not using the number from the last few years. Sending SMS for such farmers do not have any meaning. Updating the number in such case can increase the use and efficiency of the SMS.

In some instances, obsolete information is found to be sent through the SMS. The content that are sent through SMS needs to be updated. Care needs to be taken for not sending the information about the banned herbicides, denotified varieties and other obsolete practices. It prevents the farmers from being misleading. Farmers across different ecological region differs by typology, cropping-system, norms, values, domain and messaging should be done accordingly. Same kind of information for all the farmers across all the regions may not be useful for farmers who do not need that information. SMS is sent routinely on a weekly basis and in a situation when some shocks arises in farming. The necessity to increase the number of SMS is to cover all the recommendation domain for different cropping system. It is also necessary to study the heterogenous effect by farmer size on the profitability of the vegetable farmers.

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Authors' Contributions

JL and KPT were involved in conceptualizing and designing of the research. YB, SPA and SS were responsible for the literature review and provided critical feedback on the manuscript. All authors read and approved the final manuscript.

Conflicts of Interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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REFERENCES

Aker JC and M Fafchamps. 2015. Mobile phone coverage and producer markets: Evidence from West Africa. The World Bank Economic Review. 29(2)**:**262–292. https://doi.org/10.1093/wber/lhu006

Bell M. 2015. ICT–Powering behavior change for a brighter agricultural future. Washington DC: USAID/modernizing extension and advisory services (MEAS).

Bhattarai P, HR Devkota and MH Azad. 2024. Outreach research status of Nepal for technology verification and dissemination. **In:** Proceedings of 15th National Outreach Research Workshop National Outreach Research Center, Khumaltar, Lalitpur.

Birthal PS, S Kumar DS Negi and D Roy 2015. The impacts of information on returns from farming: Evidence from a nationally representative farm survey in India. Agricultural Economics, 46(4):549–561. https://doi.org/10.1111/agec.12181

FAO. 2019. Handbook on climate information for farming communities: What farmers need and what is available

Ghimire et al., 2017. Agricultural Extension Services in Nepal past, present and future. Michigan State University

N Hildebrandt and Y Nyarko, and G Romagnoli, and E Soldani 2020. Price Information, Inter-Village Networks, and 'Bargaining Spillovers': Experimental Evidence from Ghana. NYU Stern School of Business Forthcoming, Available at SSRN: https://ssrn.com/abstract=3694558 or http://dx.doi.org/10.2139/ssrn.3694558

Jaishi M, PB Nepali and KP Timsina .2022. Reform Strategy for Effective AgriculturalExtension Delivery at the Local Level in Nepal. Policy Brief, Agricultural Extension in South Asia.1-6

Khan SA, S Kumar, MZ Hussain and N Kalra. 2009. Climate change, climate variability and Indian agriculture: impacts vulnerability and adaptation strategies. In: Climate change and crops Springer, Berlin, Heidelberg p. 19-38.

Mitra S and A Sarkar 2003. Relative profitability from production and trade: A study of selected potato markets in West Bengal. Economic and Political Weekly 38(44): 4694–4699.

MoALD 2079/80. Statistical Information On Nepalese Agriculture. Ministry of Agriculture & Livestock Development Planning & Development Cooperation Coordination Division. Statistics and Analysis Section Singhadurbar, Kathmandu, Nepal.

Nakasone E, M Torero and B Minten 2014. The power of information: The ICT revolution in agricultural development. Annual Review of Resource Economics. 1:533–550.

Nepal Telecom. 2023. In: Annual Report 2023. Retrieved from https://www.ntc.net.np/annual-report

Tadesse G and G Bahiigwa 2015. Mobile phones and farmers marketing decisions in Ethiopia. World Development. 68:296–307.

Timsina,K, D Gauchan and J Lamichhane. 2023. Import and Export Issues of Agricultural Commodities and Inputs: Status, Challenges and Prospects. **In**: Proceedings Of The National Symposium On Major Agricultural Inputs Supply And Subsidy Mechanism in Nepal. p**.** 98-116

Sharma U, P Chhetri, S Minocha, A Roy, T Halukker, A Patt and J Jorien. 2021. Do Phone based Short Message Services Improve the Uptake of Agri-met Advice by Farmers? A Case Study in Haryana, India, Climate Risk Management. doi: https://doi.org/10.1016/j.crm.2021.100321

Speilman D, E Lecoutere, S Makhija, BV Campenhout.2021. Information and Communications Technology (ICT) and Agricultural Extension in Developing Countries. Annual Review of Resource Economics p. 77-200.

Tambo JA, C Aliamo, T Davis, I Mugambi, D Romney, DO Onyango. 2019. The impact of ICT-enabled extension campaign on farmers' knowledge and management of fall armyworm in Uganda. PLoS ONE 14(8): e0220844. https://doi.org/10.1371/journal.pone.0220844.

Blessing MM and O Julius. 2010. Uses of Information and Communication Technology (ICT) in agriculturand rural development in sub-saharan Africa: Experiences from South Africa and Kenya. International Journal of ICT Research andDevelopment in Africa (IJICTRDA), 1(1):1–22. https://doi.org/10.4018/jictrda.2010010101.

Soldani E. 2014. Information is power? Impact of an SMS-based Market Information System on Farmers in Ghana.

Nepal Telecom. 2021. Annual report 2021.

Timsina K, D Gauchan and J Lamichhane 2020. Import and Export Issues of Agricultural Commodities and Inputs. Status, Challenges and Prospects. Proceeding of the National Symposium on major agricultural inputs supply and subsidy mechanism in Nepal, p. 69-79.

Ghimire R and M Subedi 2017. A qualitative study examining core competency needs of agricultural extension professionals in Nepal. Asian Journal of Agricultural Extension, Economics & Sociology, 18(3):1–12. https:/104596. doi:10.1016/j.worlddev.2019.06.020.

Camacho A and E Conover 2019. The impact of receiving SMS price and weather information on small scale farmers in Colombia. World Development, 123: 1-10 doi:10.1016/j.worlddev.2019.06.02