

Economic Impact Evaluation of Varuna Mitra on Agriculture

A 24x7 Interactive Help Desk of Karnataka State
Natural Disaster Monitoring Centre



A.V. MANJUNATHA

February 2018



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The study enables to understand the usefulness of weather based forecast information provided to farmers and other stakeholders on rainfall, wind direction, wind speed, temperature and relative humidity. Economic impact of rainfall forecast on cost of cultivation, yield, net income and post-harvest losses has been estimated using with and without rainfall forecast information approach. Primary and secondary data has been used. Primary data was collected from 1350 farmers covered in 10 districts of Karnataka in addition to 50 stakeholders. The findings and recommendations provide insights for improving the existing service through corrective measures and provide roadmap for its expansion.

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Executive Summary



Executive Summary

I. Background

Varuna Mitra services were launched to provide direct weather information to the farmers and public. This help desk service was started on 1st October 2010 by the “*Karnataka State Natural Disaster Monitoring Centre (KSNDMC)*” known as the “*VARUNA MITRA*”, a 24x7 interactive help desk service. It is an Interactive Voice Response (IVR) and is geographic specific to Karnataka. It is superior to other services on two fronts; first, when compared to National Weather forecasts (IMD and AAS) that has delivered information to farmers by SMS, media and radio, with no direct link to farmers, this service is an interactive service and second, it provides gram panchayat level forecasts on rainfall, relative humidity, wind speed, wind direction and temperature in local language (Kannada) that can be easily comprehended by farmers. This information assists farmers to take decisions on agricultural activities from sowing to marketing.

The introduction of this service has replaced indigenous predictions that have frequently been inaccurate and have led to heavy losses to the farmers. This unique programme has garnered immense attention across the Indian States and over 10 States have either established a similar facility or are in the process of setting up an identical system with technical guidance from the KSNDMC.

II. Objectives of the Study

The present study focused on assessing the impact of VARUNA MITRA help desk service extended by KSNDMC with the following objectives:

- To analyze the growth of Varuna Mitra help desk services.
- To quantify the socio-economic impact of the service and to assess the perception of the farmers about Varuna Mitra.
- To assess the quality in terms of reach of the information, accuracy, duration and clarity provided by Varuna Mitra.
- To study the willingness of the beneficiaries in creating awareness about Varuna Mitra.
- To assess the need for additional information and to suggest suitable measures to improve the existing system.

III. Data, Study area and Methodology

IIIA. Data and Study area

Impact of Varuna Mitra help desk services was assessed using both primary and secondary data. Secondary data was obtained from KSNDMC that consisted of the calls made across districts, purpose of calls, coverage of crops, land holdings, and irrigation status. Data from 2013 to 2017 was considered for analysis.

This information was supplemented by primary data. The impact made by the Varuna Mitra through weather forecast information on the costs, yield and net income, and the perceptions of farmers on the scheme were captured from the primary data. Multistage random sampling technique was employed for the selection of farmers.

In the first stage, the districts were divided into three regions, namely, High Rainfall (>1200mm), Moderate Rainfall (600-1200mm) and Low Rainfall (<600mm) based on the rainfall information for the agriculture year 2016-17. Further, three districts were selected from each region. The selected districts were Dakshina Kannada and Udupi, Kodagu, and Shivamogga in the high rainfall region; Chikkamagaluru, Hassan and Kolar in moderate rainfall region; Tumakuru, Ballari, and Raichur in the low rainfall region. As adequate sample size was not available in Dakshina Kannada, neighboring district of Udupi has been included. The selected districts represent 33.33 per cent of all districts in the State and represent 8 of the 10 agro-climatic zones of Karnataka, which indicates the robustness of the sampling procedure followed. In the second stage, three taluks were selected from each district representing high, moderate and low rainfall areas. In the final stage, 50 farmers who obtained information from Varuna Mitra during July 2016 to June 2017 were randomly interviewed using a pre-tested questionnaire. Thus, a total of 1350 sample farmer were interviewed located in 32 taluks of 10 districts. Apart from this, information has been collected from 50 stakeholders to ascertain their views on Varuna Mitra services and its usefulness. The stakeholders included were public, Government functionaries, educational institutions, NGOs and the media. The primary and secondary data was analyzed using descriptive statistics such as averages, percentages, compound annual growth rates and so on.

IIIB. Methodology followed for estimating the impact

- The impact of Varuna Mitra services on cost of cultivation, yield, net income and post-harvest losses was estimated using the following approach. The impact has been estimated considering two situations; with and without-rainfall forecast information at different stages of plant growth. The difference between the decision taken with-information and without-information expressed in physical and monetary values has been considered as an incremental change, which can be positive or negative depending on the impact indicator. Reduction in cost of cultivation, increase in income (attributed from price and yield), increase in yield and decrease in post-harvest losses are considered as gain, whereas increase in cost of cultivation, decrease in income, decrease in yield and increase in post-harvest losses were considered as losses.
- Suppose, a farmer wants to apply Plant Protection Chemicals (PPCs) and he wants to know the non-rainy day for application of PPCs, he will call Varuna Mitra help desk for rainfall information. If the farmer has received accurate rainfall information on a particular day as heavy rainfall, then he will post-pone his decision for non-rainy day. By doing so he could save cost, which was supposed to be incurred on PPCs. Otherwise without-information, PPCs applied would have washed away due to heavy rain. The saving in cost is a gain to the farmer.
- In a similar manner, impact has been estimated with-information and without-information for taking decision at various stages of farming viz., ploughing, sowing/germination, vegetative growth, flowering, fruit setting, fertilizer application, PPCs application, irrigation, tank-filling, harvesting and post-harvest management

- Overall impact has been estimated by aggregating the stage-wise impact to arrive at per acre and per farm impact by using the information provided by Varuna Mitra. Finally, the impacts are presented in terms of two indicators, namely (i) Net gain or loss using the results of cost of cultivation, net income and post-harvest losses and (ii) Yield.
- The impact of Varuna Mitra information specifically on rainfall was presented for major crops viz., paddy, arecanut, coffee, ragi, jowar, mango, redgram/tur, maize, cotton, tomato and chilli. The impact for these crops expressed both in terms of Net gain or loss and Yield. The reason for considering these crops is that it accounts for 61 per cent of the cropping area benefitted by Varuna Mitra Information. The remaining crops are grouped and the impact was estimated only in terms of net gain or loss.
- The impact estimated from the primary data was considered as a base for projecting the impact of Varuna Mitra help desk services at the State level. The per farmer net returns realized across 10 districts was considered to arrive at the gains realized for the entire state. The estimates of these districts located in different agro-climatic zones was used for arriving the estimates for the remaining districts located in respective agro-climatic zones.

IV. Results and Discussion

IV-A. Impact of Varuna Mitra - Macro Analysis

- Secondary data results have shown that the performance of the Programme has been impressive. This is evident from the increase in number of calls since its inception from a meagre 6,565 in 2011 to 10.42 lakh in 2016, which is increasing at a Compound Annual Growth Rate (CAGR) of 61.55 per cent considering all 30 districts in Karnataka, while the growth rate between 2013 and 2017 is increasing at 51.46 per cent. The growth rate across districts ranged between 92.58 per cent in Kodagu district to 13.92 per cent in Dakshina Kannada. Lowest growth rate was observed in Uttara Kannada (37.94%), Dharwad (32.92%), Gadag (29.08%), and Bengaluru urban (18.83%), whereas highest growth rate was seen in Kodagu (92.58%), Mysuru (92.25%), Kolar (90.63%), Koppal (89.15%) and Chikkaballapura (83.91%). In terms of the pattern of calls during the drought years, it was found that the number of calls increased with the increase in number of districts that experienced drought. Particularly, the frequency of calls has been highest in 2016-17 as the year experienced the lowest rainfall in the past 46 years. If the calls continue to increase at the same growth rate, calls are projected at 63.57 lakhs by 2020. This shows that the programme is advantageous to farmers and other stakeholders, which also substantiates its popularity in the State.
- During 2016-17, there were a total of 1.76 lakh callers who made 10.42 lakh calls. It works out to 5,876 beneficiaries per district with an average of 34,724 calls per district and an average of 2,854 calls was made by beneficiaries per day in the State. Among the districts, the highest number of calls was received from Ballari which accounted for 11.08 per cent followed by Tumakuru (8.72%), Raichur (7.24%), Chikkaballapura (7.08%) and Kalaburagi (6.42%).
- Among the beneficiaries who called during 2016-17, 99.53 per cent of queries were with regard to rainfall which is very crucial input for agricultural operations and crop survival. The farmer mostly enquired about current day forecasts (63.02%). The kharif season (July-October) received 52.11 per cent of the total calls. Of the various purposes for which the calls were made, majority of

the farmers sought information for agriculture (90.39%), followed by horticulture (8.65%), animal husbandry (0.39%) and sericulture (0.57%). The total of 1.76 lakh farmers owned 56.38 lakh hectares of land, of which irrigated land accounted 64.54 per cent. The sample farmers sought information on rainfall for about 72 crops. Among these crops, 56.95 per cent of the calls pertained to only ten crops. They include- cotton, chilli, onion, ground nut, maize, jowar, ragi, paddy, tur and sugarcane. Among them maize accounted for highest share, both under irrigated and dry land with 14.41 per cent of the area, 10.71 per cent of the farmers and 13.80 per cent of the calls. This is followed by tur which accounted for 14.64, 7.99 and 11.05 per cent of area, number of farmers and calls, respectively. Of the calls reported, a majority of the calls were made during the germination stage of all the crops (37.35%) followed by harvesting (22.40%), sowing (12.45%) and vegetative phase (10.38%). The least number of calls were made at the transplantation stage (0.81%).

IV-B. Impact of Varuna Mitra - A Micro Analysis

Socio economic characteristics and cropping pattern of the sample farmers

- The characteristics of the farmers who sought rainfall information from VARUNA MITRA for agricultural operations reveal that 99.48 per cent were male. Farmers in all the districts were male except for Dakshina Kannada & Udupi (2.67%), Shivamogga (0.67%) and Chikkamagaluru (1.33%) where the respondents were female. The highest percentage of respondents belonged to OBC (56.45%) followed by General (27.63%), ST (9.85%) and SC (6.07%).
- The farmers with family size of four to six members were highest in moderate rainfall region accounting for 37 per cent of the total number of farmers falling under this category. The lowest of 27 per cent of farmers falling under this category were located in low rainfall region. The remaining 36 per cent were in high rainfall region. Overall at State level, the family size was 6.
- A higher proportion of them (56.74 %) were found in the age group of 36-60 years, followed by 39.26 per cent in the age group of 18-35 years. The minimum age was 18 years and 4 per cent of the farmers were above 60 years. Ballari had the highest number of farmers in the age group of 18 to 35 years and the lowest in this age group were from Shivamogga (30%). The farmers between the age group of 36 to 60 years were highest in Dakshina Kannada & Udupi (63.33%) and the lowest was in Ballari (48%). The farmers above 60 years were highest in Dakshina Kannada & Udupi (10.67%) and a few farmers in this district were also over 80 years.
- The literacy levels among the respondent farmers who contacted VARUNA MITRA were high at 97 per cent. Nearly 78 per cent of the farmers were educated up to secondary school, 14 per cent were graduates, 4 per cent of the farmers had education up to primary school, 2 per cent of the farmers were post graduates. About 3 per cent of the farmers were illiterates, which was highest in low rainfall region (4%).
- The highest percentage of farmers belonged to OBC (56.45%) followed by General (27.63%), ST (9.85%) and SC (6.07%). The SC and ST constituted 15.92 per cent of the farmers. The participation of family members was more than 51 per cent among the adults. This is inconformity of agricultural census. However, the low participation was found in Ballari and Raichur in low rainfall region and Dakshina Kannada in high rainfall region and Hassan in moderate rainfall region.

- The total operational land of sample farmers was 9588 acres which works out to be 7.11 acres per farmers which is closer to 7.93 acres as per KSNDMC data for the reference year, 2016-17. The proportion of irrigation was higher which stood at 55 per cent of the operational land, which is lesser than the 64.54 per cent land as per KSNDMC data. Among the districts, land per farmer was found at 10 acres in Ballari and 14 acres in Raichur. This is quite higher as compared to KSNDMC data, 8 and 9 acres, respectively. On the basis of irrigated land, the highest irrigated area per farmer was in Chikkamagaluru (7.86 acres) and lowest irrigated area per farmer was in Tumakuru (1.12 acres).
- Most of the irrigated farmers have adapted micro irrigation. This is clear from the higher proportion of area under micro irrigation (51.52%). More proportion of micro irrigation was found in high rainfall and moderate rainfall regions. It is quite surprising to note that normally one would expect high proportion of micro irrigation in low rainfall region. Percentage of drip/ sprinkler to the total irrigated area across districts indicates that, Kodagu has the highest drip/sprinkler area (97%), followed by Hassan (87%), Chikkamagaluru (83%) and Kolar (78%). It is strange to note that, highest area under micro irrigation has been reported in Moderate rainfall region (82%) followed by High rainfall region (71%) and Low rainfall region (2%). Relatively lower area under micro irrigation has been reported in low rainfall region specifically Raichur and Ballari, which had access to surface water.
- Nearly, 48 per cent of the area was irrigated through ground water (bore wells), 43 per cent by surface water and 9 per cent by both surface and ground water (Conjunctive use) at aggregate level. Most of the area was irrigated using ground water in Hassan (100%), Tumakuru (100%), Kolar (98%), Dakshina Kannada & Udupi (86%) and Shivamogga (83%). In the remaining districts it was dominated by either surface water or both ground water and surface water (Conjunctive use).
- The number of marginal farmers were highest in Dakshina Kannada & Udupi (47%), followed by Hassan (40%), and Tumakuru (29%), while small farmers were highest in Tumakuru (55%) followed by Kodagu (51%), Shivamogga (46%) and Hassan (45%). The percentage of medium farmers was highest in Chikkamagaluru (52%), followed by Kodagu (46%) and Raichur (41%), while large farmers were found to be highest in Ballari (35%) followed by Raichur (32%) and Chikkamagaluru (26%).
- At the aggregate level, 4.66 per cent of the area operated by 19 per cent of the marginal farmers, 20 per cent by 37 per cent of the small farmers, 31 per cent by 30 per cent of the medium farmers and 44 per cent by 15 per cent of the large farmers. Thus, indicating in-equity in distribution of operational land among marginal, small, medium and large farmers.
- The classification of farmers by size of land holding shows that more number of farmers were marginal and small farmers account for 55.56 per cent by holding 25.04 per cent of the land. The proportion of this category and land owned was lower as compared to agricultural census 2010-11 in the State, but also lower as compared to the secondary data provided by KSNDMC. According to this, the proportion of marginal and small farmers was 47.62 per cent and 10.87 per cent land.
- The net income from Agriculture, Allied activities, and non-agriculture sources for the period from July, 2016 to June, 2017 worked out to approximately Rs.3.52 lakhs per farmer. Agriculture constituted around 89 per cent of the total income. Allied activities like dairy, poultry and fishery formed only 2.5 per cent of the total income of farmers. The contribution of poultry and fishery to net income was negligible in all the districts, thus indicating lack of enterprise diversification. Average net income per farmer was highest at Rs.8.87 lakh in Chikkamagaluru, whereas it was lowest in Tumakuru (Rs.1.32 lakh).

- The sample farmers in study area had grown about 72 crops in an area of 9848.78 acres (Gross Sown Area). These crops were classified into eight groups. They are cereals, pulses, oil seeds and cash crops, fruits, vegetables, flowers and plantation crops. The proportion of GCA area under cereals was 30 per cent considering both irrigated and unirrigated followed by plantation (28%), cash crops (14%), vegetables (10%) and pulses (9%). Cereals, cash crops and pulses are the major crops grown in low rainfall region; plantation, vegetables, cereals and fruits in moderate rainfall region; plantation and cereals in high rainfall region. If we look at the specific crops across the districts, it was found that arecanut was found in Chikkamagaluru, Udupi, Tumakuru, Udupi & Dakshina Kannada districts. The cereal crops were grown in all the districts. The coffee was grown in Kodagu. The horticultural crops were grown mainly in Kolar. Among un-irrigated crops, cereals, pulses and oil seeds & cash crops accounted for around three-fourth of gross un-irrigated area.
- Around half of the gross irrigated area was occupied by plantation crops and oil seeds & cash crops. Among un-irrigated crops, cereals, pulses and oil seeds & cash crops accounted for around three-fourth of gross un-irrigated area.
- At the aggregate level with respect to irrigated area, plantation crops (43%) occupied the highest area followed by cereals (19%), cash crops (16%) and vegetables (15%). Cash crops (39%) accounted for the highest share, followed by cereals (34%) and vegetables (15%) in the low rainfall region, while plantation crops (76%) occupied highest area, followed by cereals (15%) and others (7%) in the high rainfall region. Plantation crops (55%) occupied highest share in the cropping area followed by vegetables (26%) and cereals (7%) in the moderate rainfall region.
- In un-irrigated area at the State level, cereals (44%) has covered highest area followed by pulses (20%), cash crops (12%), plantation crops (7%) and others (8%). It is interesting to note that cereals (64%) occupied highest area to the total area in high rainfall region.
- Among the sample farmers, as less as 9 per cent of the farmers had availed crop insurance. Shivamogga (29.33%) has the highest number of farmers who have availed crop insurance followed by Kolar (19%), Raichur (12%), and Ballari (11.33%). Opinions and Perceptions of sample farmers regarding Varuna Mitra
- Nearly 63 per cent of the respondents mentioned friends as the source of awareness regarding Varuna Mitra followed by RSK (16%), relatives (13%) and newspaper (6%).
- About 95 per cent of the farmers sought information regarding rainfall forecast followed by temperature (4.08%), relative humidity (2%), wind speed (0.82%) and wind direction (0.38%).
- About 89 per cent of the farmers preferred mobile phone call as the most convenient mode of seeking information from Varuna Mitra followed by text message (11%), both voice and text message (8%) and voice message (4%). With regard to language, most of the farmers preferred Kannada (88%), followed by Kannada and English (10%), only English (1.34%) and other language (1%).
- A large number of farmers contacted Varuna Mitra individually by using their mobiles (84%) and a small proportion (21.78%) contacted Varuna Mitra collectively. All the farmers in Kodagu, Hassan, Tumakuru had contacted individually.

- At the state level, each farmer has shared the rainfall information to at least 7 farmers, help desk number to 5 farmers totaling to 12 farmers. Region-wise comparison also indicate that each farmer has disseminated rainfall information to about 12 farmers.
- More than half (58.75%) the farmers have called help-desk based on the cloud cover and nearly 49.26 per cent have called by observing their crop in the field.
- Most of the farmers across seasons opined that the quality of calls was good (79.3%) and only a small number of farmers stated that the quality of their calls was poor (2.8%). Few farmers opined neutral (18.6%) view with respect to quality of calls. It is noticeable that over 70.9 per cent of the farmers from the high rainfall region were most satisfied with the quality of the call as compared to farmers from the moderate rainfall region (83.5%) and low rainfall region (83. 2%). With regard to SMS, 990 farmers (73.34%) have reported that they have not received any messages from Varuna Mitra. Among the rainfall regions, farmers from low rainfall region have received more SMS messages than other regions
- Across rainfall regions, 84 per cent of farmers from high rainfall districts, 49.11 per cent of farmers from moderate rainfall districts and 38.67 per cent of farmers from low rainfall districts have concurred that information received from Varuna Mitra help-desk has reduced their farming-related risk. All sample farmers from Kodagu commented that risks involved in their farming operations have reduced owing to the introduction of weather forecast services, while 32.67 per cent of the farmers from Hassan had a contrasting opinion. On the whole, 57 per cent of the farmers were certain about the benefits of risk reduction from weather forecast services, while 18.30 per cent differed in their opinion on risk reduction and 24.38 per cent of the farmers were neutral on the subject. All the farmers in Kodagu (100%) opined risk reduction followed by Shivamogga (82%), Chikkamagaluru (78%) and Dakshina Kannada & Udupi (71%).
- Nearly less than a per cent (40) of the total sample farmers had sought weather information for non-agriculture purposes. Ninety per cent of these farmers sought information on rainfall forecast. About 55 per cent of them had sought rainfall information to finalize a particular day for conducting social functions, 33 per cent for construction purpose, 4 per cent for fishing and sericulture purpose, and 2.5 per cent for transportation.
- The weather forecast information received by farmers was accurate to the extent of 60 to 90 per cent as opined by 62.50 per cent of the farmers. The accuracy of information ranged from 30 to 60 per cent among 12.50 per cent of the farmers. Nearly 17.50 per cent of the farmers mentioned that accuracy of information was less than 30 per cent. A majority of farmers sought short term rainfall forecast for 1 to 3 days and indicated a wide range of accuracy levels of these predictions. Overwhelming proportion of farmers (65.41%) has indicated the accuracy of the prediction range from above 50 to 100 per cent.

Opinions and Perceptions of stakeholders regarding Varuna Mitra

- The Department of Agriculture, public and media have mostly availed services of Varuna Mitra. Out of these, 50 sample covered in 21 districts comprising both agriculture and non-agriculture stakeholders were interviewed to ascertain the utility of the services of Varuna Mitra as well as to seek their feedback. The agriculture stakeholders comprise of Departments of Agriculture

and Forest. Non-agriculturist stakeholders comprise of media and industrialists. The Agriculture Department availed the information on Varuna Mitra to take the decision on agriculture operation on their farm, plan programmes and to disseminate information to the farmers in their jurisdiction. Most of the stakeholders were media people (32%), followed by agricultural officers (28%), traders (10%) and remaining were the other government officials and public.

- The non-agricultural stakeholders availed the services of Varuna Mitra for transporting goods and burning of bricks, whereas, the media people availed the information for publishing weather bulletins in regional newspapers.
- Most of the stakeholders (46%) mentioned friends as a source of information followed by government mandate (14%), Internet (12%), Newspapers (6%), RSK'S (6%), electronic and print media (4%) and others (8%).
- A total of 36 stakeholders (72%) sought information regarding rainfall forecast, whereas 8 stakeholders (16%) obtained information on rainfall and temperature. The remaining has sought information on more than 2 weather related parameters.
- On the whole 1787 phone calls were made by stakeholders, of which as less as 16 per cent of the calls were utilized for decision making. A larger proportion of the calls (19.72%) made by agriculture department stakeholders were utilized for sowing-related operations.
- An overwhelming majority of stakeholders (80%) indicated that the quality of the calls were good. Nearly 16 per cent were of neutral view. Only a negligible per cent (4%) of the callers were unsatisfied with the quality of calls.
- About 52 per cent of the stakeholders indicated accuracy level of 90-100 per cent, 70-80 per cent and 50-60 per cent by 22% of the stakeholders each.
- On the whole, 94 per cent of the stakeholders indicated the forecasts information was useful and helped them in taking decisions, resulted in positive outcomes.

IV-C. Economic Impact of Varuna Mitra on cost of cultivation, yield, net income and post-harvest losses

- Farmers have called Varuna Mitra at various stages with respect to different crops. There are several instances of farmers growing similar crops who have called at various stages. Thus, for this reason the stage-wise percentages have been worked out for 2601 sample farmers instead of actual sample size 1350. Nearly 29 per cent of the total farmers (2601) contacted Varuna Mitra help desk during harvesting followed by sowing (19%), PPC application (12.65%). Whereas the least number of farmers had contacted during tank filling (0.04%) and transplanting (0.54%).
- About 49 per cent of the total farmers (1350) had indicated a decrease in cost of cultivation to an extent of Rs. 1696 per acre, whereas increase in cost was mentioned by only 7.4 per cent of the farmers to an extent of Rs.1582 per acre. The highest decrease in cost was observed to an extent of Rs. 6273 per acre as witnessed among 56 coffee farmers (4%) who indicated the decrease at stages of irrigation and fertilizer application. With the forecast of rain for couple of days, the farmers could save the irrigation cost which otherwise would have been incurred. Other major crops that followed

coffee in terms of decrease in cost were arecanut (Rs.2571/ac), tomato (Rs.2218/ac) and mango (Rs.1268/ac).

- Increase in yield was indicated by 671 farmers (49.70%). Across major crops, highest incremental increase in yield was mentioned by 5 farmers (0.37) in jowar (1.67 qtl/ac @ 16.17%) followed by 77 farmers (5.7%) in ragi (0.77qtl/ac @ 8.83%), 83 farmers in coffee (6.1%) (0.77qtl/ac @ 8.36 %;). The incremental increase in yield was also indicated by 26 farmers (1.92%) in tomato (2.36qtl/ac @ 2.25%), 1 farmer in (3.9%) in mango (1.2qtl/ac @3.43%) and 53 farmers (3.9%) in maize (0.85qtl/ac @ 5.94%). The increase in yield was attributed to appropriate time of sowing, fertilizer application and irrigation operations based on the rain forecast received. Highest decrease in incremental yield was observed in tomato (3.41 qtl/ac @ 3.25%) by 4 farmers (0.29%), followed by 16 farmers (1.1%) in cotton (0.57 qtl/ac@4.55%), and 1 farmer in paddy (0.57qtl @ 3.64%).
- With regard to change in income, a total of 720 farmers (53.33%) indicated incremental increase in income by Rs. 826 per acre, whereas 172 farmers (12.74%) mentioned a decrease in income to an extent of Rs.750 per acre. Highest incremental increase was indicated by 42 farmers (3%) in coffee (Rs. 3713/ac @ 10.72%), 112 farmers (8%) in arecanut (Rs.3355/ac@1.39%), 20 farmers (1%) in chilli (Rs. 1626/ac@5.21%) and 16 farmers in redgram (1%) (Rs.1559/ac@9.67%). There were instances of farmers indicating decrease in income as well. Decrease in income was indicated for the same crops for which increase was mentioned. In the case of coffee, it was Rs. 3521/ac (10.16%), followed by arecanut (Rs.2658/ac @ 1.1%) and chilli (Rs.1627/ac @ 5.52%). However, this was mentioned by 19, 6 and 5 farmers, respectively.
- With respect to post-harvest losses, a total of 752 farmers (55.70%) indicated a decrease in post-harvest loss to an extent of Rs.4402 (@ 6.3%) per acre whereas 91 farmers (6.7%) indicated an increase in post-harvest losses by Rs. 4562 per acre (@6.55%). The highest decrease in post-harvest losses was indicated in coffee (Rs. 9562/ac@ 14.5%) by 119 farmers (8.8%), arecanut (Rs.8534/ac @3.22%) by 101 farmers (7.48%) and chilli (Rs.4903/ac@ 7.5%) by 16 farmers (1.18%). The highest incremental increase in post-harvest losses was observed in cotton (Rs. 9022/ac @ 17.45%) by 2 farmers, coffee (Rs. 6686/ac@ 10.14%) by 25 farmers (1.8%), arecanut (Rs.6686/ac @ 2.5%) by 7 farmers (0.51%), and ragi (Rs. 1295/ac @ 9.02%) by 14 farmers (1%).
- Per acre results across crops has indicated that arecanut had realized the highest incremental gain of Rs.12728 per acre followed by coffee (Rs.11118/ac), Chilli (Rs.6818/ac) and tomato (Rs.4338/ac). The highest net gain in the case of arecanut is due to the relatively higher market price of the crop, additional yield realized and the post-harvest losses saved with the rainfall forecast information. Similarly saving of costs incurred on irrigation, reduction of post-harvest losses and timely application of fertilizers with the rainfall information in advance has led to increased net gain in coffee. The least incremental net gain was in maize (Rs.1071/ac), and jowar (Rs. 860/ac).
- The overall net gain/return per acre irrespective of the crop and district was Rs. 5107. The highest incremental net gain per acre was observed in Raichur (Rs.8903) with cotton, redgram and paddy as prominent crops followed by Kodagu (Rs.6858/ac), and Ballari (Rs.6477/ac). The incremental net returns realised in irrigated condition (Rs.5177/ac) was 88 per cent higher than the unirrigated (Rs.2751/ac).

- The net gain per farmer was highest in Raichur (Rs.60653) followed by Ballari (Rs.33629), the districts mainly cultivating cotton, paddy and redgram, both districts are in low rainfall region. The highest net gain per farmer in Raichur is due to the high operational land holding with 6.81 acres per farmer. This is 92 per cent higher than the average holding of the entire sample farmers (3.53 acres). Among the high rainfall regions, farmers in Kodagu earned relatively higher net gain (Rs.29490) and in moderate rainfall regions, Chikkamagaluru (Rs. 15066) realized relatively higher net gain. At aggregate level, the net gain was Rs.18005 per farmer.
- The projections made at the macro level with micro level results as base indicate an overall income realized at the state level as Rs. 495.3 Crore during 2016-17, which is a result of timely operations based on the rainfall information obtained from Varuna Mitra. With the estimation for the state, the per farmer and per acre incremental net gain was Rs. 28168 and Rs. 5979, respectively. This is 56 per cent and 17 per cent higher than the per farmer (Rs.18005) and per acre (Rs.5107) results of 10 sample districts.

V. Recommendations

- Currently, the average command area under the Telemetric Weather Station (TWS) is 210 sq.km at the State level. In the case of Sujala - III watershed programme, one telemetric weather station has been installed for every 5 sq.km. In Western countries, weather observation stations installed for every 100 sq.km. Keeping this in mind, the command area of the telemetric weather station should be reduced to at least 100 sq.km to ensure more accuracy by installing more telemetric stations in the districts where the command area of the device is more than 100 sq.km.
- In addition, KSNDMC, IMD, ISRO, Agriculture Universities and Water Resources Department has installed telemetric weather stations at various locations in the State. In order to further increase the accuracy level, special efforts needed by KSNDMC to use information from all these sources for increasing accuracy levels as isolation distance significantly reduces through this effort.
- Most of the farmers have opined that they require agri-advisories from sowing to post-harvest management stage in addition to weather-based information. In this regard, Agriculture and Horticulture Universities should identify a nodal help desk (i.e., KVKs) in each district for providing Agri-advisories to farmers. In this regard, KSNDMC can forward such calls to these nodal centers for attending to the farmer queries quickly. Further, Department of Marketing and Inspection's Agmarknet may be interfaced with Varuna Mitra for providing market information. Through such integration, farmers can be richly benefitted.
- Special extension efforts needed from the concerned institutions for disseminating the information provided by Varuna Mitra including contact numbers. In addition, the contact number may be made toll free. This is essential for coverage of more cultivators in Karnataka as currently only less than 5 per cent of the cultivators have been covered directly or indirectly.
- It was opined by the sample respondents that Varuna Mitra should make an attempt to provide the forecast of the lightening to save lives and crops as lightening during the rainy season has affected crops and deaths have been reported in the State.

- Call dropping, irregularity in sending SMSs, busy line and poor voice clarity are the problems encountered by few sample farmers. This could be addressed by increasing the telephone lines and employing additional staff as number of calls is increasing at a CAGR of 51.46 per cent between 2013 and 2017.
- The name of the villages was not collected, which needs to be collected as it is quite difficult to locate the beneficiaries with the existing information. In addition, there should be mechanism to regularly update the mobile numbers as the beneficiaries would have changed mobile numbers overtime.
- A significant number of respondents are not aware about the forecast of other parameters such as wind speed, wind direction, temperature and relative humidity. The tele-advisors may provide awareness in this regard.
- A small per cent (2.62%) of the cultivators in the State are aware of Varuna Mitra services. In view of this, special efforts needed from concerned institutions such as Panchayats, Agriculture and Horticulture Departments and Universities to create awareness. Charts and posters about Varuna Mitra services have to be displayed in all these places and mass media (TV, Radio and Newspaper) may be effectively used as well.
- Most of the stakeholders opined that the information provided was accurate and useful in taking decisions. However, in order to improve the effectiveness and expansion of Varuna Mitra, Dissemination of AgroMet advisories, Toll Free Calls and increase in number of Tele Lines was mainly suggested by stakeholders.

Introduction

01



Introduction

CHAPTER 1

1.1. Background

Development of Indian Agriculture and welfare of farmers depend on number of factors. The extension of agricultural services is one of the important factors that are provided by the extension systems of the State Departments of Agriculture, State Agricultural Universities, (SAUs), KVKs, NGOs and Private Agencies. Recently, a host of other modes of information have begun to supplement extension in various ways on different components of agriculture. Among these, Information and Communication Technology (ICT) is playing a major role in agriculture as that of other sectors in the last two decades. There were 8000 websites, 80 DAC websites and 8 organisations are providing information to farmers on various aspects of agriculture (Tripathi, 2015). They are in the form of audio, mobile SMS, mobile apps, web portals, call centres, visual, print and videos and implemented by the public, private and NGO sectors. These include different kinds of information related to agriculture and allied activities and include, Cold storages, Godowns, Seeds, Fertilisers, Agricultural Banking, Agricultural Insurance, Crop Pest Prevention, Commodity Prices by Markets, Buying and selling, Crop advisory, Weather forecasting, Good Agricultural Practices, Livestock, Fisheries, Vermi-compost and so on. Despite this, the information was accessed only by a few farmers. According to National Sample Survey Organisation data (NSSO, 2014) only 41 per cent of the farming population (less than half) accessed information on agriculture (IFPRI and CRISP, 2015).

Weather plays a vital role in Indian agriculture and there is no aspect of agriculture that is not affected by it. In recent times, ICT applications of weather forecasts have been developed to translate meteorological parameters into understandable agricultural terms through advisories. However, the dissemination of weather-based information has been inadequate as compared to the other advisory services for agriculture. The Indian agrimet i.e. weather forecasting and advisory services are the only major source of information to the farmers. To supplement this, a few more services were launched to disseminate weather-related information to the farmers in the form of bulletins and recorded messages without directly interacting with them. Most of these advisories or information dissemination channels were not fully accurate as they dealt with a wide geographical area rather than specific regions as needed by the farmers.

However, it is known that there are a large number of unpredictable factors in the development of monsoon. The likelihood of error will be higher in the longer range of forecast. As such, the IMD finds it difficult to forecast local weather conditions. Apart from this, the available weather-based and natural calamities information is not directly disseminated to the farmers.

To fill this gap, VARUNA MITRA services were launched which provides direct information to the farmers. This help desk service was started on 1st October 2010 by the “Karnataka State Natural Disaster Monitoring Centre (KSNDMC)” known as the “VARUNA MITRA” (Friend of Rain) an interactive help desk service. VARUNA MITRA Service is an Interactive Voice Response (IVR) and geographic specific to Karnataka. It is

superior to other services on two fronts, one, when compared to National Weather forecasts (IMD and AAS) that has delivered information to farmers by SMS, media and radio, with no direct link to farmers, this service is an interactive service, and two, it provides location specific needs up to the panchayat level in local languages that can be easily comprehended by farmers. This information assists farmers to conduct agricultural activities by taking timely corrective measures to prevent crop losses and to adapt based on the advice rendered due to erratic rainfall or climate change.

The VARUNAMITRA help desk provides 14 weather (Hydro meteorological) and natural disaster (Geological) related information/parameters like, cloud cover, rain, hailstorm, cyclone, storm surges, drought, flood, minimum and maximum temperatures, relative humidity, wind speed, wind direction, heavy winds, sunshine hours, solar radiation (Hydro meteorological), Tsunami, Earthquake and land slide (Geological) directly to farmers as well as the public. It has been functioning to disseminate Gram Panchayath level Weather Related Information, Forecast and Advisories mostly on actual rainfall recorded, weather forecast, distribution of temperature, relative humidity, wind speed and wind direction. The help desk number is 9243345433 (mobile) and 080-22745732, 080-22745234 (land lines) with 32 parallel lines that facilitates receiving 32 calls simultaneously at any given point of time, functioning on 24 x 7 basis for 365 days to provide information to farmers. It started with a staff strength of 2 in 2010 (Tele advisors) and has increased to 32 (12 females & 18 males and 2 coordinators) as number of calls have increased. The weather information, forecast and advisories are being disseminated via email, SMS to the mobile phones of officers and public, dynamic web-portal www.ksndmc.org, social media like face book, twitter, electronic and print media on a day to day basis. The forecasts disseminates to farmers at every 15 minutes which are generated based on data and information collected from the Global Positioning Response System (GPRS) enabled and Solar Powered Telemetric Weather Station (TWS) at every 250 sq. km. at 747 hoblis and Telemetric Rain Gauge (TRG) stations covering 25 sq. km. by utilizing RKVY funds. In addition, 179 Telemetric Weather Stations were set up in Sujala - III watershed area (11 districts) in 2015-16 (GoK 2016). The jurisdiction of each telemetric station is 5 sq. km. (Micro-Watershed). These are in addition to 26 AWS installed in Karnataka State by IMD (IMD Bangalore Centre 2011), 117 ISRO including 15 in Kodagu district (Naveen, 2009) and a few by agricultural universities and water resources department. The VARUNA MITRA services covered only a few districts up to 2013 (Shashidhar Hegde, 2014). However, post 2013, all the 6073 panchayats and villages with a population of 6175 each were covered in all the districts. The introduction of this programme has replaced indigenous predictions that have frequently been inaccurate and have led to heavy losses to the farmers. This unique programme has garnered immense attention across the Indian States and over 10 States have either established a similar facility or are in the process of setting up an identical system with technical guidance from the KSNDMC.

This help desk is manned by trained persons who provide weather based information to the farmers, agriculture departments and horticulture departments. The trained person first receives calls from farmers and other stakeholders and requests them to name, the department, panchayat and district they are calling from and then responds with the information sought in language most fluent to the caller. The response would normally be either that there is no possibility of rainfall or there is a likelihood of rainfall occurring in the next three days in their panchayat. The information helps farmers to plan or schedule their agricultural activities such as irrigation, applying fertilizers, sowing, pesticide application, weeding, harvesting the crop and drawing a plan for hiring labour among others. Taking into consideration the dynamic nature of climatic conditions, the information received could minimize crop

loss due to any weather aberrations and avert risks. In addition, it helps the Government as well as the public in planning and executing disaster mitigation plans at micro-level. Apart from these effective benefits, the information also helps in settling crop insurance claims.

Over the years, this programme has gained popularity in the State, mainly due to its voice based programmes that are very useful for those with a low literacy level in the farming community. The significant progress of the service is evident from the increase in number of dedicated lines as well as number of calls over a short duration since its initiation. The service was launched with one help desk and 2 dedicated lines, that gradually increased to 8 lines and at present, there are 32 dedicated lines catering to all the districts, panchayats and villages. The number of calls increased from 6,565 in 2011 to 10.42 lakh calls (1.76 lakh callers) by the end of July 2017. This tremendous progress needs to be seen in terms of increasing agriculture productivity, income and economic benefits or losses to farmers as well as to ascertain the perceptions of farmers about the efficacy of the programme and gather their feedback. This study has been undertaken to examine these issues and provide recommendations that further mainstream and improve their role in providing an array of climate forecasts and crop advisory services.

1.2. Objectives of the Study

The present study focuses on assessing the effectiveness of VARUNA MITRA help desk service extended by KSNDMC with the following objectives:

- To analyse the growth of VARUNA MITRA Help Desk Services.
- To quantify the Socio-Economic impact of the service and to assess the perception of the farmers about VARUNA MITRA.
- To assess the quality in terms of reach of the information, accuracy, duration and clarity provided by VARUNA MITRA Help Desk.
- To assess the willingness of the farming community beneficiaries in creating awareness about VARUNA MITRA Help Desk Services.
- To assess the need for additional information and to suggest suitable measures to improve the existing system.

1.3. Methodology

Impact of Varuna Mitra help desk services was assessed using both primary and secondary data. Secondary data was obtained from KSNDMC that consisted of the calls made across districts, purpose of calls, coverage of crops, land holdings, and irrigation status. Data from 2013 to 2017 was considered for analysis.

This information was supplemented by primary data. The impact made by the Varuna Mitra through weather forecast information on the costs, yield and net income, and the perceptions of farmers on the scheme were captured from the primary data. Multistage random sampling technique was employed for the selection of farmers.

In the first stage, the districts were divided into three regions, namely, High Rainfall (>1200mm), Moderate Rainfall (600-1200mm) and Low Rainfall (<600mm) based on the rainfall for the agriculture year 2016-17. Further, three districts were selected from each region. The selected districts were, Dakshina Kannada and Udupi, Kodagu, and Shivamogga in the high rainfall region, Chikkamagaluru, Hassan, and Kolar in moderate rainfall region, Tumakuru, Ballari, and Raichur in the low rainfall region. As adequate sample size was not available in Dakshina Kannada, neighbouring district of Udupi has been included. (Table 1.1)

Table 1.1: Districts Based on Actual Rainfall (2016-17)

Categories	District Name	Total Calls	Actual RF (mm)	Zones
High	Dakshina Kannada	648	2921.73	Coastal
	Udupi	692	3391.26	Coastal
	Kodagu	5915	1856.11	Hilly Zone (HZ)
	Shivamogga	12040	1409.05	Southern Transition Zone (STZ)
Moderate	Chikkamagaluru	45793	1191.70	Central Dry Zone (CDZ)
	Hassan	43644	775.75	Southern Transition Zone (STZ)
	Kolar	52734	600.35	Eastern Dry Zone (EDZ)
Low	Tumakuru	94236	513.24	Southern Dry Zone (SDZ)
	Ballari	120147	386.08	Northern Dry Zone (NDZ)
	Raichur	78683	459.51	North Eastern Dry Zone (NEDZ)

Note: Districts were classified as High rainfall districts (>1200mm) Moderate rainfall districts (600-1200mm) and Low rainfall districts (<600mm) based on the actual rainfall during the reference period.

Source: KSNDMC data base, 2017.

The selected districts represent 33.33 per cent of all districts in the state and represent 8 of the 10 agro-climatic zones of Karnataka, which indicates the robustness of the sampling procedure followed. In the second stage, three taluks were selected from each district representing high, medium and low rainfall areas. In the final stage, 50 farmers who obtained information from Varuna Mitra during July 2016 to June 2017 were randomly interviewed using a pre-tested questionnaire. Thus, a total of 1350 sample farmer were interviewed located in 32 taluks of 10 districts (Table 1.2). Apart from this, information has been collected from 50 stakeholders to ascertain their views on Varuna Mitra services and its usefulness. The stakeholders included were public, Government functionaries, educational institutions, NGOs and the media. The primary and secondary data was analysed using descriptive statistics such as averages, percentages, compound annual growth rates, etc.

Table 1.2: Sample Size

Category	District	Taluk	Sample Size	Total
High	Dakshina Kannada	Sulya	56	150
		Putturu		
		Mangalore		
		Bantwala		
		Belthangadi		
	Udupi	Karkala	94	
		Kundapura		
		Udupi		
	Kodagu	Somvarpet	50	150
		Virajpet	50	
		Madikeri	50	
	Shivamogga	Soraba	50	150
		Hosanagara	50	
		Sagara	50	
Moderate	Chikkamagaluru	Kaduru	50	150
		Mudigere	50	
		Koppa	50	
	Hassan	Arasikere	50	150
		Channarayapatna	50	
		Holenarasipura	50	
	Kolar	Srinivasapura	50	150
		Kolar	50	
		Mulbagal	50	
Low	Tumakuru	Kunigal	50	150
		Chikkanayakanahalli	50	
		Sira	50	
	Ballari	Sandur	50	150
		Hadagali	50	
		Ballari	50	
	Raichur	Lingasaguru	50	150
		Raichur	50	
		Manvi	50	
Total Sample Size				1350

1.3.1. Methodology followed for estimating the impact

The impact of Varuna Mitra services on cost of cultivation, yield, net income and post-harvest losses was estimated using following approach. The impact has been estimated considering two situations; with and without rainfall forecast information at different stages of plant growth. The difference between the decision taken with-information and without-information expressed in physical and monetary values, which has been considered as an incremental change, which can be positive or negative depending on the impact indicator. Reduction in cost of cultivation, increase in income, increase in yield and decrease in post-harvest losses are considered as gain, whereas increase in cost of cultivation, decrease in income, decrease in yield and increase in post-harvest losses were considered as losses.

Suppose, a farmer wants to apply Plant Protection Chemicals (PPCs) and he wants to know the non-rainy day for application of PPCs, he will call Varuna Mitra help desk for rainfall information. If the farmer has received accurate rainfall information on a particular day as heavy rainfall, then he will post-pone his decision for non-rainy day. By doing so he could save cost, which was supposed to be incurred on PPCs. Otherwise without-information, PPCs applied would have washed away due to heavy rain. The saving in cost is a gain to the farmer.

In the case of sowing stage, rainfall plays a major role. Usually farmers start sowing after a few rainy days. If farmer gets accurate information about the continuous rainfall for few days, he can decide the sowing activity. From this, he could save cost incurred towards supplementary irrigation. This saving in cost is also a gain to the farmer, which also impose positive outcomes on yield and net income. Sowing at accurate time with timely information will increase the germination percentage, which ultimately reflects in the increase in yield and net income.

In a similar manner, impact has been estimated with-information and without-information for taking decision at various stages of farming viz., ploughing, sowing/germination, vegetative growth, flowering, fruit setting, fertilizer application, PPCs application, irrigation, tank-filling, harvesting and post-harvest management.

Overall impact has been estimated by aggregating the stage-wise impact to arrive at per acre and per farm impact by using the information provided by Varuna Mitra. Finally, the impacts are presented in terms of two indicators, namely (i) Net gain or loss using the results of cost of cultivation, net income and post-harvest losses and (ii) Yield.

The impact of Varuna Mitra information specifically on rainfall was presented for major crops viz., paddy, arecanut, coffee, ragi, jowar, mango, redgram/tur, maize, cotton, tomato and chilli. The impact for these crops expressed both in terms of Net gain or loss and Yield. The reason for considering these crops as it accounts for 61 per cent of the cropping area benefitted by Varuna Mitra Information. The remaining crops are grouped and the impact was estimated only in terms of net gain or loss.

1.4. Organization of Report

The report is organised into eight chapters. Chapter one presents background, objectives, data, study area, methodology. The second chapter highlights the IT based agri-advisory services as well as weather based advisories which provides insights for improving Varuna Mitra services as well as its expansion. The analysis made in this chapter is based on review of literature. The third chapter focuses on analysis of Secondary data provided by KSNDMC about Varuna Mitra. The fourth chapter presents the stakeholders analysis. The fifth chapter presents the socio-economic characteristics and cropping pattern of sample farmers. The sixth chapter analyses the opinions and perceptions of the farmers and stakeholders regarding Varuna Mitra. The seventh chapter focuses on the economic impact derived by the farmers due to weather based information specifically rainfall. The last chapter presents the summary, conclusions and offers recommendations.



GPRS Enabled Solar
Powered Telemetric
Rain Gauge and Weather
Station

Rain gauge station in
Bellary district



Maize plot of a Varuna
Mitra beneficiary at
seedling stage

Information and Communication Technology in Agriculture: Insights to Varuna Mitra

02



Information and Communication Technology in Agriculture: Insights to Varuna Mitra

CHAPTER 2

Agriculture is the backbone of the Country with a workforce of close to 228 million engaged in agriculture (Census, 2011) that accounts for 48.89 per cent of the total workforce. Over 58 per cent of the rural households depend on agriculture as their means of livelihood along with fisheries and forestry. A majority of them are marginal and small farmers. The contribution of agriculture was 17.3 per cent of the Gross Value Added during 2016-17 at 2011-12 prices. Over the years the Country has witnessed Green Revolution, Yellow Revolution, White Revolution, Blue Revolution, Bio Technology Revolution and the most recent is the Information and Communication Technology Revolution.

Green revolution which had begun in 1965 has drastically changed the agricultural scenario in the Country with a significant increase in yield levels and farmer's income. However, the fruits of the Green Revolution were not sustained for long. There has been stagnation in productivity, decline in farmers' income and State Domestic Product, post-harvest losses were huge and migration of farmers into non-farming activities. Apart from these, there were droughts, failure of rains and natural calamities that further contributed to the misery of farmers. Lack of market information, timely inputs and weather based advisories were attributed for these problems. To provide remedies to these issues and educate the farmers, new ICT services were provided that include websites, portals and mobile based applications. They pertain to summarized information related to agriculture and allied activities mostly on Cold storages, Godowns, Seeds, Fertilisers, Agricultural Banking, Agricultural Insurance, Crop Pest Prevention, Commodity Prices by Markets, Buying and Selling, Crop Advisory, Weather Forecasting, Good Agricultural Practices, Livestock, Fisheries and Vermi-compost among others. Many of these services have been delivered to the farmers and Government functionaries through ICT enabled delivery channels such as Internet, Government Offices, Touch Screen Kiosks, Krishi Vigyan Kendras, Kisan Call Centres, Agri-Clinics, Common Service Centres, Mobile Phones, Broadcast, IVRS, interactive messaging using unstructured Supplementary Service Data and Voice Recognition for ensuring timely access to agriculture related information for the farmers (Goel & Samrat Bandopadhyay, 2015).

The existing agricultural information dissemination channels were largely promoted or launched by the Central, State, institutions, private organisations and NGOs web sites, portals and applications. Many of these were launched based on the National Policy for Farmers (NPF), 2007 that emphasized the use of Information and Communication Technology (ICT) at the village level to communicate relevant and accurate advisories and requisite information to the farmers. Consequently, many steps by the Government in this regard have led to a voluminous growth of ICT information. Tripathi (2015) listed close to 8000 websites, 80 DAC websites and 8 organisations that provide information to farmers on various aspects of agriculture. The Department of Agriculture, Cooperation and Farmers Welfare (DAC) has developed about 80 portals, applications and websites with the collaboration of the National Informatics Centre under the Centrally Sponsored Scheme "*National e-Governance Plan in Agriculture (NeGP-A)*". All these services have facilitated expedite sharing of information and innovations and act as a key agent in changing the agrarian situation and the lives of farmers (Paraganiha et.al. 2012). On these grounds, the present chapter reviews the facilities available to farmers in the form of crop and weather advisories. It is based on secondary sources such as websites and portals, journals, newspapers

and so on. Section one of the chapter presents the agri-advisories available at all India and state level. The second section covers only the weather based advisories for farmers. These advisories are grouped into Macro (National), Micro (State) and Regional Level Advisories (Universities). As there are numerous advisories, only the important and recent initiatives have been discussed in the subsequent sections. This review chapter will provide insights for improving the Varuna Mitra services as well as its expansion.

2.1. Agri-advisories to Farmers

The Central Government has launched a large number of web and mobile based applications for dissemination of agricultural related activities, free of cost. The most frequently accessed among them have been briefly discussed below.

2.1.1. National e-Governance Plan - Agriculture (NeGP-A)

Under this programme, various modes of delivery of services have been envisaged with an objective of providing extension to the farmers (extending Research from Lab to Land). These include internet, touch screen kiosks, agri-clinics, private kiosks, mass media, common service centres, kisan call centres and integrated platforms in the departmental offices coupled with physical outreach of extension personnel equipped with pico-projectors and hand-held devices.

2.1.2. Kisan Call Centre (KCC)

Kisan call centres were established by the Ministry of Agriculture and Cooperation, Government of India in January 2004 to provide agricultural information to the farmers. The main purpose of these call centres have been to answer queries raised by farmers in their local language, via a toll free.

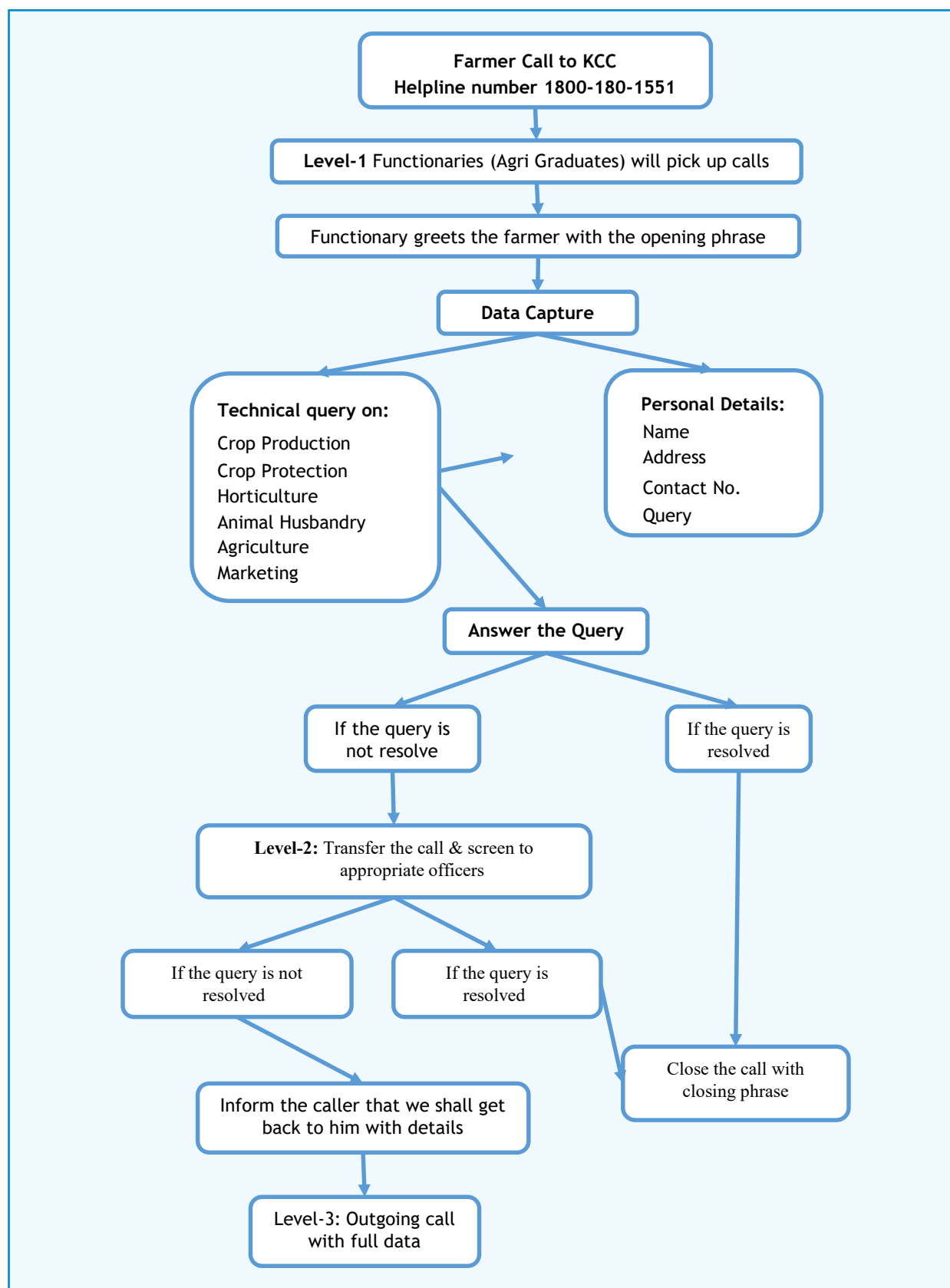
The farmers can access the information through landline and mobile network of both public and private telephone service providing agencies. The centre works from 6 A.M. To 10 P.M. on all seven days of the week. The farmers can access information on any of the following aspects:

- Disease and pest control for different crops grown in the region
- Good agricultural practices, livestock management, fishery, etc.
- Best practices in agriculture in the State as well as of other States
- Crop related information in agriculture, horticulture, animal husbandry, aromatic plants, spices, plantation crops, cash crops, etc.
- Vermi-compost, organic farming, including organic plant protection, etc.
- Information on HYV seeds and nutrient management for different crops
- Market related information for different crops in the State.
- Weather Forecast
- Farmer support programmes which are being implemented by the Government and Agriculture related information that impacts farmers, farming practices, etc.

The centres in 25 States gained popularity as a result of an increase in the number of calls received from the farmers. Tripathi (2015) found that the number of calls increased from 2.31 Lakh in 2003-2004 to 48.01 Lakh in 2014-15. Further, an impact study of the centres by the Administrative Staff College of India, Hyderabad (ASCI) has revealed that 84 per cent of the farmers expressed overall satisfaction with the advice provided to them by the Call Centre Agents (CCAs). The study also pointed out that KCC advice resulted in effective control of pests, weeds, diseases and better management of fertilizer use.

The advice given by KCCs also enabled the farmers to take timely decisions and thereby resulted in an increase in crop production and productivity.

Figure 2.1: Schematic representation of KCC



Source: http://www.megagriculture.gov.in/PUBLIC/kisan-call-center/schematic_representation.aspx

2.1.3. mKisan Portal - Mobile based Services for Farmers

mKisan SMS Portal was inaugurated by the Hon'ble President of India on July 16, 2013. The Portal enables all Central, State Government organizations down to block level including State Agricultural Universities, Krishi Vigyan Kendras, Agro-Meteorological field units dealing with agriculture and allied sectors to provide information/ services/ advisories to farmers via SMS in their regional language based on preference of agricultural practices and location. The specific information that the portal broadcasts include videos of agricultural farming in their local language and updated newsfeeds for the farmers. It also provides information on CWC storage godowns by location, seed and fertilizer dealers by State, agricultural banking, agricultural insurance by Banks, crop pest and prevention database, crop recommendation by location, commodity prices by market, SMS alerts, crop advisory, crop protection and the various buying and selling platforms available to the farmers. In addition, the portal provides information on the weather as well as forecasts conditions up to taluk level for a period of seven days. The usage of the MKisan portal by the farmers has been overwhelming with a count of 548 crore messages, 3.79 lakh advisories and more than 1698 crore SMSs sent to farmers across the country since its inception.

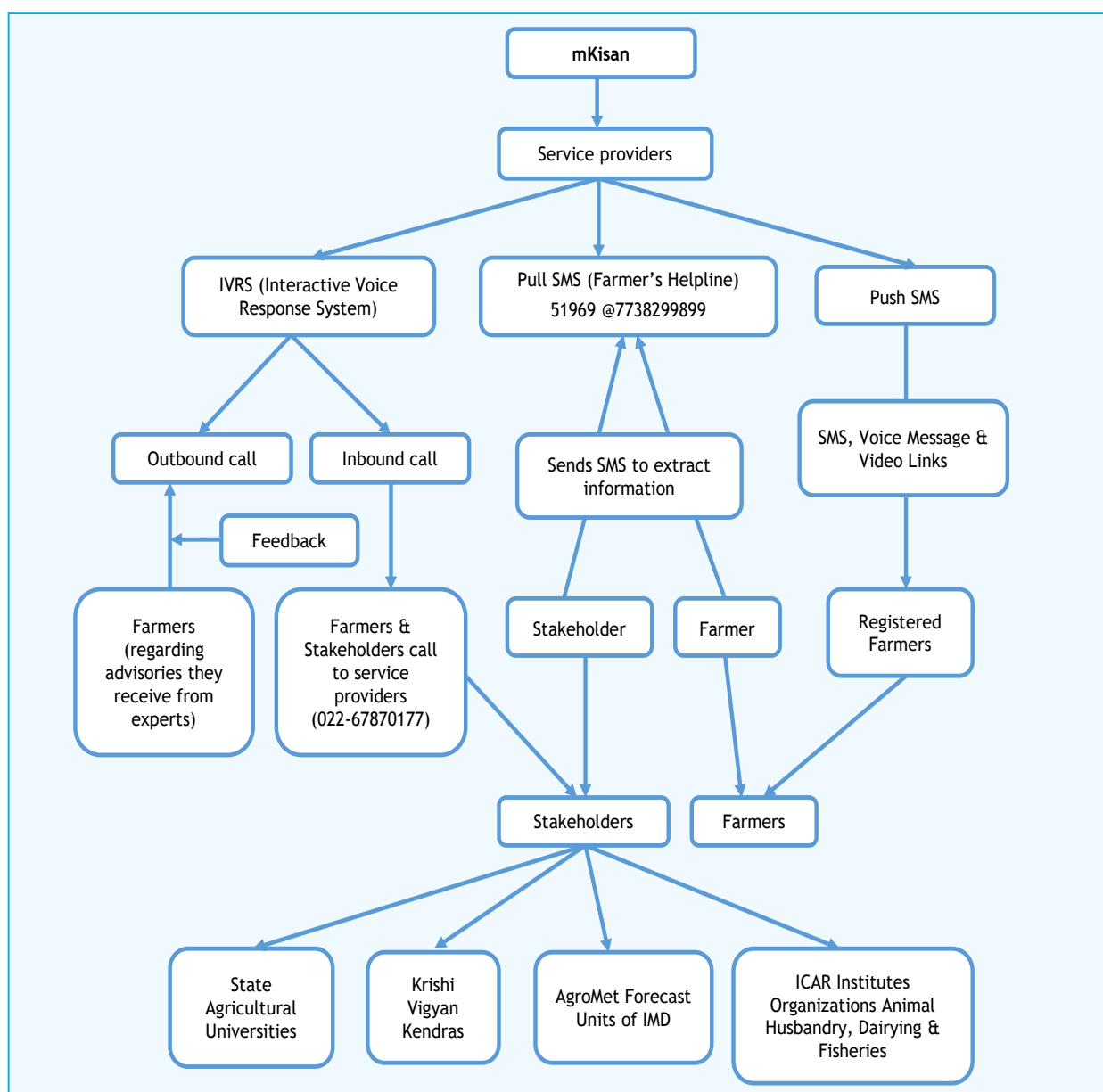


Figure 2.2: Schematic representation of mKisan

Source: Compiled from <http://mkisan.gov.in>

2.1.4. Mobile Based Services for Agriculture

Mobile revolution is taking place in India. This is evident from the access to mobiles among our population. As per 2011 Population Census, fifty-three per cent of households had a mobile phone. A recent household Survey on India's Citizen Environment & Consumer Economy (ICE 360° survey) conducted in 2016 has revealed that eighty-eight per cent of households in India today have a mobile phone. Another estimate shows that up to 80 per cent of the Indian population has access to a mobile phone. But only 10 to 15 per cent of the farmers are benefitting from the mobile phone services. Whatever may be the differences across the studies, one thing is clear a large proportion of Indian population have mobile phones. Considering this, several mobile based services for farmers and other stakeholders that are being delivered through organisations, departments and offices of the Central and State Governments down to block level including State agricultural universities, Krishi Vigyan Kendras, Agro-Meteorological Field Units. All these services have been brought under the umbrella of mKisan portal of the Ministry of Agriculture, Cooperation and Farmers Welfare, Government of India. As such, the mKisan consolidates services that include - SMS (both push and pull), interactive voice response system, unstructured supplementary services of data or USSD (which is essential for an interactive SMS and facilitate data entry and query on web portals without internet) mobile Apps (Narasimhan 2015).

2.2. Marketing Information

There are many websites and mobile Apps that provide information on the agriculture market prices, its trends and other bulletins related to the agriculture markets. They have been discussed below.

2.2.1. Marketing Information Network (AGMARKNET)

Agricultural Marketing Information Network (AGMARKNET) was launched in March 2000 by the Union Ministry of Agriculture and has created a database covering 300 commodities and 2000 varieties. Under this programme, the Directorate of Marketing and Inspection envisages to link 7000 markets located in various States and as of March 2014, 192 markets were linked in Karnataka. The portal transmits data of all markets in English and eight regional languages. It displays commodity-wise, variety-wise daily prices and arrivals information from all wholesale markets across the Country. Each farmer can register their mobile number and request for price information with respect to three commodities in three markets of their choice and information provided is free of cost. The portal also helps various stakeholders such as industry, policy makers and academic institutions by providing agricultural marketing related information from a single window. One can also view trend reports on prices and arrivals. This portal helps in reducing the information asymmetry in agricultural prices and thus is of immense use to stakeholders. The list of detailed information that the portal provides are as follows:

- Prices and Arrivals (Daily Max, Min, Modal, MSP; Weekly/ monthly prices/ arrivals trends; Future prices from 3 National commodity exchanges)
- Grades and Standards
- Commodity Profiles (Paddy/Rice, Bengal Gram, Mustard-Rapeseed, Red Gram, Soybean, Wheat, Groundnut, Sunflower, Black Gram, Sesame, Green Gram, Potato, Maize, Jowar, Cotton, Grapes, Chilli, Mandarin Orange, etc.)
- Market Profiles (Contact details, rail/road connectivity, market charges, infrastructure facilities,

revenue, etc.)

- Other Reports (Best Marketing Practices, Market Directory, Scheme Guidelines, DPRs of Terminal Markets, etc.)
- Research Studies
- Companies involved in Contract Farming
- Schemes of Directorate of Marketing and Inspection (DMI) for strengthening the Agricultural Marketing Infrastructure.

2.2.2. Agri Market Mobile App

The mobile App was launched in December 2015. It is used to source market prices of crops in the markets within a radius of 50 km of the farmer's mobile location captured by GPS. There is also an option to get prices of any crop, in any market irrespective of GPS location. It was developed primarily to keep farmers abreast of crop prices and discourage them from attempting distress sale of their produce. The App can be accessed on web and android platforms by registering on the mkisan portal (<http://mkisan.gov.in/Default.aspx>).

2.2.3. e-RaKAM (e-Rashtriya Kisan Agri Mandi)

This Portal was launched by the Union Government in 2017 to provide a platform to sell farmers' agricultural produce by connecting them with several buyers. It is a digital initiative that brings together FPOs, PSUs civil supplies and buyers on a single platform to buy agricultural produce (Anon 2017).

In addition, there are four categories of portals that provide wider agriculture related information, namely:

- Farmers Portal
- Agrimahiti
- National Portal of India
- Farm Net forum

a) Farmers Portal

This portal provides complete information related to agriculture for each region in each district of each State in India. Detailed information on farmers' insurance, agricultural storage, crops, extension activities, seeds, pesticides, farm machineries, etc., including information on fertilizers, market prices, package and practices, programmes, welfare schemes are also given. An interactive map also contains block level details related to soil fertility, storage, insurance, training, etc. To access relevant information across India, the user needs to choose their State from the map provided on the page and follow the instruction.

b) Agrimahiti.com

Agrimahiti.com is a free online agriculture information and community Portal and has been in existence since 2013. It provides solution to start new farming areas with a complete manual on how to grow

crops, job opportunities in the agriculture sector and so on.

c) National Portal of India

This link provides information on agricultural produces, machineries, research, etc. including detailed information on the Government policies, schemes, agricultural loans, markets prices, animal husbandry, fisheries, horticulture, loans and credit, sericulture, etc.

d) Farm Net Forum

Farm net forum is a farming and agriculture forum in India that allows farmers to register themselves and have discussion on various topics on agriculture, post their queries and get appropriate solutions from the forum.

2.2.4. e-NAM (National Agricultural Market Portal) an online Portal for Trading in Agriculture Produce

This pan India online trading portal was launched on the 125th birth anniversary of Baba Saheb Ambedkar (14th April 2016). It presently helps 21 mandis in 8 States (Uttar Pradesh, Madhya Pradesh, Jharkhand, Himachal Pradesh, Gujarat, Telangana, Rajasthan and Haryana) with real time price discovery and transparency in the auction process, and gives farmers access to a nationwide market. Farmers can buy and sell online thereby liberating them from the clutches of middlemen and realise a fair market value for their produce (Anon 2016). Using this portal, a farmer can decide where the produce can be sold, when it will be sold and at what prices. There are plans to integrate all the 585 regulate markets on the e-NAM platform by March 2018.

2.3. Various Android Apps for Agriculture

The IT division of Ministry of Agriculture, Cooperation and Farmers Welfare has launched several android apps to provide quick and relevant information to farmers.

The aim of these Apps is to provide information about the latest agriculture trends, equipment, technologies and methods being used. The farmers can download these Apps from the Google play store. Some of them are discussed below:

2.3.1. Kisan Suvidha - A New Mobile App

The Kisan Suvidha was launched in 2016. The farmers can download this App on a smart phone and register their number to access the information on five critical parameters namely, weather, input dealers, market price, Plant protection and expert advisories. For instance, if the farmers selected weather, the App displays details of temperature, humidity, wind and rainfall for the current day and the forecast for the next five days and any weather alerts like hailstorms or unseasonal rains. If market price is selected on the App's main navigation menu, details on latest price of all crops traded in a mandi or registered agriculture market of the district farmer belongs to. The farmers can also see the maximum price in the district, State and the entire Country on a particular day. Based on the information, farmers can decide on whether to take their produce to the mandi or delay transportation based on current prices accessed from the App.

If plant protection is selected, information on pest, weed and disease-related information as well as management practices for each stage of crop development from nursery to harvesting area is displayed.

The 'agro' of the app section also shows messages for farmers from district agriculture officials and State universities in their local languages. These primarily deal with crop management practices based on the prevailing situation; say a remedy for a widespread pest attack or imminent showers.

If input dealer is selected on the App's main navigation menu, it displays the names and mobile numbers of input dealers selling pesticides, seeds, fertiliser and machinery and provides information on the identification and management of crop pest and diseases. It is a handy tool for farmers and they can make a call and compare input prices and their availability before heading out to purchase these inputs.

2.3.2. Pusa Krishi

This App was launched in March 2016. It provides information to the farmers on the new varieties of crops developed by Indian Council of Agriculture Research (ICAR), conservation of cultivation practices, farm machinery and its implementation that will help farmers to increase their returns. This App also provides weather highlights that forewarn farmers to take measures to save their crops.

2.3.3. MKisan Application

The android app allows farmers and all other stakeholders to obtain advisories and information sent by experts and Government officials at different levels through mkisan portal without registering on the portal.

2.3.4. Shetkari Masik Android App

The App can be used to download Shetkari Masik magazine and read without internet connectivity. "Shetkari Masik" is one of the most popular monthly magazines in the Agriculture sector since its first publication in 1965 by the Department of Agriculture, Maharashtra.

2.3.5. Farm-o-Pedia App

The App is targeted for farmers and others involved in agriculture businesses based in rural Gujarat. The App can be used to get information on the suitable crops that can be produced as per soil and season, crop wise information, weather information as well as information on animal husbandry.

2.3.6. Crop Insurance Android App

This App was launched in December 2015 and can be downloaded from the mKisan portal. It is used to calculate the Insurance Premium for notified crops based on area, coverage amount and loan amount in case of loanee farmer. The App can also be used to get details of normal sum insured, extended sum insured, premium details and subsidy information of any notified crop in any notified area.

2.4. Other Agri-Advisory sources

2.4.1. Village Knowledge Centres (VKCs)

The VKCs were initiated by the Ministry of Information and Communication Technologies. The National Commission on farmers headed by M. S. Swaminathan (2007) recommended setting up of Village Knowledge Centres (VKCs) in the Country. Based on this, the centres were set up across the Country in the late

1990s. The aim of the VKCs have been to provide information on Government programmes as well as the market and weather parameters for the poor, marginal and small farmers to improve timeliness and efficiency of farm operations and enhance their income through producer-oriented markets.

Village Information Centres (VICs) were established by various Governmental agencies, institutions and NGOs all over the Country. These Village Knowledge Centres serve as information dissemination centres that provide farmers instant access to latest information/ knowledge available in the field of agriculture, from crop production to marketing. In coastal areas, these centres provide information to fishermen on sea conditions such as wave height, turbulence and fish density to apprise fishermen before venturing in to the sea.

2.4.2. Indian Institute of Soil Science - Bhopal

The Institute has developed a web-based system that calculates the quantum and quality of fertiliser that should be applied to the soil for targeted yield. Eleven States including Karnataka have availed this facility. The soil testing laboratories in these States have shared data on the type of soil that are present in their regions. This system facilitates farmers to overcome the problem of over-use of fertiliser that erodes soil health (George Parsai, 2012).

2.4.3. Soil Health Portal, Fertiliser Quality Control System Portal and Participatory Guarantee System

The Ministry of Agriculture, Government of India, launched three portals namely, Soil Health Portal, Fertiliser Quality Control System Portal and Participatory Guarantee System in July 2015. The objective of these portals has been to make the process of organic farming certification, fertilisers quality checks and issuance of soil health cards more transparent and accountable (Narsimhan, 2015).

2.4.4. ICAR (Indian Council of Agricultural Research)

In India, the ICAR has developed inter-linked agricultural information cells at each of its Institutes and in some State Agricultural Universities to form a National Agricultural Information System (ARIS).

2.4.5. InDG (India Development Gateway)

This gateway disseminates information on improved technological innovations to the farming community and service providers in rural areas. The present areas of focus for the agriculture sector in this portal pertains to agriculture credit, policies and schemes, MGNREGA, market information, weather information, agriculture best practices, etc.

2.4.6. Agropedia

This portal mimics the format of Wikipedia, but is specific to Indian agriculture. It provides a long list of Indian agricultural websites and various portals for farmers and also furnishes summarised information related to each agriculture website or portal.

In addition to the above, each State has websites and portals for dissemination of information on agriculture in their respective local languages. The Indian Agriculture Institutes websites also provide information on various facets of agriculture.

2.4.7. NGOs

World Foundation India (OWFI), an Information and Communication Technology NGO provide information to needy farmers through a simple mobile App called “Lifelines-Agriculture”. The App requires that a farmer record their query and send it to a toll-free number. This recorded message is then retrieved to be further researched and discussed by a team of knowledge workers (agricultural experts) who within 24 hours, send a voice based response back to the farmer. In the past eight years, OWFI has responded to 490,000 questions sent to them via the App.

2.4.8. Indian Farmers Fertiliser Cooperative (IFFCO) Ltd (Agriportal)

It is also known as IFFCO KISAN SANCHAR LIMITED (IKSL). The IFFCO, together with Telecom major Bharti Airtel and Star Mobitel promote IFFCO KISAN SANCHAR LTD (IFFCO Kisan). It is actively working with DAC& FW to ensure high quality of services to the farmers who call on KCC. A farmer friendly mobile App ‘IFFCO Kisan’ was developed and launched to provide customized and personalized advisory and information services related to weather, agriculture, animal husbandry, market information and other areas of interest to them.

2.4.9. RML Information Services Pvt. Ltd. (RML)

RML formerly known as Reuters Market Light was incorporated in 2006 and their services were first launched in Maharashtra on October 1, 2007. It is a unique mobile-based provider of technical and financial advice to farmers in India. It provides personalised information on farming techniques, crop recommendations, weather forecasts and various other pieces of agricultural information across 17 States in 9 different languages. It also features Krishidoot, a component that acts as a platform for farmers, enterprises and agricultural stakeholders to interact and transact. Through Krishidoot, the users of the platform can buy and sell agricultural produce and supplies at published prices without operating through middlemen and agents.

2.4.10. NDDB (National Dairy Development Board)

The National Dairy Development Board (NDDB) launched a mobile application on July 7, 2015 that recommended a balanced diet formula for cows and buffaloes to help boost dairy farmers’ income by raising milk yield and cutting feed cost. This App named as ‘Pashu Poshan’ on both web and android platforms can be accessed by registering on the INAPH portal (inaph.nddb.coop). To avail better advice from this website, the farmer needs to provide complete animal profile, including breed, age, milk production, fat content in milk, apart from food items being currently fed to the animal along with the cost in order to formulate the balanced ratio formula. Based on the information furnished, the farmer is advised on an effective and balanced diet for the animal/s. As on 2015, the NDDB has received profiles of 6 lakh milch animals in 40,000 villages and recommended farmers about the balanced feed and fodder for their cattle. This resulted in reducing the feed cost by Rs.5 to Rs.15 per day per animal and an average increase in milk production by an average of 300 ml per animal per day. The App has been scaled up to provide this facility across the Country (Anon 2015).

2.4.11. Private Companies

There are several companies providing market information to farmers. Some of them are Rainbow Agri, Mandi trades and Mpower’s ICT and Livestock Management Systems (LMS) thus reducing the gap between the buyer and farmer.

Rainbow Agri

Rainbow Agri have a host of services where farmers can talk to communities, users can buy and sell local products and buyers can even receive live price updates. They are also connected to neighbourhood farmers directly and see real images of their crop. Rainbow gets farmers, street vendors and even small stores to reach buyers in their local areas and even customize deliveries to suit the buyer's needs. The other advantages are; availability of discounts, ability to submit details in local languages and facilitates tracking order. With Rainbow Live Price, all the crops in India have been arranged comprehensively by location, weather, market names and type.

Mandi Trades

Information about the commodity, their prices and a map based view of available farm products with the ability of connecting to a required farmer can be obtained via a simple phone call through this App. A buy/sell platform aims to solve the problems of marketing and farmers daily struggles to sell their produce. When they register with the site, it uploads information about the commodity, location of cultivation and updates its database. In the process, farmers learn of average demand, peak/low demand season, in and off season needs, rare items, their prices and can plan their farm activities accordingly.

Mpower Social

Livestock farming is one of the most important forms of livelihood for many families. Unfortunately, the ratio of registered veterinarians to cattle is very low. As such, Mpower's ICT Livestock Management Systems (LMS) aims to decrease this gap by connecting livestock professionals to small holder farmers via Livestock intermediaries. These Livestock workers register the farmers, gather regular updates about their cattle and provide expert medical advice - all through their mobile application. This reduces the cost of consulting an expert or a doctor.

In brief, Rainbow Agri connects local buyers and sellers; Mandi Trades lists Government crop price updates, important information for farmers in remote villages and Mpower Social offers veterinary advice for cattle owners.

Sandesh Pathak Application

The Sandesh Pathak application was developed jointly by C-DAC Mumbai, IIT-Madras, IIT Hyderabad, IIT Kharagpur and C-DAC Thiruvananthapuram. It will enable SMS messages containing agriculture related information to be read out loud, for the benefit of farmers who may have difficulty in reading.

ITC's e-Choupal

The Indian Tobacco Company (ITC) began e-Choupal as a cost-effective means of dealing directly with farmers to buy agricultural products for export. The system is now becoming a mega-market for rural India and at present, farmers can secure orders with ITC directly through Internet kiosks. As a result, ITC and the farmers achieve savings by bypassing the intermediaries and the local entrepreneurs gain commissions on the transactions made through their kiosks. The kiosks can also be used for companies to sell products and services directly to the farmers and train the farmers on how to use them (Sahdev Singh, 2006).

2.5. State-wise Advisories for Farmers

2.5.1. Karnataka

Kisan Call Centres

Kisan Call Centres have been set up across the Country and in Karnataka; the KCC was set up in January 2004. Similar call centres have been established by the Directorate of Agriculture, the UAS Dharwad, Agricultural Marketing Board, Horticulture Department, Central Silk Board, Indian Institute of Horticulture Research (IIHR), Hesaraghatta. These Centres provide expert advice to farmers on a number of subjects, including crops, seeds, seasonal conditions, fertilizers, soil moisture and pests.

Unified Marketing Platform

The Unified Marketing platform (UMP) was a State Government initiative launched in 2014 by the Rashtriya e-Market Services (ReMS). Through this, farmers can trade directly with the buyers. Up until 2016, 14 lakh farmers were benefited from UMP without the interference of middlemen.

Karnataka Krishi Marata Vahini

The Department of Agricultural Marketing launched the Karnataka Krishi Marata Vahini, a Government of Karnataka portal linked to National AGMARKNET website. Users of this portal can check details about market profiles, warehouses, infrastructure, committees, etc. List of sellers, buyers and a registration facility for probable buyers have been provided on the website. In addition, other information such as; price reports for agricultural commodities, downloadable forms and procedures, information on agriculture acts, schemes, department profile, etc. are available on this website.

Farmers can also subscribe to alerts by registering their mobile numbers or logging on to the website (<http://www.krishimaratavahini.kar.nic.in>) to get the price details through SMS free of cost, by contacting the KSAMB or APMC officials. The SMSs have been delivered in English or Kannada. Farmers can also dial the toll-free number 18004251552 for information on the market, between 8 am and 8 pm. To organize their search results, farmers have to choose ten agricultural commodities and ten APMC markets on the website. Based on their choices, SMSs will be sent to them after 4 PM with the demand and prices of each selected commodity in various APMCs.

Agriculture Website (www.raitamitra.kar.nic.in)

The State created new agriculture website (www.raitamitra.kar.nic.in) in March 2014 to facilitate farmers to post queries and obtain clarity from experts through SMS on several agricultural aspects.

Electronic Solutions against Agricultural Pests (e-SAP)

The University of Agricultural Sciences, Raichur, has developed a unique pilot IT enabled hand-held device called Electronic Solutions against Agricultural Pests (e-SAP). eSAP is an image-based model that captures high quality images of pests, their symptoms and then guides the user in identifying the pest.

This helps the extension worker, who is often not an expert, to collect specimens instantly from the farmer's field and send it to the scientists and experts in real time.

Krishi Agri Portal

e-Krishi is a National portal of India started by University of Agricultural Sciences, Bengaluru. It provides information related to Agriculture, Horticulture, Sericulture, Animal Husbandry, Fishery, Farm Mechanization, Government Welfare Programmes, Weather Reports, Krishi News and highlights a few success stories of farmers.

Media

In addition to above, print media, newspapers, magazines, radio, television, the internet and extension services are providing agriculture information including information on weather.

2.5.2. Kerala

Karshaka Information Systems Services and Networking (KISSAN)

KISSAN was launched in 2003 by the Agriculture Department of Kerala. A major objective of this initiative has been to provide agricultural information to the right person at the right time in the right place and in the right context. Farmers can access information on markets, fertiliser use, weather, crop husbandry, etc., from various sources like television, internet, telephone and mobile. Information on agriculture and weather has been telecasted to farmers via television and agricultural videos. In addition, experts in agriculture and allied services would answer questions posted by farmers via SMS.

2.5.3. Andhra Pradesh

The 'Plantix' App

This App was launched by the Andhra Pradesh Government in 2017. In the event of a pest infestation, the farmer needs to photograph the crop and upload the images on the App. These photographs are analyzed using artificial intelligence algorithms and the results returned immediately to each farmer. The results include critical information on symptoms, triggers, chemicals as well as biological treatments.

2.5.4. Jharkhand

Jharkhand claimed to be the first State that launched weather forecast updates at the Gram Panchayat scale in March 2017 through internet and mobile App. However, the claim is refuted as Karnataka is the first State to introduce this system. Their forecast presently covers 14 weather parameters, available in Hindi, English and Nagpuri languages, with an hourly update of six weather parameters namely, minimum temperature, maximum temperature, rainfall, relative humidity, wind speed and direction and cloud cover.

2.5.5. Tamil Nadu

Tamil Nadu Government launched a programme in 2013 called e-Extinction and created a website called www.agritech.tnau.ac in that furnishes an exhaustive list of various components of agriculture (Prabhu, 2013)

2.5.6. Bihar

Bihar launched Kisan Choupal in collaboration with Krishi Vigyan Kendra in 2012 that is based on a need assessment of farmers in identified village by the scientists on agriculture and allied enterprises. At Kisan choupal, the dialogue/ discussion/ problems solving is facilitated with help of information technologies, showing technical videos to farmers, movies, etc. This has increased awareness of farmers on cropping practices and new techniques and facilitated better and wider reach of these technologies.

Many State Governments have launched many mitras to create awareness about these facilities through its extension machinery. These mitras include Kisan Mitra (Agriculture), Gokul Mitra (Animal Husbandry) and Matsya Mitra (Fisheries) to enable the farmers to effectively utilise these innovative technologies available in the Country.

2.6. Weather Based Services with macro coverage

2.6.1. Need of Weather Based Information

Good yields of agriculture crops depend on variety of factors. Weather is one of the factors or inputs for developing risk mitigation tools such as index insurance products for farmers. The weather based helps the farmers to decide about his choice on crop management including appropriate time for sowing, weeding, harvesting, fertilizer application and to get the best from their investment and hard work. An agriculturally relevant forecast is not only useful for efficient management of farm inputs but also leads to precise impact assessment (Gadgil, 1989). It is very essential to the farmers not only protect themselves from the natural factors but also to take decisions or alter agricultural operations based on weather conditions to enhance the agricultural output, quality of the product, minimise the farm loss through proper management of agricultural operations and take contingency plans to cope up the situation. There are also evidences in the country which have shown a substantial proportion of our agricultural production is lost due to both aberrant weather and post-harvest losses. The farmers can minimise the losses if not completely prevent if the timely weather advisories are provided. In order to provide these kinds of information to farmers various initiatives were made in this country.

It is also necessary for the farmers to make decision to get the best from their investment and hard work. In recent years, weather is being used as an input for developing risk mitigation tools such as index insurance products for farmers.

Modern agriculture is becoming knowledge intensive. Farmers need both generic and dynamic information on matters relating to farm operations and markets. The extension system by and large has not been able to respond to their needs, particularly in the area of dynamic information and advice on economically viable crop diversification and land and water use based on meteorological and marketing factors.

Under the National Monsoon Mission initiative institutions of Earth System Science Organisation (ESSO), the Indian Institute of Tropical Meteorology (ESSO-IITM), Pune, India Meteorological Department (ESSO-IMD), Indian National Centre for Ocean Information Services (ESSO-INCOIS), Hyderabad and National Centre for Medium Range Weather Forecasting (ESSO-NCMRWF) and NOIDA have embarked upon to build a state-of-the-art coupled ocean-atmospheric climate model for improved prediction of monsoon rainfall on extended range to seasonal time scale (16 days to one season) and improved prediction of temperature, rainfall and extreme weather events on short to medium range time scale (up to 15 days). These predictions or forecasts have been disseminated through various modes to different stakeholders in general and the farmers in particular. In the past, Radio, TV and Newspapers for disseminating of weather information. However, the situation has changed overtime with the introduction of a plethora of weather Apps, portals and channels providing real time weather and forecasts available at the click of a button. The most popular ones have been briefly highlighted in the following section.

2.6.2. Indian Meteorological Department (IMD)

IMD was established in 1875 is an agency of the Ministry of Earth Sciences, Government of India. It began regular weather services for farmers in 1945 in the form of a “Farmers’ Weather Bulletin” and broadcasts through All India Radio in regional languages. In 1971, on the recommendation of the National Commission on Agriculture (NCA), it launched Agro- meteorological Advisory Services (AAS), a comprehensive tool tailored to farmers’ need. Following which, in 1975-1976, the U.S. National Aeronautics and Space Administration (NASA) conducted a Satellite Instructional and Television Experiment (SITE) with IMD and agricultural agencies that led to the production of crop specific weather-based agronomic advisories for different regions of the Country. These integrated Agro- meteorological Advisory Services were further developed in 2007.

The National Centre for Medium Range Weather Forecasting (NCMRWF) under the Ministry of Earth Sciences (MoES), Government of India, in collaboration with India Meteorological Department (IMD), Indian Council of Agricultural Research and State Agricultural Universities were providing Agro-meteorological Advisory Services (AAS) at the scale of agro-climatic zone to the farming community based on location-specific Medium Range Weather Forecast (MRWF) (NCMRWF, 1999). However, since 2007, the entire framework of AAS that was developed and successfully demonstrated by NCMRWF, was relocated at IMD under MoES to extend the service (in operational mode) to districts under these agro-climatic zones. It is renamed as Integrated Agro-meteorological Advisory Service.

Agro-met Advisory Services use three dissemination channels namely, mass media, group awareness campaigns and individual contacts. Weather information is also available through toll free number 1800 180 1717.

It communicates information on disaster related cyclone, floods, heavy rains, etc., through SMS to individuals who have registered on the weather forecaster’s official website. The information is also disseminated to officials involved in administration, district magistrates besides fishermen, farmers and general public. They provide weather forecasts up to district level covering a radius of 50 km.

With a rising demand for location specific updates on weather parameters, the IMD started releasing district weather forecasts - for rainfall, maximum and minimum temperature, wind speed and direction, relative humidity and cloudiness - with up to five days advance warning and a weekly cumulative rainfall forecast. These products were sent twice a week along with other value-added information to 130 AgroMet Field Units (AMFUs) for preparation of district level advisories. Subsequently, the farmers were advised to follow particular agri-operations to reap better returns taking into account the weather parameters.

2.6.3. Gramin Krishi Mausam Sewa (GKMS)

Weather related advisory service (Agro meteorological Advisory Services) to farmers under Garmin Krishi Mausam Sewa (GKMS) has been implemented by the Department of Agriculture, Indian Meteorological Department (IMD) and Ministry of Earth Services (MoES), Govt. of India.

It provides weather information twice a week to farmers in collaboration with State Agricultural Universities (SAUs), Institutions of Indian Council of Agricultural Research (ICAR), IITs, etc. They provide district level weather forecast for next 5-days on rainfall, maximum temperature, minimum temperature, wind speed, wind direction, relative humidity and clouds. Weekly cumulative rainfall forecast and crop specific advisories are also provided to farmers. Crop specific advisories to farmers are disseminated via different print/ visual/ Radio/ IT based media including short message service (SMS) and Interactive Voice Response Service (IVRS) that facilitates appropriate field level actions. Weather forecast based agro-meteorological advisories are disseminated through the Kisan portal launched by Ministry of Agriculture and also under public private partnerships (Anon, 2017).

2.6.4. Agro Meteorological Advisory Services (AAS)

IMD launched AAS in 2007, following which a District-level Agro-meteorological Advisory Service (DAAS) was introduced in 2008, with the aim of providing relevant weather information and management advisories at a district level across the Country. The National Centre for Medium Range Weather Forecasting (NCMRWF) and Indian Meteorological Department provide information to farmers on weather parameters through Agro- Meteorological Field Units (AMFU) located in the State Agricultural Universities and Research Institutions (130 Units) across the Country. The information is disseminated by these Units through various modes such as print and electronic media, fax, phone, SMS and print bulletins. The AAS units across the Country provide weather forecast twice a week. These forecasts are converted into farm level advisories by AAS units and disseminated to the farmers in vernacular languages through various modes such as print and electronic media, cable, personal contact as well as public awareness programme in Kisan Melas by agricultural Universities to educate the farmers on the usage of farm advisories. In addition, various websites also disseminate weather based advisories to the farming community.

2.6.5. India Weather App

This App provides current weather and four days forecast across the Country for more than 300 cities.

2.6.6. Skymet Weather Services

Skymet Weather Services is a private Indian company that provides weather forecast and weather graphics to the Indian media since 2003. It also caters to the major insurance companies, power sector and agriculture sector. Skymet along with few NGOs has been closely working to improve the sustenance of farmer in different remote blocks of many States in India. It also caters to different companies that require marine weather forecasts. The company also launched a weather website that allows a common user to source accurate weather information for free. It also launched an App for Android and Apple users that provide weather information in multiple regional languages. It is a strong contender in terms of weather forecasts to IMD and has been accurate with its forecast every year since its initiation in 2012.

2.6.7. Accu Weather

Joel N. Myers founded Accu Weather, an American media company that provides commercial weather forecasting services worldwide in 1962. It provides smart phone weather applications and online forecasts and videos for numerous radio stations, newspapers and local TV stations.

2.6.8. Weather Portal for the Power

The Union Government launched a weather portal for the power sector that was developed by Power System Operation Corporation Limited (POSCO) and India Meteorological Department (IMD). The web portal aims to provide information regarding weather forecast in a bid to help State discoms take pro-active steps regarding supply planning requirements, planning for infrastructure availability and to ensure cost effective and reliable supply. The other features available on the portal include weekly regional weather summaries, the Doppler Weather Radar, satellite images using Indian satellite INSAT 3D developed by the Indian Space Research Organisation among others.

2.6.9. Mahalanobis National Crop Forecast Centre (MNCFC)

Under the National Agricultural Drought Assessment and Monitoring System (NADAMS) programme, Mahalanobis National Crop Forecast Centre (MNCFC) regularly (on monthly basis) carries out drought assessment at District/ sub-district level using satellite based remote sensing data, rainfall data and ground information with respect to sowing progression, irrigation percentage, under the National Agricultural Drought Assessment and Monitoring System (NADAMS) programme, etc.

2.7. Weather Based Services at State level

2.7.1. Karnataka

The University of Agricultural Sciences (UAS) Dharwad, sends timely free text messages (SMS) to farmers on weather forecast. These messages are sent to farmers once every three days with forecasts on humidity, maximum and minimum temperature for the next two days. The objective of these timely SMSs has been to help farmers effectively plan agricultural activities like sowing, harvesting and spraying pesticides thereby mitigating production risks. This facility has been implemented in Dharwad, Haveri,

Gadag, Uttara Kannada, Bagalkot and Belgaum districts. It was found that the forecast of this programme was 90 per cent accurate and immensely helped the farmers involved in cultivation of highly expensive and weather sensitive crops like cotton and grapes (Vincent Dsouza, 2011).

2.7.2. Kerala

The SFAC created a web portal (www.krishi.info) in 2016 where farmers can access weather information. It provides 5 days rainfall forecast and a variety of agricultural services for farmers in Kerala.

2.7.3. Jharkhand

Jharkhand launched a panchayat level weather forecast facility in March 2017 through internet and mobile App. Forecast of 14 weather parameters have been available in Hindi, English and Nagpuri languages with an hourly update of six weather parameters viz. minimum temperature, maximum temperature, rainfall, relative humidity, wind speed and direction, and cloud cover.

Post the launch of Varuna Mitra Services in Karnataka, other States such as Bihar, Odisha, Madhya Pradesh, Andhra Pradesh, Telangana, Jharkhand, and Uttarakhand have taken steps to replicate this system.

2.8. KSNDMC services and insights from other advisories to Varuna Mitra

The KSNDMC provides natural disaster and agricultural development related information through help desk, general radio service, Very Small Aperture Terminal and other methods. The centre serves agriculture, horticulture, fisheries, transportation, power and electricity sectors, disaster management agencies and other beneficiaries through a web enabled database management, application development and customization.

On 1st October 2010, KSNDMC introduced “VARUNA MITRA” Helpdesk services to the farmers and general public, where in the Centre started with two telephones operating 24 hours x 7 days x 365 days basis. These two lines facilitated the general public, specifically the farmers to directly contact the scientific personnel of KSNDMC and get the recent updates on the weather conditions pertaining to their Hoblis. The Help Desk started providing weather related information by detailing on actual rainfall recorded, weather forecast, distribution of temperature, relative humidity, wind speed and wind direction in the state. The information provided to the farmers was aimed at reducing the losses due to any weather aberration. The Help-Desk services have been helping the farming community in scheduling their agricultural activities in accordance with the dynamically changing climatic conditions.

Overtime, tremendous increase in the number of calls has been observed over time with annual average growth rate of 234% and hence it was difficult to receive all the calls with just two telephone lines. Thus, a dedicated mobile number “9243345433” was introduced to address the increased call volumes. This is a dedicated telephone line with 30 parallel lines which facilitates receiving 30 simultaneous calls at any point of time.

The schematic representation of KSNDMC services is depicted in **Figure 2.3** and Insights from other models for expansion of Varuna Mitra in **Figure 2.4**. Expansion requires integration with already existing models and institutions for providing AgriMet advisories in a single window mode.

Figure 2.3: Schematic representation of KSNDMC services

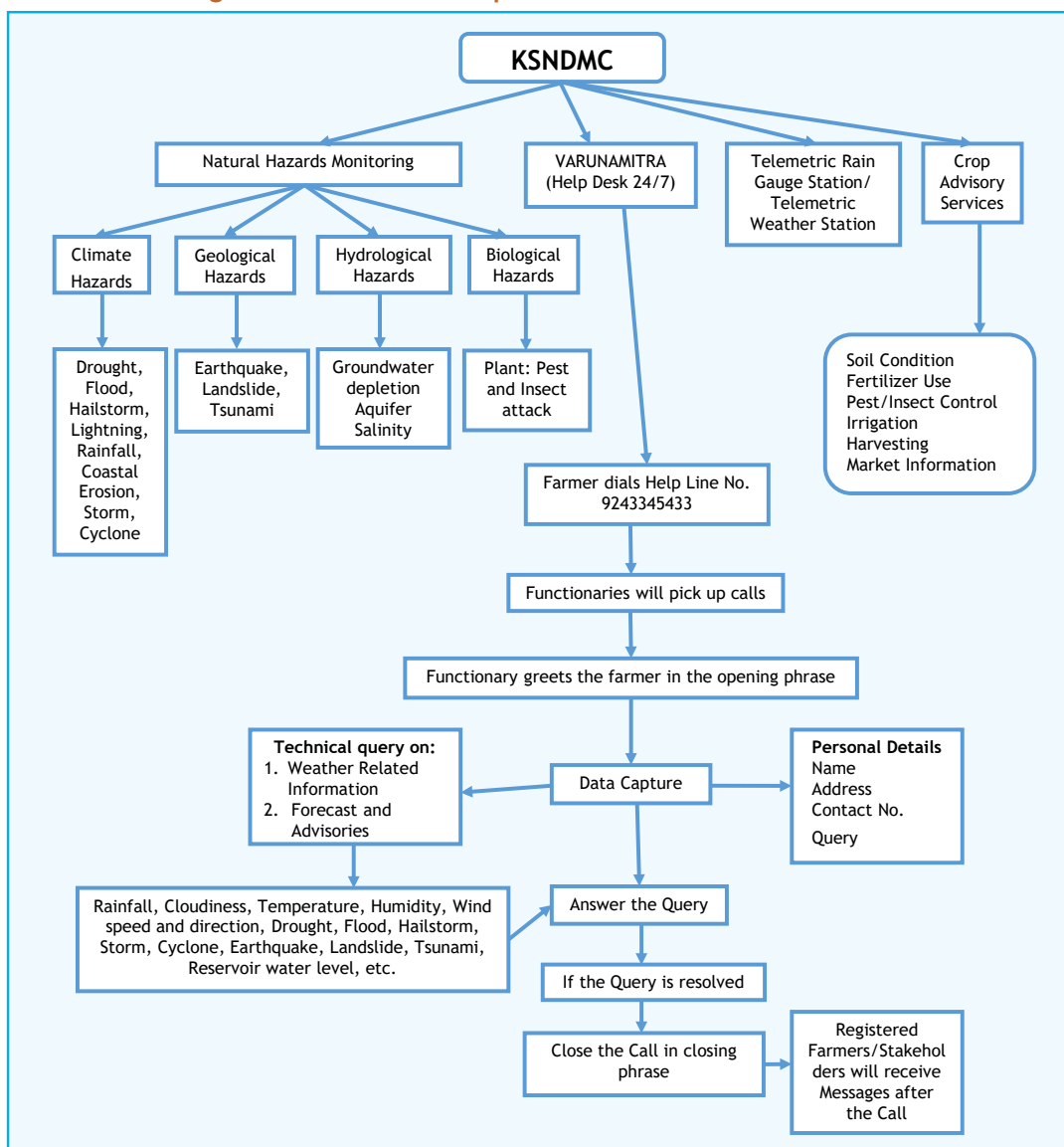
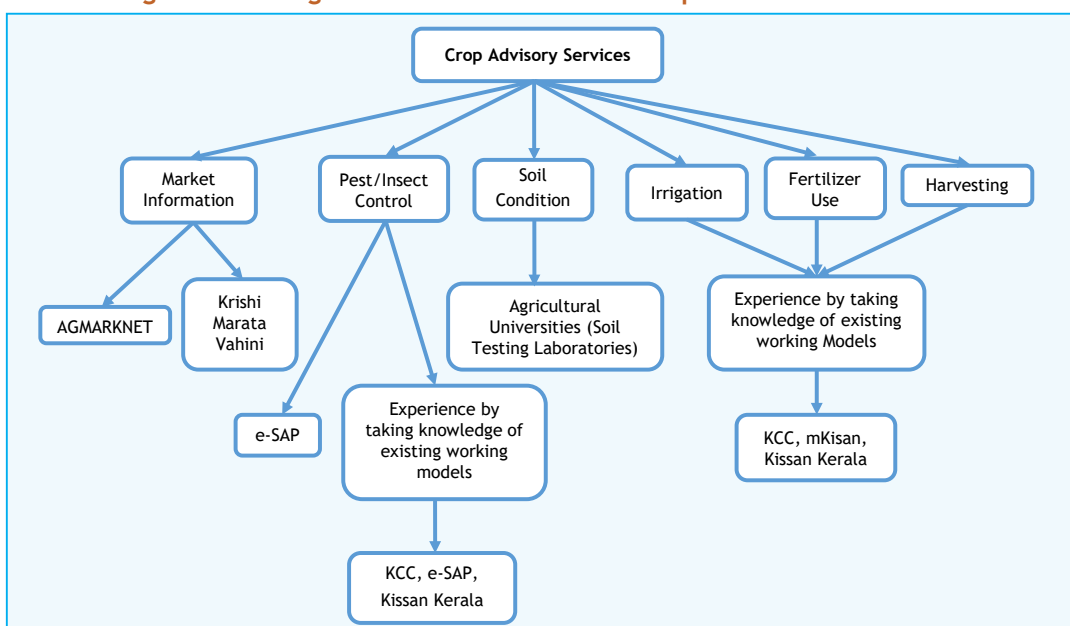


Figure 2.4: Insights from other models for expansion of Varuna Mitra

Source: Compiled from <https://www.ksndmc.org/>

2.9. ICT Information Availed by Sample Farmers

Despite of the ICT information on agriculture is available for the use of farmers; the usage of these is low among the farmers. This is evident from our field investigation. Out of 1350 farmers, only 224 farmers have accesses to information which account for just 16.59 per cent (Table 2.1). Of this 16 farmers have availed more than one program which comes to 240 responses. Among these a large segment of farmers (150) have availed the ICT information facilities on agriculture from State programmes and the rest (90 farmers) from the all India programmes. A majority of the farmers (50.7%) have availed information from Krishi Marata Vahini followed by others like Raitha Samparka Kendras and Agriculture universities (47.4%) within the state. In contrast to this a significant proportion of farmers were availed services from Kissan call centre (92.3%) programmes of India. Across the regions, low rainfall districts account for 74.8 per cent of farmers availed services from other services like RSK. Similar trend is observed across the rainfall regions and districts. Among the union government services, the rainfall regions, it has been found that a larger proportion in the high rainfall regions than low rainfall region. Across the districts we do not found much variation. Contacting Krishi Marat Vahini through SMS and calls was mainly to know the market prices and direct contact of RSK is mainly for agricultural advisories. A large segment of the farmers have sought information from kisan call centres in the form of calls.

Table 2.1: ICT Information Availed by Farmers from Various Sources

Districts	Krishi marata vahini	Raitha mitra	Mkissan	Kissan call centre	Accu weather	Sky met	Others like RSK	Total No. of Beneficiaries who responded	No Response	Total Number of responses	Total No. of Beneficiaries
Dakshina Kannada & Udupi	0(0)	0(0)	0(0)	1(0.67)	0(0)	0(0)	2(1.34)	3(2.00)	147(98.00)	3(2.00)	150(100)
Kodagu	14(9.34)	0(0)	0(0)	14(9.34)	0(0)	0(0)	0(0)	27(18.00)	123(82.00)	28(18.67)	150(100)
Shivamogga	12(8.00)	1(0.67)	0(0)	28(18.67)	0(0)	0(0)	0(0)	33(22.00)	117(78.00)	41(27.34)	150(100)
High Rainfall Region Total	26(5.78)	1(0.23)	0(0)	43(9.56)	0(0)	0(0)	2(0.45)	63(14.00)	387(86.00)	72(16.00)	450(100)
Chikkamagaluru	5(3.34)	1(0.67)	1(0.67)	16(10.67)	2(1.34)	0(0)	4(2.67)	27(18.00)	123(82.00)	29(19.34)	150(100)
Hassan	22(14.67)	0(0)	0(0)	1(0.67)	0(0)	0(0)	0(0)	23(15.34)	127(84.67)	23(15.34)	150(100)
Kolar	1(0.67)	1(0.67)	0(0)	13(8.67)	0(0)	0(0)	0(0)	13(8.67)	137(91.34)	15(10.00)	150(100)
Moderate Rainfall Region Total	28(6.23)	2(0.45)	1(0.23)	30(6.67)	2(0.45)	0(0)	4(0.89)	63(14.00)	387(86.00)	67(14.89)	450(100)
Tumakuru	21(14.00)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	21(14.00)	129(86.00)	21(14.00)	150(100)
Ballari	0(0)	0(0)	0(0)	4(2.67)	0(0)	0(0)	30(20.)	33(22.00)	117(78.00)	34(22.67)	150(100)
Raichur	1(0.67)	0(0)	2(1.34)	6(4.00)	0(0)	2(1.34)	35(23.34)	44(29.34)	106(70.67)	46(30.67)	150(100)
Low Rainfall Region Total	22(4.89)	0(0)	2(0.45)	10(2.23)	0(0)	2(0.45)	65(14.45)	98(21.78)	352(78.23)	101(22.45)	450(100)
Grand Total	76(5.63)	3(0.23)	3(0.23)	83(6.15)	2(0.15)	2(0.15)	71(5.26)	224(16.59)	1126(83.41)	240(17.78)	1350(100)

Note: Figures within parenthesis are percentages to the total; Source: KSNDMC data base, 2017

2.10. Additional Information Expected by the Farmers

Farmers have indicated that the Varuna Mitra should make an attempt to provide additional or new types of information and services on wide variety of agricultural operations. These are grouped in to three broad categories namely,

I. Market Related

1. Market know how
2. Prices of different commodities in markets
3. Market location

II. Technology Related

1. Pest and disease management
2. Package of Practices
3. Plant protection measures
4. Integrated Pest Management
5. Information on agricultural implements
6. Soil testing and information on new varieties
7. New technologies in agriculture
8. Technology related support for crop cultivation according to local conditions

III. Other Services

1. Information on Crop Insurance
2. Government subsidy programmes
3. Minimum Support prices
4. Storage facilities
5. Water management
6. Loss of crops in other states to take advantage of that to such crops to get more profit
7. Information on Krishi melas and training programmes conducted by the Agricultural Universities
8. Agri-advises along with Weather information
9. Alerts for farming related facts
10. Track Animals Moving towards crops and destruction

The field data in the respect of the above shows that out of 40.67 per cent of farmers has indicated the additional information not required. However, more than 59 per cent have indicated that they need additional information on different aspects of agriculture. A large segment of them expected Technical information (32.96%) followed by Market information (21.26%) and the agri advisory services (2%) (**Table 2.2**). Across the rainfall regions as well as districts, the proportion of not required additional information was considerably high in the case of low rainfall region than other regions and districts.

Among the major category of services expected, market information was found to be low in high rainfall region as compared to other two regions. This is mainly the cropping pattern in the high rainfall region is limited as compared to other regions, where we find diversion of agriculture is predominant. In case the Varuna Mitra function doesn't permit to provide these services, they may be integrated with various IT information sources mentioned above.

Table 2.2: Additional Information Sought by Farmers

District / Region	% to the total number of farmers					Total No. of farmers
	Market Information	Technical Information	Agri Advisories in addition to Weather	General Information	Not Required Additional Information	
Dakshina Kannada and Udupi	6.67	40.67	6.67	14.00	32.00	150
Kodagu	38.67	18.67	1.33	0.00	41.33	150
Shivamogga	6.67	47.33	2.00	2.67	41.33	150
High Rainfall Region Total	17.33	35.56	3.33	5.56	38.22	450
Chikkamagaluru	4.00	54.67	4.67	2.00	34.67	150
Hassan	24.00	32.67	0.00	0.00	43.33	150
Kolar	42.67	32.00	0.67	2.00	22.67	150
Moderate Rainfall Region Total	23.56	39.78	1.78	1.33	33.56	450
Tumakuru	47.33	24.67	0.00	1.33	26.67	150
Ballari	12.00	28.00	1.33	2.67	56.00	150
Raichur	9.33	18.00	1.33	3.33	68.00	150
Low Rainfall Region Total	22.89	23.56	0.89	2.44	50.22	450
Grand Total	21.26	32.96	2.00	3.11	40.67	1350

Source: KSNDMC data base, 2017

2.11. Conclusion

There are several agricultural portals, web sites, applications and mobile services for the dissemination of information to farmers from seed to seed. Some of these information services also deliver weather related information that can be used to reduce risks faced by the farmers. In addition, there are specific information sources exclusively providing weather information on weather parameters. In spite of this information, agriculture is at cross roads. Therefore, integration of all these information sources is very essential for improving accuracy of forecasts that enable proactive adaptation responses for effective performance of agriculture. Expansion of services of Varuna Mitra requires integration with already existing models and institutions for providing agriMet advisories in a single window mode. The Varuna Mitra forecast information should be integrated with any one or many of the following existing systems, so that farmers could reap better results.

1. The KSNDMC is regularly receiving the messages from agriculture department on various agricultural operations. These messages are being forwarded to the farmers who have registered with Varuna Mitra without any advice. This exercise is not more beneficial to the farmers. Therefore, the Varuna Mitra should add the forecast information to these messages which would help farmers whether he can carry out the advice or not.

2. Varuna Mitra should send the rainfall or weather related predictions to the agriculture department, so that the agriculture department can give advice to the farmers what he can do and not to do based on the rainfall and weather information.
3. The VM or agriculture department should make some kind of arrangement to give wide publicity of the forecast of rain and other weather related aspects to the farmers for carrying out operations in agricultural and allied sectors at hobli or group of hoblis level.
4. The agriculture Department soon after receiving the forecast information from VM should alert the PDOs of the Gram panchayats or the RSKs and make them responsible to disseminate the weather forecast of VM to the farmers with passing information about what kind agricultural operations that they can take based on forecast.
5. Indian Meteorological Department is providing information to farmers on weather related information through Agro meteorological Field Units (AMFU) located in the State Agricultural Universities and research Institutions across the state. These Units may be made use of for the dissemination of information and with advice the farmers to plan the agricultural operations.

Otherwise, the scattered information on agriculture across various sources would remain under-utilised by the farmers and the agriculture sector as a whole.



Interaction with officials of Agriculture Department in Kolar district



Interacting with officials of Agriculture Department in Shivamogga district

Impact of Varuna Mitra - A Macro Analysis

03



Impact of Varuna Mitra – A Macro Analysis

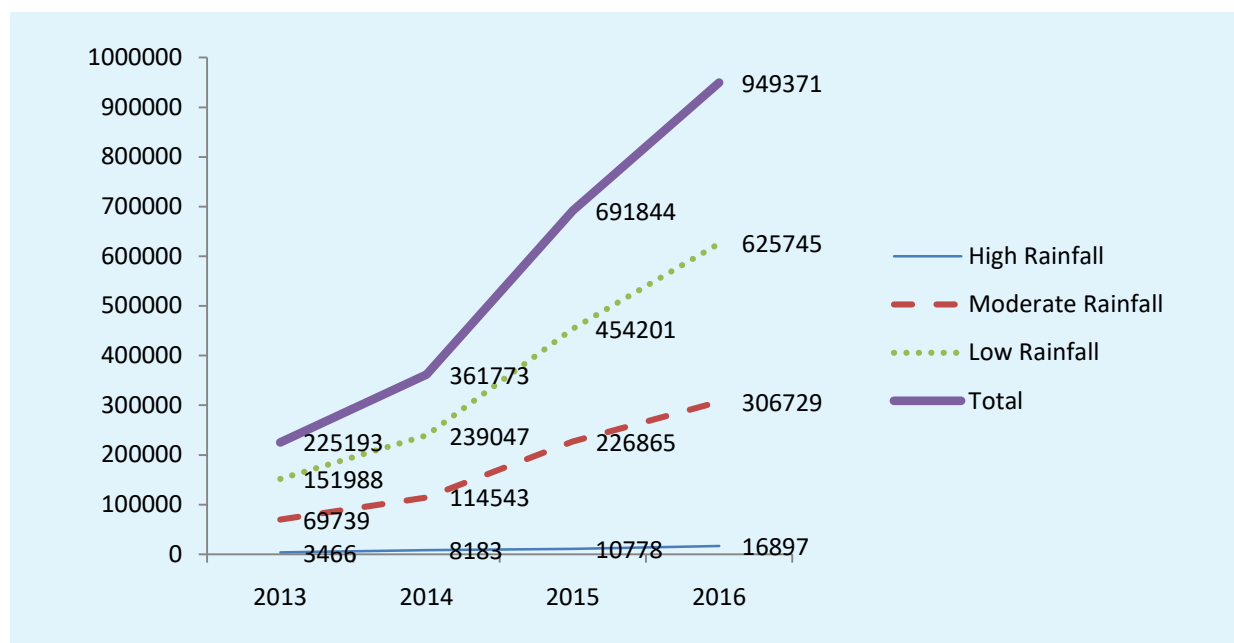
CHAPTER 3

This chapter is based on secondary data provided by KSNDMC pertaining to the period of 2013-14 to 2016-17 for a macro picture and an in-depth analysis of the latest agricultural year (July 2016 to June 2017). For the purpose of logical interpretation, the study districts have been classified based on the actual rainfall received during the reference period, viz. High Rainfall Districts (>1200mm), Moderate Rainfall Districts (600-1200mm) and Low Rainfall Districts (<600mm). The statistics on number of calls, purpose wise calls, the category of beneficiaries, advises sought on crops, category of lands, sector wise calls and spread of these across the districts have been analysed in the following sections.

3.1. Trends in Number of Calls

The Varuna Mitra programme has gained extensive popularity in the State, which is evident from the increase in number of calls received from different stake holders. At the outset of the programme, the centre received one call every hour but that has increased multi-fold and presently it receives thousands of calls every hour. The year-wise increase in number of calls showed that several calls were received from different beneficiaries, such as farmers, public, Government departments and educational institutions, etc. In 2011, the centre received 6,565 calls which increased to 10.41 lakh calls (**Figure 3.1**) in 2016-17 excluding disconnected calls (0.47 lakh).

Figure 3.1: Number of Calls from 2013 to 2016



Source: Compiled from KSNDMC Database, 2017

The district wise cumulative calls for four years were 22.28 lakhs from 2013 to 2016 and it is projected that the calls would increase to 63.57 lakhs by 2020. Among the calls made during the last four years, more than 42per cent of the calls were made during 2016 alone. Across the districts, the number of calls

from Ballari was the highest (12.17%) followed by Raichur (9.48%), Tumakuru (7.79%) and Kalaburagi (7.69%). This is evident from **Table 3.1** and **Figure 3.1**. Further, fewer calls were received from the coastal and urbanized districts. Specifically, the latter districts such as Dakshina Kannada and Udupi and urbanized districts such as Bengaluru Urban, Bengaluru Rural, Mysore, Mandya and Ramanagara. This may be attributed to the fact that people did not need information on rainfall as coastal areas have hitherto most often received adequate and assured rainfall. Similarly, in urban areas, as agriculture was not a predominant occupation and those who had farms diversified their economic activities, people were not wholly dependent on rainfall forecasts. With respect to frequency of calls based on regions categorized by annual rainfall, it was found that fewer calls were received from high rainfall regions compared to moderate and low rainfall regions. In addition, the average number of calls received was observed to have a similar pattern.

The CAGR of calls was 61.55 per cent with the highest growth rate in Kodagu (92.58%). The districts of Dakshina Kannada (14%), Bengaluru urban (19%), Gadag (29%) had registered lowest growth rates. During 2017 the total number of calls received was 12.99 lakh which brings the growth rate to 51.46 per cent. In terms of the pattern of calls during the drought years, it was found that the number of calls increased with the increase in number of districts that experienced drought. Particularly, the frequency of calls was highest in 2016 (**Table 3.2**) as the year experienced the lowest rainfall in the last 46 years.

Table 3.1: Number of Calls made by Farmers to VARUNA MITRA Helpdesk Services

District	No. of Calls (Jan-Dec)				Total	CAGR (%)	% to the Total
	2013	2014	2015	2016			
High Rainfall							
Udupi	103	177	230	515	1025	71.00	0.05
Dakshina Kannada	368	227	262	544	1401	13.92	0.06
Uttara Kannada	301	358	544	790	1993	37.94	0.09
Kodagu	745	3013	3296	5321	12375	92.58	0.56
Shivamogga	1949	4408	6446	9727	22530	70.89	1.01
Total	3466	8183	10778	16897	39324	69.56	1.77
Average calls per district	693	1637	2156	3379	7865	69.56	0.35
Moderate Rainfall							
Chikkamagaluru	9982	20501	30920	41954	103357	61.38	4.64
Bidar	6950	13379	30670	31415	82414	65.34	3.70
Kalaburagi	14501	24666	65413	66675	171255	66.29	7.69
Hassan	9758	15587	20459	37394	83198	56.49	3.73
Bengaluru Rural	2830	3524	7686	14598	28638	72.78	1.29
Bengaluru Urban	1463	1153	1578	2455	6649	18.83	0.30
Belagavi	13040	17084	26687	44955	101766	51.07	4.57
Yadgir	5034	9377	19798	24465	58674	69.39	2.63
Kolar	6181	9272	23654	42818	81925	90.63	3.68
Total	69739	114543	226865	306729	717876	63.84	32.23
Average calls per district	7749	12727	25207	34081	79764	63.84	3.58
Low Rainfall							
Ramanagara	1039	1456	2258	3490	8243	49.76	0.37
Chikkaballapura	9996	12852	37126	62176	122150	83.91	5.48

Table Contd...

District	No. of Calls (Jan-Dec)				Total	CAGR (%)	% to the Total
	2013	2014	2015	2016			
Tumakuru	20255	29721	52127	71364	173467	52.17	7.79
Mandya	3539	3397	3759	9800	20495	40.43	0.92
Dharwad	7795	8481	14786	18307	49369	32.92	2.22
Davanagere	6608	10466	21198	29175	67447	64.05	3.03
Raichur	16671	41347	77564	75655	211237	65.56	9.48
Mysuru	1225	2589	3644	8705	16163	92.25	0.73
Vijayapura	13609	20907	34918	64818	134252	68.25	6.03
Haveri	4029	5764	9366	11680	30839	42.59	1.38
Chamarajanagar	4692	7468	9861	24044	46065	72.40	2.07
Koppal	4843	8221	22666	32776	68506	89.15	3.07
Ballari	26574	43697	90856	110143	271270	60.63	12.17
Bagalkot	10791	13875	23155	35318	83139	48.47	3.73
Gadag	6998	7769	11985	15051	41803	29.08	1.88
Chitradurga	13324	21037	38932	53243	126536	58.69	5.68
Total	151988	239047	454201	625745	1470981	60.27	66.02
Average calls per district	9499	14940	28388	39109	91936	60.27	4.13
Grand Total	225193	361773	691844	949371	2228181	61.55	100.00
Percentage of calls each year	10.11	16.24	31.05	42.61	100.00		

Source: Compiled from KSNDMC Data base, 2017

Note: CAGR-Compound Annual Growth Rate

Table 3.2: Year-Wise Rainfall and Droughts and Number of Calls in Karnataka

Year	Drought Districts (No.)	Drought Taluks (No.)	Number of Calls (June-May)	Annual Growth Rate (%) for Number of Calls	Annual Rainfall (in mm)
2012-13	26	157	64101	-	869
2013-14	22	64	288796	350.53	1182
2014-15	9	53	343908	19.08	1168
2015-16	26	98	780221	126.87	1008
2016-17	27	160	1154986	48.03	833

Source: Department of Agriculture, 2017; Compiled from KSNDMC Data base, 2017

On examining the data furnished by KSNDMC for the study period July 2016 to June 2017, it was found that 11.17 lakh calls were recorded that availed the services of the 24/7 Varuna Mitra helpline that was started by KSNDMC in 2010. However, the data was considered dubious specifically due to the fact that during the reference period, 20 people in 8 districts made 28,455 calls (Table 3.3). In order to verify calls, those numbers were contacted, however, calls to them did not connect. Consequently, those numbers were deleted from the analysis. Following which, the total calls count was reduced to 10.88 lakh calls. In addition, 0.47 lakh calls were not considered as they were recorded but disconnected due to various reasons (Table 3.4). Ultimately, 10.41 lakh calls by 1.76 lakh beneficiaries was considered for further detailed analysis.

Table 3.3: Abnormal Calls Deleted from the Analysis (Jul 2016-Jun2017)

Phone Nos.	District	No. of Times Called
7976000000	Ballari	1481
8618000000	Bijapur	1039
8217000000	Chikkaballapura	1079
9450000000	Chikkamagaluru	1713
9482000000	Chikkamagaluru	1743
7892000000	Chitradurga	1109
7893000000	Chitradurga	1494
9449000000	Hassan	3148
9481000000	Hassan	1550
9480000000	Hassan	1281
8073000000	Kolar	1408
9483000000	Tumakuru	1327
8218000000	Tumakuru	1235
8311000000	Tumakuru	1320
8310000000	Tumakuru	1209
8619000000	Tumakuru	1293
8074000000	Tumakuru	1350
9448000000	Tumakuru	1445
7975000000	Tumakuru	1134
8660000000	Tumakuru	1097
Total		28455

Source: Compiled from KSNDMC Data base, 2017

Table 3.4: Overall Call Status of Varuna Mitra Services during Jul 2016 - Jun 2017

Sl. No.	Call Details	No. of Calls	% to the Total
1	Disconnected	46538	4.17
2	Not Considered	28455	2.55
3	Connected(Considered for Entire Analysis)	1041722	93.28
	Total	1116715	100.00

Source: Compiled from KSNDMC Data, 2017

Note: The maximum Callers and Calls made more than 365 times are over lapping

3.2. Background of Varuna Mitra Beneficiaries

3.2.1 Calls across the Districts during the Reference Year - July 2016 to June 2017

The total numbers of 1.76 lakh beneficiaries sought information from Varuna Mitra during the period; July 2016-June 2017, which accounted for 2.67 per cent of the cultivators in Karnataka as per 2011 Census. Among the districts, the highest number of calls was received from Ballari which accounted for 11.08 per cent followed by Tumakuru (8.72%), Raichur (7.24%), Chikkaballapura (7.08%) and Kalaburagi

(6.42%) (Table 3.5). The least proportion of cultivators who made calls were from Dakshina Kannada, Udupi and Uttara Kannada and largely urbanized districts.

Table 3.5: Usages of Varuna Mitra Services by Cultivators

District	Total Cultivators as per census	Total Farmer Beneficiaries of VM	Beneficiaries as Percentage to Cultivators	Other Beneficiaries	Total Calls of VM	Average No. of Calls per Beneficiary	Maximum No. of Calls made by Individual	Percentage to the Total Beneficiary	Percentage to the Total Calls
High Rainfall									
Udupi	63143	135	0.21	4	649	5	99	0.08	0.06
Dakshina Kannada	33810	100	0.30	5	606	6	71	0.06	0.06
Uttara Kannada	111581	176	0.16	5	787	4	31	0.10	0.08
Kodagu	21174	1093	5.16	3	5611	5	178	0.62	0.54
Shivamogga	204493	2444	1.20	6	11548	5	117	1.39	1.11
Total	434201	3948	0.91	23	19201	5	496	2.25	1.84
Average Calls per District	86840	790		5	3840	5	99	0.45	0.37
Moderate Rainfall									
Chikkamagaluru	155392	7817	5.03	12	43724	6	321	4.44	4.20
Bidar	141302	5581	3.95	8	31067	6	395	3.17	2.98
Kalaburagi	220198	11856	5.38	17	66847	6	180	6.74	6.42
Hassan	437034	5936	1.36	13	41744	7	567	3.38	4.01
Bengaluru Rural	127770	2149	1.68	16	17001	8	244	1.23	1.63
Bengaluru Urban	95619	414	0.43	117	2954	6	166	0.30	0.28
Belagavi	711980	9037	1.27	14	44921	5	963	5.13	4.31
Yadgir	159333	4870	3.06	8	26229	5	203	2.77	2.52
Kolar	183057	6356	3.47	8	50592	8	860	3.61	4.86
Total	2231685	54016	2.42	213	325079	6	3899	30.77	31.21
Average Calls per District	247965	6002		24	36120	6	433	3.42	3.47
Low Rainfall									
Ramanagara	208130	580	0.28	4	4126	7	166	0.33	0.40
Chikkaballapura	212226	9070	4.27	18	73756	8	384	5.16	7.08
Tumakuru	505910	14078	2.78	31	90861	6	539	8.00	8.72
Mandya	388981	2203	0.57	5	14667	7	350	1.25	1.41
Dharwad	164279	3557	2.17	13	18683	5	320	2.03	1.79
Davanagere	230846	6809	2.95	15	36976	5	444	3.87	3.55
Raichur	245299	14839	6.05	15	75413	5	809	8.43	7.24
Mysuru	349337	1918	0.55	10	11814	6	184	1.09	1.13
Vijayapura	262217	11425	4.36	8	64980	6	464	6.49	6.24
Haveri	203055	2871	1.41	5	15545	5	165	1.63	1.49
Chamarajanagar	113105	3667	3.24	5	26890	7	451	2.08	2.58
Koppal	163413	6839	4.19	9	35724	5	525	3.89	3.43
Ballari	258080	20887	8.09	31	115453	6	767	11.87	11.08
Bagalkot	196199	6213	3.17	7	33720	5	179	3.53	3.24
Gadag	127441	2862	2.25	4	15530	5	569	1.63	1.49
Chitradurga	286245	10051	3.51	17	63304	6	504	5.71	6.08
Total	3914763	117869	3.01	197	697442	6	6820	66.98	66.95
Average Calls per District	244673	7367	-	12	43590	6	426	4.19	4.18
Grand Total	6580649	175833	2.67	433	1041722	6	11215	100.00	100.00

Source: Data Compiled from KSNDMC Data base and Census, 2017

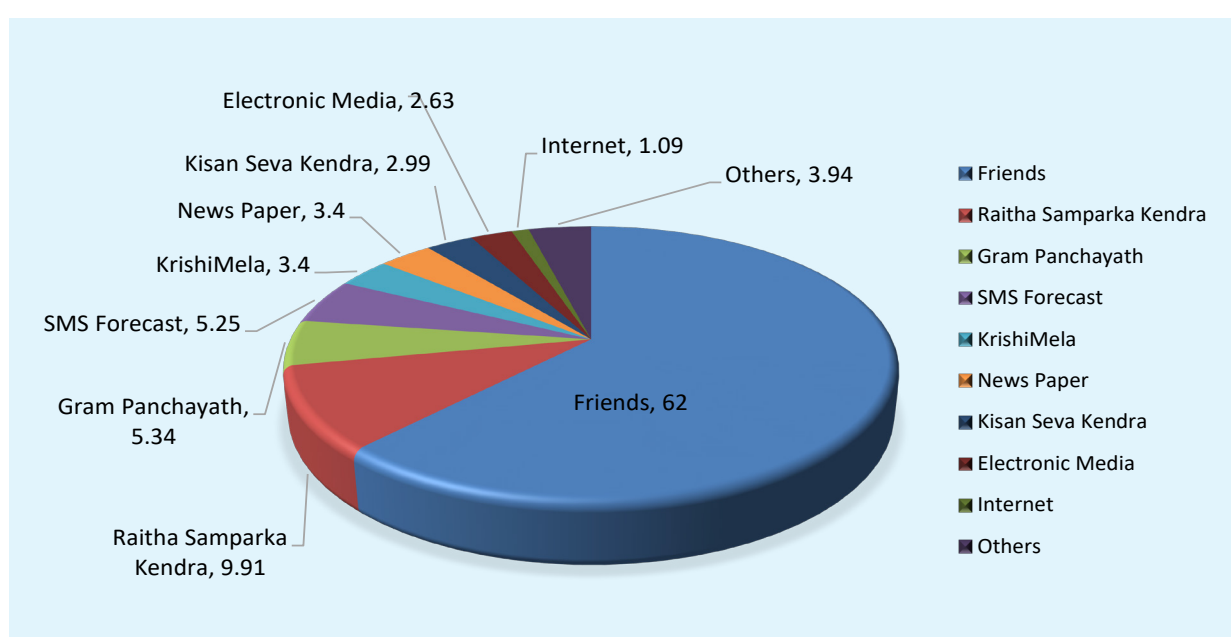
Note: 1. Only in Koppal and Chitradurga districts, two farmers each were called Varuna Mitra services 527 and 504 times, respectively. 2. Out of 32 maximum callers, two are stake holders, a Government officer in Kodagu and another one media person in Bengaluru Urban

There were total of 1.76 lakh callers who made 10.41 lakhs calls. It works out to 5,867 beneficiaries per district with an average of 34,724 calls per district and an average of 2,854 calls was made by beneficiaries per day in the State. Across the rainfall category districts, a high number of beneficiaries and calls were made from low rainfall districts as compared to moderate and high rainfall districts. The average calls made by each beneficiary was six calls at the State level and five calls per person in low rainfall and moderate rainfall districts compared to high rainfall regions. Among the districts, highest average calls per beneficiary (8 Nos) were from Kolar, Chikkaballapura and Bengaluru Rural and seven from Hassan, Ramanagara, Mandya and Chamarajanagar. The table also revealed that the maximum number of calls made by single individual in each district was exceptionally high. For instance, 32 beneficiaries made 11,215 calls and estimated at 350 calls per person. Therefore, it is uncertain, how many of those calls were genuine and used in positively altering agricultural operations. It could be speculated that many might have called out of curiosity. In reality, only a few calls out of them used for taking farming related decisions.

3.2.2. Source of Information to the Beneficiaries about Varuna Mitra Help Line Number

Nearly 1.76 lakh beneficiaries learnt about the Varuna Mitra help desk number from multiple sources. A major proportion of beneficiaries and public learnt about the service from friends (62%) followed by Raitha Samparka Kendras (9.91%), Gram Panchayat (5.34%), SMS (5.25%), Others (3.94%), Krishi Mela and newspapers (3.4% each) (Table 3.6 and Figure 3.2). Across the districts and different rainfall regions, friends have played a major role in dissemination of information about Varuna Mitra more than any other source. Only in Udupi district, several beneficiaries received information by SMS (30.94%). This may be attributed to communication by friends and KSNDMC messages to the Government officers. The Government sources - Gram Panchayat, Raitha Samparka Kendras, Krishi Melas and Kisan Seva Kendras that disseminated information accounted for 21.64 per cent followed by Media which includes electronic media, newspaper and internet (7.12%).

Figure 3.2: Sources of Awareness on Varuna Mitra



Source: KSNDMC, 2017

Table 3.6: Percentage Distribution of Beneficiaries by Source of Awareness about Varuna Mitra (Jul 2016-Jun 2017)

District	% to the total number of beneficiaries										No. of beneficiaries
	Friends	Raitha Samparka Kendra	Gram Panchayath	SMS Fore-cast	Krishi Mela	News Paper	Kisan Seva Kendra	Electronic Media	Internet	Others	
High Rainfall											
Udupi	37.41	8.63	3.60	30.94	2.16	5.04	1.44	2.88	3.60	4.32	139
Dakshina Kannada	53.33	10.48	7.62	8.57	3.81	5.71	2.86	4.76	0.95	1.90	105
Uttara Kannada	59.12	9.94	5.52	5.52	1.66	7.18	2.21	1.66	1.66	5.52	181
Kodagu	60.95	9.03	5.57	8.21	3.19	3.10	2.46	2.46	0.36	4.65	1096
Shivamogga	56.20	9.92	5.47	11.84	3.35	3.35	2.82	2.45	0.90	3.71	2450
Total	56.91	9.64	5.49	11.13	3.20	3.58	2.64	2.49	0.88	4.03	3971
Moderate Rainfall											
Chikkamagaluru	64.16	10.31	6.02	2.71	3.45	3.01	2.70	2.50	1.14	4.01	7829
Bidar	59.94	8.77	3.78	7.30	3.49	3.85	3.44	3.11	1.09	5.24	5589
Kalaburagi	62.26	9.36	4.32	4.65	3.76	3.82	3.31	2.66	0.96	4.90	11873
Hassan	62.92	10.10	6.32	3.78	3.55	3.11	2.81	2.54	0.84	4.03	5949
Bengaluru Rural	62.12	9.84	4.99	5.22	3.79	3.60	3.23	3.00	0.97	3.23	2165
Bengaluru Urban	61.39	10.55	5.08	2.45	3.58	4.52	3.01	3.20	2.82	3.39	531
Belagavi	59.31	10.88	5.94	8.36	3.24	2.98	2.86	2.12	0.95	3.35	9051
Yadgir	61.30	9.33	5.15	6.93	3.40	3.03	3.01	2.99	1.21	3.65	4878
Kolar	62.68	10.36	5.81	4.07	3.43	3.38	2.97	2.42	1.08	3.80	6364
Total	61.82	9.92	5.28	5.31	3.51	3.36	3.03	2.60	1.04	4.13	54229
Low Rainfall											
Ramanagara	60.10	8.05	6.34	9.42	2.91	3.60	2.57	3.42	0.68	2.91	584
Chikkaballapura	63.74	10.10	5.20	4.21	3.42	3.27	2.89	2.46	1.08	3.61	9088
Tumakuru	62.87	10.87	6.33	3.18	3.32	3.14	2.94	2.64	1.13	3.58	14109
Mandya	63.90	11.10	7.56	2.17	3.13	3.26	2.17	2.40	0.50	3.80	2208
Dharwad	55.41	9.55	4.06	7.70	3.59	7.87	3.67	2.86	1.46	3.84	3570
Davanagere	62.73	9.86	5.74	5.60	2.92	3.15	2.68	2.18	1.14	3.99	6824
Raichur	63.05	9.26	4.97	4.63	3.51	3.34	3.12	2.86	1.21	4.06	14854
Mysuru	62.40	12.60	7.88	1.30	2.75	2.80	2.49	2.65	1.19	3.94	1928
Vijayapura	61.03	8.83	4.98	7.10	3.31	3.58	3.13	2.90	1.01	4.12	11433
Haveri	59.14	10.61	4.76	9.77	2.92	3.23	2.89	2.09	0.87	3.72	2876
Chamarajanagar	63.83	11.06	6.32	3.59	2.97	2.81	3.00	1.85	0.98	3.59	3672
Koppal	62.05	9.97	4.89	5.55	3.62	3.29	2.75	2.80	1.05	4.03	6848
Ballari	63.98	9.36	4.82	4.44	3.38	3.21	2.89	2.80	1.25	3.87	20918
Bagalkot	59.71	10.72	5.13	6.77	3.57	3.26	3.33	2.51	0.93	4.07	6220
Gadag	61.58	8.93	4.92	4.57	4.33	4.33	3.14	3.04	1.01	4.15	2866
Chitradurga	61.44	10.50	5.94	5.35	3.26	3.19	3.13	2.44	1.23	3.52	10068
Total	62.32	9.92	5.37	5.02	3.36	3.41	2.98	2.65	1.12	3.85	118066
Grand Total Percentage	62.0	9.91	5.34	5.25	3.40	3.40	2.99	2.63	1.09	3.94	176266

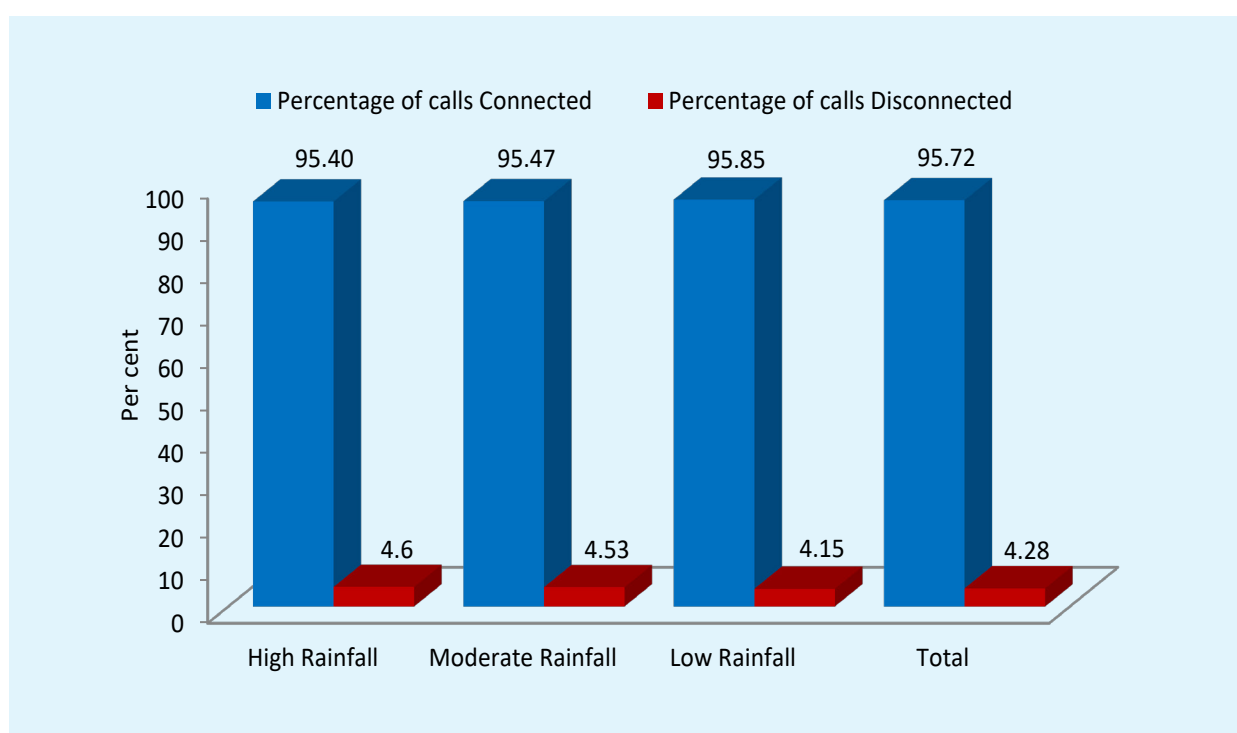
Source: Data Compiled from KSNDMC Database, 2017

Note: 1. Only in Koppal and Chitradurga districts, two farmers each were called Varuna Mitra services 527 and 504 times, respectively. 2. Out of 32 maximum callers, two are stake holders, a Government officer in Kodagu and another one media person in Bengaluru Urban

3.2.3. Call Status of Varuna Mitra Beneficiaries

The statistics on the number of calls by beneficiaries that were connected and disconnected have been presented in **Table 3.7** and **Figure 3.3**. During 2016-17, 1.76 lakh beneficiaries in the State called 10.42 lakh times seeking information on various weather parameters. Out of the total calls, those that connected accounted for 95.72 per cent and the remaining 4.28 per cent were disconnected due to various reasons such as lack of clarity, lines busy, network problems and unanswered calls by tele advisors. The proportion of connected calls was the highest in the low rainfall regions which stood at 95.85 per cent above the State average. The lowest connected calls were in high rainfall regions compared to the moderate rainfall region. While, the disconnected calls were higher (4.60%) in high rainfall regions compared to the remaining regions. Particularly, the proportion of disconnected calls was considerably higher in Dakshina Kannada (6.48%), Udupi (6.21%) and Uttara Kannada (5.41%). The high proportion of disconnected calls in high rainfall regions maybe due to network problems. In moderate rainfall regions, calls from Bengaluru Urban and Rural districts experienced more disconnections. Again, disconnected calls in these districts maybe due to network Problems. The State average number of calls disconnected was 1,551. As expected the average disconnected calls were relatively lower in high rain fall district than other regions. However, the proportion of disconnected calls to total calls of those districts was more. The reasons for such a high proportion of disconnected calls need to be identified to reduce its frequency.

Figure 3.3: Percentage of Calls Connected and Disconnected during Jul 2016- Jun 2017



Source: KSNDMC, 2017

Table 3.7: Beneficiaries Calls Connected and Disconnected during 2016-17

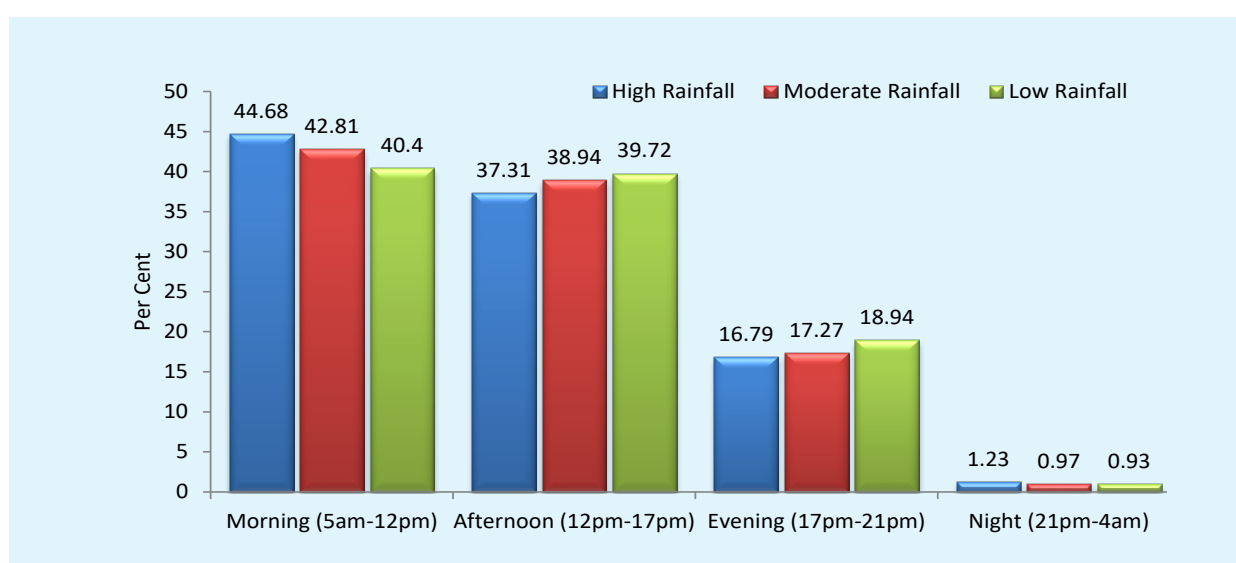
District	No. of calls Connected	No. of calls Disconnected	Total calls made	Percentage of calls Connected	Percentage of calls Disconnected	Percentage to the Total
High Rainfall						
Udupi	649	43	692	93.79	6.21	100
Dakshina Kannada	606	42	648	93.52	6.48	100
Uttara Kannada	787	45	832	94.59	5.41	100
Kodagu	5611	304	5915	94.86	5.14	100
Shivamogga	11548	492	12040	95.91	4.09	100
Total	19201	926	20127	95.40	4.60	100
Average calls per District	3840	185	4025	95.40	4.60	100
Moderate Rainfall						
Chikkamagaluru	43724	2069	45793	95.48	4.52	100
Bidar	31067	1774	32841	94.60	5.40	100
Kalaburagi	66847	2951	69798	95.77	4.23	100
Hassan	41744	1900	43644	95.65	4.35	100
Bengaluru Rural	17001	1027	18028	94.30	5.70	100
Bengaluru Urban	2954	251	3205	92.17	7.83	100
Belagavi	44921	1899	46820	95.94	4.06	100
Yadgir	26229	1429	27658	94.83	5.17	100
Kolar	50592	2142	52734	95.94	4.06	100
Total	325079	15442	340521	95.47	4.53	100
Average calls per District	36120	1716	37836	95.47	4.53	100
Low Rainfall						
Ramanagara	4126	178	4304	95.86	4.14	100
Chikkaballapura	73756	2966	76722	96.13	3.87	100
Tumakuru	90861	3375	94236	96.42	3.58	100
Mandya	14667	893	15560	94.26	5.74	100
Dharwad	18683	1024	19707	94.80	5.20	100
Davanagere	36976	1527	38503	96.03	3.97	100
Raichur	75413	3270	78683	95.84	4.16	100
Mysuru	11814	697	12511	94.43	5.57	100
Vijayapura	64980	2755	67735	95.93	4.07	100
Haveri	15545	870	16415	94.70	5.30	100
Chamarajanagar	26890	1299	28189	95.39	4.61	100
Koppal	35724	1623	37347	95.65	4.35	100
Ballari	115453	4694	120147	96.09	3.91	100
Bagalkot	33720	1523	35243	95.68	4.32	100
Gadag	15530	992	16522	94.00	6.00	100
Chitradurga	63304	2484	65788	96.22	3.78	100
Total	697442	30170	727612	95.85	4.15	100
Average calls per District	43590	1886	45476	95.85	4.15	100
Grand Total	1041722	46538	1088260	95.72	4.28	100

Source: Data Compiled from KSNDMC Database, 2017

3.2.4. Calls made at Different Timings of the Day

The distribution of 10.41 lakh calls at different timings of the day has been presented in **Table 3.8** and **Figure 3.4**. It was found that 41.23 per cent of the calls were made in the morning followed by 39.43 per cent calls in the afternoon and thereafter the frequency of calls gradually reduced. Farmers are likely to enquire about the weather to proceed with their respective agriculture activities during the rest of the day. Therefore, it is obvious that the occurrence of calls were highest in the morning. Among the different regions based on rainfall categories, the proportion of calls were 44.68 per cent in the morning in the high rainfall districts compared to moderate rainfall (42.81%) and Low rainfall districts (40.40%). On the contrary, in the high rainfall areas, the proportion of calls made in the afternoon was less (37.31%) as compared to moderate (38.94%) and low rainfall areas (39.72%). Across the districts, more or less a similar pattern is evident.

Figure 3.4: Percentage of Calls at Different Timings of the Day during 2016-17



Source: KSNDMC, 2017

Table 3.8: Percentage Distribution of Total Calls by Different Timing of the Day (Per Cent)

District	Morning (5am-12pm)	Afternoon (12pm-5pm)	Evening (5pm-9pm)	Night (9pm-4am)	Total	Absolute Numbers
High Rainfall						
Udupi	37.90	38.67	22.50	0.92	100	649
Dakshina Kannada	32.51	42.24	23.10	2.15	100	606
Uttara Kannada	44.73	35.20	19.31	0.76	100	787
Kodagu	50.44	37.43	11.67	0.46	100	5611
Shivamogga	42.90	37.05	18.44	1.60	100	11548
Total	44.68	37.31	16.79	1.23	100	19201
Average calls per District	1433	645	1716	47	-	3840
Moderate Rainfall						
Chikkamagaluru	44.99	38.08	15.76	1.17	100	43724
Bidar	43.35	38.90	16.76	0.98	100	31067
Kalaburagi	41.39	37.63	20.11	0.86	100	66847
Hassan	46.21	39.58	13.29	0.93	100	41744
Bengaluru Rural	42.17	41.56	15.65	0.62	100	17001

Table Contd...

District	Morning (5am-12pm)	Afternoon (12pm-5pm)	Evening (5pm-9pm)	Night (9pm-4am)	Total	Absolute Numbers
Bengaluru Urban	37.98	35.71	24.07	2.23	100	2954
Belagavi	44.72	36.79	17.20	1.29	100	44921
Yadgir	38.55	38.38	22.31	0.77	100	26229
Kolar	40.70	42.44	16.02	0.84	100	50592
Total	42.81	38.94	17.27	0.97	100	325079
Average calls per District	14067	6238	15464	351	-	36120
Low Rainfall						
Ramanagara	36.38	47.60	15.51	0.51	100	4126
Chikkaballapura	40.83	41.23	17.36	0.58	100	73756
Tumakuru	38.26	44.31	16.61	0.81	100	90861
Mandya	39.39	43.96	15.90	0.75	100	14667
Dharwad	40.02	40.28	18.33	1.36	100	36976
Davanagere	42.95	33.43	21.33	2.30	100	18683
Raichur	37.92	37.83	23.52	0.73	100	75413
Mysuru	42.08	40.88	16.59	0.45	100	11814
Vijayapura	42.95	38.41	17.78	0.86	100	64980
Haveri	44.40	35.34	17.89	2.37	100	15545
Chamarajanagar	43.24	42.08	13.98	0.71	100	26890
Koppal	39.12	39.95	20.03	0.90	100	35724
Ballari	40.04	37.00	22.07	0.89	100	115453
Bagalkot	42.65	39.01	17.32	1.03	100	33720
Gadag	42.55	35.76	20.10	1.58	100	15530
Chitradurga	40.47	41.04	17.51	0.98	100	63304
Total	40.40	39.72	18.94	0.93	100	697442
Average calls per District	17315	8257	17612	407	-	43590
Grand Total	410796	191478	429544	9904	-	1041722
Percentage to the Grand Total	41.23	39.43	18.38	0.95	-	100.00

Source: Data Compiled from KSNDMC Database, 2017

3.2.5. Classification of Beneficiaries by Number of Calls made by them

Among the 1.76 lakh callers during the year 2016-17, the maximum number of beneficiaries made 1-20 calls that accounted for 93.96 per cent followed by 4.22 per cent of callers who made between 21-40 calls (Table 3.9a). Across the different category of rainfall districts, a relatively higher number of beneficiaries (95.24%) made between 1-20 calls in the high rainfall category. While, 21-40 calls were made by 4.31 per cent beneficiaries in the moderate rainfall region and 4.21 per cent in the low rainfall category districts, respectively. Whereas, the proportion of beneficiaries from high rainfall areas who made calls that ranged between 21-40 calls was lower and stood at 3.58 per cent. The beneficiaries, who made calls between 41-60 times and above were very low across districts and regions categorized by rainfall (Table 3.9a). The proportion of beneficiaries who called 1-5 times in a year (average calls 6) were 79.08 per cent of the total beneficiaries during the reference year (Table 3.9b). Among the districts and category of districts, the number of beneficiaries from high rainfall districts who called 1-5 times in a year accounted for 84.14 per cent of the total beneficiaries.

Out of 1.76 lakh calls, 42.05 per cent of the beneficiaries called once and 14.17 per cent called twice (Annexure 3.1). Together, they accounted for 56.22 per cent of the total beneficiaries as against the State average of 6 calls per beneficiary. If we consider single callers as fresher of Varuna Mitra services, on an average 0.74 lakh new callers availed the services of Varuna Mitra during the reference year.

There are 30 beneficiaries who have made more than 365 calls, which work out to one call every day. In Tumakuru and Ballari districts, five farmers individually made more than 365 calls in a year. These statistics are unreliable given the recorded abnormal frequency of calls by individual farmers. Generally, no farmer will call at such a frequency to take farming related decisions.

Table 3.9a: Distribution of Beneficiaries by Number of Calls made during 2016-17

District	1-20 Calls	21-40 Calls	41-60 Calls	61-80 Calls	>81 Calls	Percentage to the Total	Absolute Numbers
High Rainfall							
Udupi	94.24	3.60	1.44	0.00	0.72	100.00	139
Dakshina Kannada	93.33	4.76	0.00	1.90	0.00	100.00	105
Uttara Kannada	93.92	6.08	0.00	0.00	0.00	100.00	181
Kodagu	95.26	3.74	0.64	0.18	0.18	100.00	1096
Shivamogga	95.47	3.27	0.90	0.12	0.24	100.00	2450
Total	95.24	3.58	0.78	0.18	0.23	100.00	3971
Average calls per District	756	28	6	1	2	-	794
Moderate Rainfall							
Chikkamagaluru	94.51	4.09	0.80	0.31	0.29	100.00	7829
Bidar	94.52	3.86	0.88	0.34	0.39	100.00	5589
Kalaburagi	94.33	4.20	0.94	0.26	0.26	100.00	11873
Hassan	92.22	4.87	1.61	0.61	0.69	100.00	5949
Bengaluru Rural	90.25	6.19	1.62	1.06	0.88	100.00	2165
Bengaluru Urban	94.54	3.77	0.75	0.56	0.38	100.00	531
Belagavi	95.68	3.13	0.76	0.22	0.21	100.00	9051
Yadgir	94.87	3.85	0.84	0.23	0.21	100.00	4878
Kolar	90.46	6.05	1.82	1.01	0.66	100.00	6364
Total	93.80	4.31	1.08	0.43	0.39	100.00	54229
Average calls per District	5652	259	65	26	23	-	6025
Low Rainfall							
Ramanagara	90.92	5.48	2.40	0.68	0.51	100.00	584
Chikkaballapura	90.22	6.15	1.93	0.72	0.99	100.00	9088
Tumakuru	93.02	4.92	1.14	0.47	0.45	100.00	14109
Mandya	92.53	4.57	1.72	0.54	0.63	100.00	2208
Dharwad	95.32	3.22	0.87	0.31	0.28	100.00	3570
Davanagere	95.21	3.27	0.89	0.37	0.26	100.00	6824
Raichur	95.54	3.33	0.77	0.18	0.18	100.00	14854
Mysuru	93.62	4.82	0.73	0.36	0.47	100.00	1928
Vijayapura	94.28	4.15	1.00	0.31	0.26	100.00	11433
Haveri	94.75	3.79	0.87	0.24	0.35	100.00	2876
Chamarajanagar	91.48	5.42	1.72	0.65	0.74	100.00	3672
Koppal	95.01	3.97	0.61	0.20	0.20	100.00	6848
Ballari	94.67	3.90	0.86	0.33	0.25	100.00	20918
Bagalkot	95.10	3.54	0.84	0.24	0.29	100.00	6220
Gadag	95.15	2.97	1.15	0.35	0.38	100.00	2866
Chitradurga	92.98	4.80	1.30	0.50	0.43	100.00	10068
Total	93.99	4.21	1.06	0.37	0.37	100.00	118066
Average calls per District	6936	311	78	28	27	-	7379
Grand Total	165619	7446	1865	679	657	-	176266
Percentage to Grand Total	93.96	4.22	1.06	0.39	0.37	-	100.00

Source: Data Compiled from KSNDMC Database, 2017

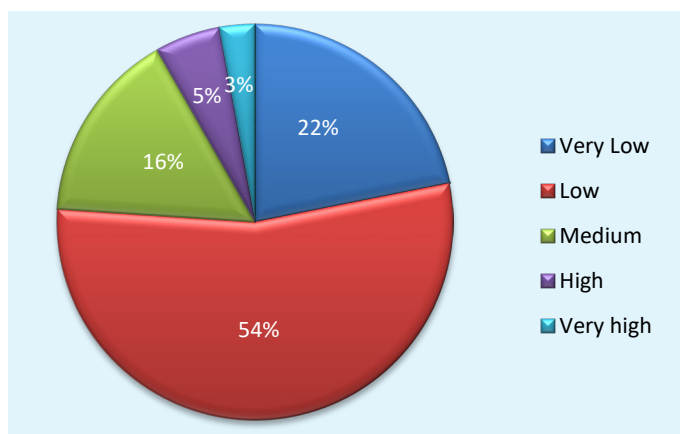
Table 3.9b: Distribution of Beneficiaries by Number of Calls made during 2016-17

District	1-5 Calls	6-10 Calls	11-15 Calls	16-20 Calls	Percentage to the Total	Absolute Numbers
High Rainfall						
Udupi	90.08	6.87	3.05	0.00	100.00	131
Dakshina Kannada	82.65	11.22	3.06	3.06	100.00	98
Uttara Kannada	87.06	6.47	2.94	3.53	100.00	170
Kodagu	81.13	11.97	4.41	2.49	100.00	1044
Shivamogga	84.99	9.75	4.02	1.24	100.00	2339
Total	84.14	10.15	4.02	1.69	100.00	3782
Average calls per District	636	77	30	13	-	756
Moderate Rainfall						
Chikkamagaluru	78.93	13.04	5.37	2.66	100.00	7399
Bidar	80.30	11.49	5.51	2.71	100.00	5283
Kalaburagi	79.23	11.85	5.50	3.42	100.00	11200
Hassan	78.14	12.52	5.83	3.50	100.00	5486
Bengaluru Rural	76.97	13.00	6.65	3.38	100.00	1954
Bengaluru Urban	86.85	6.18	4.38	2.59	100.00	502
Belagavi	81.62	11.02	4.85	2.52	100.00	8660
Yadgir	80.40	11.37	4.99	3.24	100.00	4628
Kolar	75.28	13.79	6.65	4.27	100.00	5757
Total	79.23	12.08	5.52	3.16	100.00	50869
Average calls per District	4478	683	312	179	-	5652
Low Rainfall						
Ramanagara	79.66	13.56	4.33	2.45	100.00	531
Chikkaballapura	75.13	13.90	6.88	4.09	100.00	8199
Tumakuru	76.86	13.48	6.23	3.43	100.00	13124
Mandya	79.15	12.53	5.43	2.89	100.00	2043
Dharwad	82.07	11.28	4.08	2.56	100.00	3403
Davanagere	79.91	11.71	5.59	2.79	100.00	6497
Raichur	80.08	12.28	4.97	2.66	100.00	14191
Mysuru	78.34	11.97	6.43	3.27	100.00	1805
Vijayapura	78.94	12.58	5.36	3.12	100.00	10779
Haveri	82.20	11.12	3.89	2.79	100.00	2725
Chamarajanagar	75.44	14.29	6.19	4.08	100.00	3359
Koppal	80.66	11.85	4.86	2.63	100.00	6506
Ballari	79.09	12.31	5.64	2.96	100.00	19803
Bagalkot	79.88	12.10	4.99	3.03	100.00	5915
Gadag	79.76	12.43	5.13	2.68	100.00	2727
Chitradurga	78.41	13.20	5.41	2.98	100.00	9361
Total	78.84	12.60	5.50	3.06	100.00	110968
Average calls per District	5468	874	382	213	-	6936
Grand Total	130972	20508	9067	5072	-	165619
Percentage to Grand Total	79.08	12.38	5.47	3.06	-	100.00

Source: Data Compiled from KSNDMC Database, 2017

3.2.6. Duration of Calls

The beneficiaries have interacted with Varuna Mitra directly and sought information on the various weather parameters. The interaction time between them has varied depending on the nature of the query. The data showed that 54.19 per cent of the beneficiaries have taken 31-60 seconds (Table 3.10 and Figure 3.5), 76.05 per cent interacted for less than 60 seconds and 91.77 per cent interacted with Varuna Mitra tele advisors for less than 90 seconds. In the high rainfall districts, 51.76% of the beneficiaries spoke for 31-60 seconds, which is lower than the State average and other regions. Across districts, the duration of a majority of the farmers who interacted with Varuna Mitra was around the State average with some minor variations. The call duration that lasted more than 91 seconds were very few. This shows that the interaction between the farmers and Varuna Mitra staff generally lasted for a short duration as the staff attend to approximately 2,854 calls per day on an average.



Source: KSNDMC, 2017

Figure 3.5: Percentage Distribution of Beneficiary Calls by Duration

Table 3.10: Percentage Distribution of Beneficiary Calls by Duration during 2016-17

District	Very Low (1-30 Sec)	Low (31-60 Sec)	Medium (61-90 Sec)	High (91-120 Sec)	Very High (>121 Sec)	Total Percentage	Absolute Numbers
High Rainfall							
Udupi	21.26	47.77	14.18	7.86	8.94	100.00	649
Dakshina Kannada	21.62	46.20	11.55	6.11	14.52	100.00	606
Uttara Kannada	12.71	47.01	19.06	10.80	10.42	100.00	787
Kodagu	17.22	56.82	15.67	6.61	3.69	100.00	5611
Shivamogga	19.82	50.14	17.07	7.10	5.87	100.00	11548
Total	18.87	51.76	16.47	7.10	5.80	100.00	19201
Average calls per District	725	1988	632	273	223	-	3840
Moderate Rainfall							
Chikkamagaluru	20.41	55.08	16.27	5.36	2.88	100.00	43724
Bidar	16.82	55.77	17.61	6.25	3.55	100.00	31067
Kalaburagi	19.99	54.30	16.78	5.95	2.97	100.00	66847
Hassan	24.78	55.71	13.32	4.12	2.07	100.00	41744
Bengaluru Rural	25.65	56.00	12.21	3.99	2.15	100.00	17001
Bengaluru Urban	16.76	45.70	14.93	7.21	15.40	100.00	2954
Belagavi	18.81	53.69	16.94	6.58	3.97	100.00	44921
Yadgir	20.22	54.09	16.32	6.03	3.35	100.00	26229
Kolar	27.76	53.75	12.34	3.98	2.17	100.00	50592
Total	21.69	54.55	15.38	5.36	3.01	100.00	325079
Average calls per District	7835	19704	5556	1937	1088	-	36120

Table Contd...

District	Very Low (1-30 Sec)	Low (31-60 Sec)	Medium (61-90 Sec)	High (91-120 Sec)	Very High (>121 Sec)	Total Percentage	Absolute Numbers
Low Rainfall							
Ramanagara	28.28	52.98	11.27	4.65	2.81	100.00	4126
Chikkaballapura	27.96	54.95	11.87	3.55	1.67	100.00	73756
Tumakuru	26.92	53.61	13.65	4.01	1.80	100.00	90861
Mandya	22.59	53.47	15.33	5.43	3.17	100.00	14667
Dharwad	16.16	54.12	18.80	7.08	3.83	100.00	18683
Davanagere	18.08	53.66	18.04	6.63	3.59	100.00	36976
Raichur	20.65	53.39	17.22	5.86	2.88	100.00	75413
Mysuru	26.65	52.61	14.18	4.27	2.29	100.00	11814
Vijayapura	19.81	54.98	16.47	5.84	2.90	100.00	64980
Haveri	17.57	54.05	17.09	7.07	4.21	100.00	15545
Chamarajanagar	29.67	53.90	11.27	3.63	1.53	100.00	26890
Koppal	19.83	53.22	17.30	6.29	3.36	100.00	35724
Ballari	19.05	54.27	17.91	5.92	2.85	100.00	115453
Bagalkot	18.69	54.23	17.27	6.17	3.63	100.00	33720
Gadag	17.11	54.09	18.33	6.85	3.63	100.00	15530
Chitradurga	22.09	54.57	15.70	5.00	2.65	100.00	63304
Total	22.02	54.09	15.86	5.33	2.70	100.00	697442
Average calls per District	9600	23576	6911	2325	1177	-	43590
Grand Total	227733	564493	163750	55999	29747	-	1041722
Percentage to Grand Total	21.86	54.19	15.72	5.38	2.86	100.00	100

Source: Data Compiled from KSNDMC Database, 2017

3.2.7. Purpose of Enquiry

During 2016-17, 1.76 lakh beneficiaries in the State sought information from Varuna Mitra on various weather based and hydrological information. **Table 3.11** showed the percentage distribution of the beneficiaries by purpose of enquiry. Among the beneficiaries, almost all the queries were with regard to rainfall which is very crucial input for agricultural operations and crop survival followed by only a negligible proportion (0.47%) of beneficiaries that enquired about temperature, wind direction, crop details, cyclones and others. Across districts and regions categorized by rainfall, the same pattern of enquiry prevailed.

3.2.8. Duration of Forecast Sought by Beneficiaries

Table 3.12 indicated the percentage distribution of beneficiaries by duration of forecast. Out of 1.76 lakh beneficiaries, 63.02 per cent of them sought information for current day forecast. While, 34.35 per cent of beneficiaries sought information for 2-3 days forecast. Less than one per cent of the beneficiaries sought information for the next few hours and some enquired about forecasts for more than a week. Among the different category of rainfall districts, there was no significant difference in proportions except in the case of two coastal districts namely, Dakshina Kannada and Udupi, where the proportion of beneficiaries who sought information for current day was slightly higher than the State average and more than many of the other districts. Most of them might have sought rainfall forecast for the current day and 2 to 3 days, evident from the larger proportion of beneficiaries (99.71%) who sought information on rainfall.

Table 3.11: Percentage Distribution of Beneficiaries by Purpose of Enquiry during 2016-17

District	Rain-fall	Cloudi-ness	Tempe-rature	Tsunami	Wind Speed Direction	DAM	Earth-quake	Cyclone	Crop details	Drought	Humidity	Data SMS	Land-slides	Other	Grand Total
High Rainfall															
Udupi	99.28	0.72	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	139
Dakshina Kannada	99.05	0.00	0.00	0.00	0.00	0.00	0.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00	105
Uttara Kannada	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	181
Kodagu	99.54	0.27	0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1096
Shivamogga	99.59	0.29	0.04	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2450
Total	99.57	0.28	0.08	0.03	0.03	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3971
Average calls per District	791	2	1	0	0	0	0	0	0	0	0	0	0	0	794
Moderate Rainfall															
Chikkamagaluru	99.51	0.33	0.01	0.06	0.04	0.00	0.00	0.01	0.01	0.00	0.01	0.00	0.00	0.00	7829
Bidar	99.43	0.39	0.07	0.04	0.05	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	5589
Kalaburagi	99.52	0.29	0.05	0.07	0.02	0.00	0.01	0.00	0.03	0.02	0.00	0.00	0.00	0.00	11873
Hassan	99.63	0.24	0.00	0.08	0.03	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5949
Bengaluru Rural	99.45	0.37	0.05	0.05	0.05	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2165
Bengaluru Urban	98.68	0.56	0.19	0.00	0.19	0.00	0.00	0.00	0.00	0.00	0.19	0.00	0.00	0.19	531
Belagavi	99.61	0.28	0.02	0.02	0.00	0.02	0.01	0.01	0.00	0.01	0.00	0.01	0.00	0.00	9051
Yadgir	99.47	0.41	0.04	0.04	0.04	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	4878
Kolar	99.59	0.24	0.09	0.02	0.03	0.00	0.02	0.02	0.00	0.00	0.00	0.00	0.00	0.00	6364
Total	99.53	0.31	0.04	0.05	0.03	0.00	0.01	0.01	0.01	0.01	0.00	0.00	0.00	0.00	54229
Average calls per District	5997	19	3	3	2	0	1	0	1	0	0	0	0	0	6025
Low Rainfall															
Ramanagara	99.83	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	584
Chikkaballapura	99.64	0.28	0.03	0.03	0.00	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.00	9088
Tumakuru	99.53	0.30	0.09	0.04	0.01	0.00	0.01	0.00	0.00	0.01	0.01	0.00	0.01	0.01	14109
Mandya	99.18	0.54	0.09	0.00	0.05	0.05	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.05	2208
Dharwad	99.55	0.34	0.06	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00	3570
Davanagere	99.38	0.40	0.04	0.07	0.06	0.00	0.00	0.03	0.01	0.00	0.00	0.00	0.00	0.00	6824
Raichur	99.50	0.32	0.03	0.07	0.02	0.03	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.01	14854
Mysuru	99.27	0.57	0.05	0.05	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1928
Vijayapura	99.51	0.43	0.00	0.02	0.03	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	11433
Haveri	99.48	0.49	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2876
Chamarajanagar	99.48	0.35	0.05	0.03	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.03	3672
Koppal	99.61	0.26	0.06	0.03	0.01	0.00	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	6848
Ballari	99.53	0.32	0.06	0.05	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20918
Bagalkot	99.71	0.19	0.03	0.02	0.02	0.02	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	6220
Gadag	99.55	0.31	0.10	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2866
Chitradurga	99.51	0.29	0.07	0.09	0.01	0.01	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10068
Total	99.52	0.33	0.05	0.05	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	118066
Average calls per District	7344	24	4	3	1	1	1	0	0	0	0	0	0	0	7379
Grand Total	175432	567	84	81	37	16	15	9	8	4	4	3	1	5	176266
Percentage to Grand Total	99.53	0.32	0.05	0.05	0.02	0.01	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	100.00

Source: Data Compiled from KSNDMC Database, 2017

Table 3.12: Percentage Distribution of Beneficiaries of Varuna Mitra by Duration of Forecast Information during 2016-17

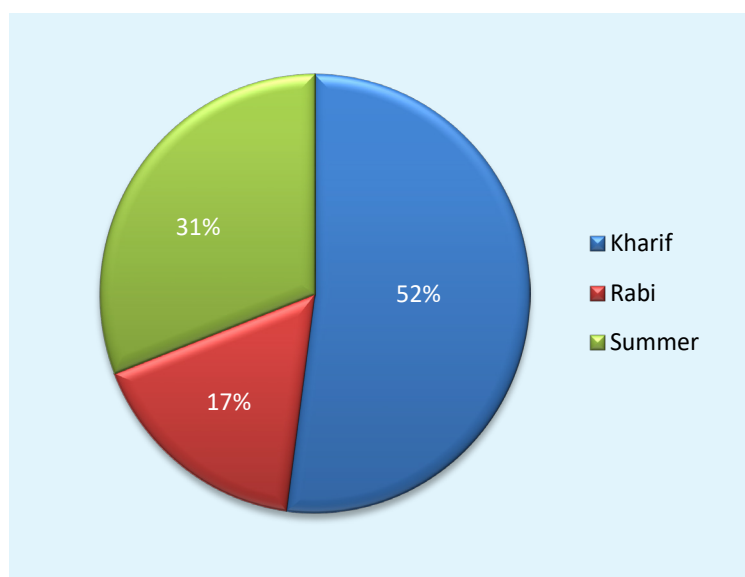
District	% to the total no. of beneficiaries										No. of beneficiaries
	Current Day	For next 2-3 days	Month	Next 12 hours	Next 6 hours	1 week	Previous rainfall info	Annual	2 weeks	Season	
High Rainfall											
Udupi	69.06	28.06	0.00	1.44	0.72	0.00	0.72	0.00	0.00	0.00	139
Dakshina Kannada	70.48	27.62	0.00	0.00	0.95	0.95	0.00	0.00	0.00	0.00	105
Uttara Kannada	62.98	32.60	0.55	1.66	1.10	1.10	0.00	0.00	0.00	0.00	181
Kodagu	60.04	38.05	0.00	1.00	0.82	0.00	0.09	0.00	0.00	0.00	1096
Shivamogga	64.49	32.41	0.00	1.39	1.22	0.29	0.12	0.04	0.04	0.00	2450
Total	63.51	33.69	0.03	1.26	1.08	0.25	0.13	0.03	0.03	0.00	3971
Average calls per District	504	268	0	10	9	2	1	0	0	0	794
Moderate Rainfall											
Chikkamagaluru	63.20	34.36	0.00	1.46	0.65	0.22	0.06	0.01	0.04	0.00	7829
Bidar	61.59	35.96	0.00	1.38	0.75	0.27	0.04	0.00	0.00	0.02	5589
Kalaburagi	62.48	35.03	0.02	1.52	0.71	0.18	0.04	0.01	0.00	0.02	11873
Hassan	61.46	35.84	0.02	1.61	0.67	0.29	0.07	0.02	0.03	0.00	5949
Bengaluru Rural	61.39	35.70	0.00	1.89	0.69	0.23	0.05	0.05	0.00	0.00	2165
Bengaluru Urban	66.29	30.51	0.00	1.51	0.75	0.19	0.75	0.00	0.00	0.00	531
Belagavi	62.08	35.13	0.00	1.52	1.02	0.17	0.04	0.01	0.00	0.02	9051
Yadgir	63.65	33.39	0.00	1.50	1.07	0.25	0.06	0.04	0.02	0.02	4878
Kolar	61.25	36.31	0.00	1.73	0.57	0.05	0.08	0.02	0.00	0.00	6364
Total	62.27	35.12	0.01	1.55	0.77	0.20	0.06	0.01	0.01	0.01	54229
Average calls per District	3752	2116	0	93	46	12	4	1	1	1	6025
Low Rainfall											
Ramanagara	64.38	33.56	0.00	0.86	0.68	0.34	0.00	0.17	0.00	0.00	584
Chikkaballapura	61.92	35.51	0.00	1.85	0.54	0.09	0.06	0.04	0.00	0.00	9088
Tumakuru	63.23	34.25	0.01	1.47	0.70	0.24	0.04	0.04	0.01	0.01	14109
Mandya	63.32	33.74	0.00	1.90	0.72	0.27	0.05	0.00	0.00	0.00	2208
Dharwad	60.17	37.62	0.00	1.43	0.56	0.22	0.00	0.00	0.00	0.00	3570
Davanagere	64.43	32.49	0.01	1.91	0.97	0.15	0.03	0.01	0.00	0.00	6824
Raichur	64.71	32.85	0.01	1.51	0.64	0.17	0.10	0.00	0.01	0.01	14854
Mysuru	62.45	34.18	0.00	2.23	0.73	0.31	0.05	0.05	0.00	0.00	1928
Vijayapura	62.46	34.90	0.00	1.57	0.91	0.11	0.03	0.00	0.00	0.01	11433
Haveri	64.43	32.61	0.03	1.50	1.08	0.28	0.07	0.00	0.00	0.00	2876
Chamarajanagar	60.62	36.96	0.00	1.23	0.93	0.19	0.05	0.00	0.03	0.00	3672
Koppal	64.98	32.32	0.01	1.65	0.74	0.25	0.01	0.00	0.01	0.01	6848
Ballari	63.95	33.49	0.00	1.73	0.60	0.18	0.04	0.00	0.00	0.00	20918
Bagalkot	60.98	36.06	0.02	1.53	1.09	0.21	0.10	0.00	0.02	0.00	6220
Gadag	62.88	34.09	0.00	1.85	0.84	0.24	0.03	0.03	0.03	0.00	2866
Chitradurga	64.25	33.10	0.00	1.62	0.67	0.22	0.08	0.02	0.04	0.00	10068
Total	63.35	34.01	0.01	1.63	0.74	0.19	0.05	0.01	0.01	0.00	118066
Average calls per District	4675	2510	0	120	54	14	4	1	1	0	7379
Grand Total	111083	60540	11	2811	1327	340	100	25	18	11	176266
Percentage to Grand Total	63.02	34.35	0.01	1.59	0.75	0.19	0.06	0.01	0.01	0.01	100.00

Source: Data Compiled from KSNDMC Database, 2017

3.2.9. Distribution of Beneficiaries based on Season

The number of calls made by beneficiaries under the Varuna Mitra services during different seasons of July 2016 - June 2017 has been presented in **Table 3.13**. Out of 10.41 lakh calls received by different beneficiaries, 52.11 per cent pertained to calls made during Kharif season (July to October) followed by summer season (March to June) 30.89 per cent and Rabi season (November to February) 17 per cent. Across different rainfall category and districts, a similar pattern prevailed. This showed that Varuna Mitra services were extensively used by beneficiaries during kharif season rather than the other two seasons across the State (**Figure 3.6**). This may be attributed to the fact that most areas of the State are dry lands that are cultivated during the rainy season. In each season, it was noticed that the initial month (sowing, germination, vegetative growth) and the last month of the season (harvesting and post-harvest operations) reported the maximum number of calls across the districts. These patterns of seasonal frequency of calls are associated with the farmers' field operations as most of the decisions were taken during these months. Farmers are heavily dependent on rainfall for survival of crops and required information on rainfall forecast to prevent post-harvest losses. One more interesting fact is that, there has been an unprecedented increase in calls during certain months mainly to take preventive measures to save harvested crops and in urban areas, for the public residing in low lying areas to take precautionary steps anticipating inundation from poor drainage systems. For instance, the average calls per month were 86,810 as against this; in June 2017 the helpline received 1.51 lakh calls, the highest in a single month since its inception.

Across districts, Ballari, Tumakuru, Raichur, Chikkaballapura, Kalaburagi and Vijayapura accounted for the maximum number of calls and the least number of calls were from Dakshina Kannada and Udupi (**Table 3.13**).



Source: KSNDMC, 2017

Figure 3.6: Number of Calls during Different Seasons

3.2.10. Calls during Different Rainy Seasons

Of the 10.41 lakh calls received by Varuna Mitra, approximately 5.26 lakh calls (50.52%) were received during the south-west monsoon period followed by 25.89 per cent during post-monsoon and 19.77 per cent in the pre-monsoon period. While, calls during the winter season did not figure much. These results showed that during the kharif season which coincides with the south-west monsoon farmers queries were on rainfall forecast to make agricultural decisions. This fact is further validated by the reported number of calls made during the kharif season (52.11%) (**Annexure 3.2**).

Table 3.13: Number of Calls made by Farmers of Varuna Mitra during Different Seasons during 2016-17

District	Kharif					Rabi					Summer					Grand Total
	Jul	Aug	Sep	Oct	Total No. of Calls	Jan	Feb	Nov	Dec	Total No. of Calls	Mar	Apr	May	Jun	Total No. of Calls	
High Rainfall																
Udupi	54.59	16.16	11.79	17.47	229	17.52	13.14	37.96	31.39	137	19.79	26.50	42.05	11.66	283	649
Dakshina Kannada	48.78	17.07	8.54	25.61	82	42.47	20.97	13.44	23.12	186	41.12	37.57	12.72	8.58	338	606
Uttara Kannada	32.35	20.22	17.25	30.19	371	5.08	3.39	55.37	36.16	177	7.11	14.64	36.40	41.84	239	787
Kodagu	31.91	15.55	20.27	32.27	1100	44.58	19.38	11.16	24.89	2214	48.37	27.08	14.98	9.58	2297	5611
Shivamogga	46.36	22.57	14.21	16.86	3695	14.99	2.30	33.97	48.74	2741	13.83	20.89	29.15	36.13	5112	11548
Total	42.89	20.65	15.45	21.02	5477	27.68	10.17	24.80	37.34	5455	24.55	23.30	25.19	26.96	8269	19201
Average calls per District	470	226	169	230	1095	302	111	271	407	1091	406	385	417	446	1654	3840.2
Moderate Rainfall																
Chikkamagaluru	26.13	30.25	18.55	25.06	16396	28.72	7.76	28.89	34.64	9555	18.85	25.24	25.23	30.68	17773	43724
Bidar	20.61	23.10	26.84	29.45	22124	20.68	3.71	33.17	42.45	2780	17.52	12.58	16.18	53.72	6163	31067
Kalaburagi	27.97	21.15	30.47	20.41	46658	13.79	2.89	39.56	43.77	7791	16.24	12.31	16.78	54.66	12398	66847
Hassan	23.41	27.09	22.65	26.85	15355	30.64	7.34	25.85	36.17	9129	22.26	28.02	26.40	23.33	17260	41744
Bengaluru Rural	21.51	25.43	24.04	29.01	7628	26.72	2.58	31.28	39.43	3533	22.48	30.31	26.42	20.79	5840	17001
Bengaluru Urban	23.40	28.90	22.09	25.62	1218	24.26	4.98	30.95	39.81	643	20.49	24.15	26.53	28.82	1093	2954
Belagavi	35.70	18.39	22.30	23.61	21987	16.90	4.78	43.03	35.29	4794	9.71	11.57	28.95	49.77	18140	44921
Yadgir	29.27	21.31	25.70	23.72	15971	8.09	1.30	31.87	58.74	4217	9.88	26.95	24.57	38.60	6041	26229
Kolar	23.43	21.91	21.93	32.73	21751	25.38	3.28	31.01	40.34	11997	22.54	26.94	27.08	23.44	16844	50592
Total	26.63	22.83	25.17	25.37	169088	22.94	4.66	32.25	40.15	54439	17.70	21.59	24.86	35.85	101552	325079
Average calls per District	5004	4289	4729	4766	18788	1387	282	1951	2429	6049	1998	2436	2805	4045	11284	36119.89
Low Rainfall																
Ramanagara	21.22	27.54	19.54	31.71	1725	22.46	4.23	33.64	39.68	993	21.95	32.32	26.49	19.25	1408	4126
Chikkaballapura	23.07	28.81	23.29	24.83	35280	25.47	2.79	31.84	39.90	14264	20.27	24.41	26.00	29.32	24212	73756
Tumakuru	21.22	26.20	22.45	30.12	35324	27.09	4.46	31.23	37.23	17982	18.97	29.17	28.40	23.46	37555	90861
Mandya	20.74	24.47	25.15	29.64	4083	27.42	7.02	26.26	39.30	3191	21.41	30.07	27.95	20.57	7393	14667
Dharwad	22.94	18.58	27.38	31.10	11701	6.47	2.50	57.12	33.91	2675	7.80	10.03	20.87	61.30	4307	18683
Davanagere	24.94	37.90	20.23	16.92	18096	11.97	4.27	44.89	38.87	4103	12.07	21.46	28.59	37.88	14777	36976
Raichur	28.29	29.00	21.78	20.93	44945	7.35	0.83	23.90	67.92	17676	11.02	17.83	19.59	51.56	12792	75413
Mysuru	27.31	20.86	22.38	29.45	3284	29.38	5.56	28.64	36.43	1746	12.65	29.29	30.45	27.61	6784	11814
Vijayapura	27.94	19.22	28.80	24.05	42014	11.09	3.08	38.51	47.32	8335	18.28	13.39	20.70	47.63	14631	64980
Haveri	31.93	25.46	22.88	19.73	6922	9.36	3.21	51.84	35.59	1742	5.16	13.49	24.40	56.95	6881	15545
Chamarajana-nagar	21.41	22.04	23.65	32.90	10964	22.98	6.87	40.57	29.58	3986	15.63	29.00	27.09	28.27	11940	26890
Koppal	25.96	28.31	21.77	23.96	19419	7.03	1.24	35.75	55.98	6047	9.51	19.61	33.20	37.67	10258	35724
Ballari	22.69	28.71	26.60	22.01	74715	13.79	1.23	36.56	48.42	19878	13.69	15.35	22.92	48.04	20860	115453
Bagalkot	32.70	21.54	22.55	23.22	19022	9.67	3.20	49.26	37.87	3567	9.91	13.10	29.59	47.40	11131	33720
Gadag	29.28	21.29	19.41	30.02	9966	5.74	1.03	58.47	34.76	2319	5.67	10.20	27.80	56.33	3245	15530
Chitradurga	26.72	31.52	20.39	21.38	30777	19.30	3.42	38.64	38.63	8682	13.63	24.39	30.07	31.91	23845	63304
Total	25.34	26.82	23.84	24.00	368237	16.56	2.81	35.03	45.60	117186	14.89	21.97	26.69	36.44	212019	697442
Average calls per District	5832	6173	5486	5525	23015	1213	206	2566	3340	7324	1973	2911	3537	4829	13251	43590.12
Grand Total	140687	138500	131176	132439	542802	33398	6388	59959	77335	177080	51583	70431	83923	115903	321840	1041722
Percentage to the Grand Total	25.92	25.52	24.17	24.40		18.86	3.61	33.86	43.67		16.03	21.88	26.08	36.01		

Source: Data Compiled from KSNDMC Database, 2017

3.2.11. Distribution of Calls by Caller Group

The distribution of calls by caller group has been presented in **Table 3.14a**. The Varuna Mitra help desk received 10.41 lakh calls by 1.76 lakh callers from 10 stakeholders, namely; farmers, public, Government officers of Agriculture Department, media, fishermen, private companies, educational institutions, energy and power sector, transport sector, NGOs and others. Among the caller groups, 99.75 per cent of the total callers were farmers with 99.85 per cent of calls. This implied that Varuna Mitra services have been highly beneficial to farmers more than any other groups. Only a negligible proportion of calls were made by the public (0.05%), Government officers, particularly agricultural department (0.04%) and media (0.04%). This indicated that other caller groups had not availed the Varuna Mitra services as much as the farmers. Across the districts and regions categorized by rainfall, farmers accounted for the maximum number of callers (**Annexure 3.3a, 3.3b**). The farmers and government officers on an average at the State level called six times, while calls from the media stood at seven. The others called twice on an average (**Table 3.14b**).

Table 3.14a: Percentage Distribution of Beneficiaries and Calls by Caller Group

Group	High Rainfall		Moderate Rainfall		Low Rainfall		Total	
	No. of Beneficiary	No. of calls	No. of Beneficiary	No. of calls	No. of Beneficiary	No. of calls	No. of Beneficiary	No. of calls
Farmer	99.42	98.46	99.61	99.77	99.83	99.93	99.75	99.85
Public	0.25	0.15	0.22	0.07	0.09	0.04	0.13	0.05
Government officer	0.10	0.96	0.06	0.04	0.03	0.02	0.04	0.04
Media	0.10	0.36	0.06	0.09	0.02	0.01	0.03	0.04
Fisherman	0.08	0.06	0.01	0.00	0.01	0.00	0.01	0.00
Private Companies	0.03	0.01	0.02	0.01	0.00	0.00	0.01	0.00
Educational Institutes	0.03	0.01	0.01	0.00	0.00	0.00	0.00	0.00
Energy & Power Sector	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00
NGO	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Transport Sector	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Others	0.00	0.00	0.01	0.02	0.01	0.00	0.01	0.01
Total (%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total (Nos.)	3971	19201	54229	325079	118066	697442	176266	1041722

Source: Data Compiled from KSNDMC Database, 2017

Table 3.14b: Average Calls made by Different Stakeholders

Group	High Rainfall		Moderate Rainfall		Low Rainfall		Total	
	No. of Beneficiary	Avg. calls per Beneficiary	No. of Beneficiary	Avg. calls per Beneficiary	No. of Beneficiary	Avg. calls per Beneficiary	No. of Beneficiary	Avg. calls per Beneficiary
Farmer	3948	5	54016	6	117869	6	175833	6
Public	10	3	117	2	102	3	229	2
Government officer	4	46	34	4	40	3	78	6
Media	4	18	34	8	20	3	58	7
Fisherman	3	4	3	1	10	2	16	2
Private Companies	1	1	9	2	3	1	13	2
Educational Institutes	1	1	3	2	4	2	8	2
Energy & Power Sector	0	0	4	2	4	2	8	2
NGO	0	0	2	3	2	1	4	2
Transport Sector	0	0	0	0	1	1	1	1
Others	0	0	7	9	11	2	18	5
Total	3971	5	54229	6	118066	6	176266	6

Source: Data Compiled from KSNDMC Database, 2017

3.3. Analysis of Farmer Group based on Call Details

The total beneficiaries of Varuna Mitra were 1,76,266 who made 10,41,722 calls during the period July 2016 to June 2017. Of them, the farming sector beneficiaries were 1,75,833 who made 10,40,171 calls that wholly accounted for 99.75 per cent of the beneficiaries and 99.85 of the calls made to Varuna Mitra. The distribution of these farmers across the agriculture and allied sector is shown in **Table 3.15a**. From the table, it is clear that in terms of number of farmers and their calls, agriculture accounted for a major share with 90.39 per cent and 90.26 per cent, respectively, followed by horticulture with 8.65 per cent and 8.90 per cent. While, the sericulture and animal husbandry sector utilised the Varuna Mitra services to a minimal extent. Therefore, it is clear that crop husbandry, mainly the food crops category had utilised the services of Varuna Mitra. However, high value crops in the horticulture sector that is expected to normally require periodic weather information for the application of pesticide & fertiliser and while harvesting, had not utilised this service effectively. The results across the rainfall category have not varied much as an overwhelming proportion of farmers and calls across the districts witnessed more or less similar trend (**Table 3.15b**). The average number of calls made by each stakeholder was six. While, in case of Animal Husbandry and Sericulture sector the average calls were three and seven respectively. Among the district category, Hassan and Bengaluru Rural had a higher average frequency of calls from agriculture and horticulture sectors. Similarly, in Sericulture, more number of average calls was from Kolar, Ramanagara, Bengaluru Rural, Chikballapur and Mandya districts.

3.3.1. Land Holdings

As we find in the above tables there were 1.75 lakh farmers who availed the services of Varuna Mitra. These farmers owned 56.38 lakh hectares (This land may not be the total land held by the beneficiary farmer) of which, irrigated land accounted for 64.54 per cent. The reported land area may be the land under the crop for which he sought information from Varuna Mitra. The distribution of farmers and their land across the different land holding has been shown in **Table 3.16**. From the table, it is evident that marginal farmers account for 36.08 per cent followed by both, semi-medium and medium farmers at over 23 per cent, small farmers around 12 per cent and the lowest proportion was in the case of large farmers (5.58%). The marginal and small farmers' together account for 47.62 per cent which is low when compared to 76.47 per cent at State level as per agricultural census (2010-11).

In terms of land held by different size class of holdings, the medium farmers account for 39.11 per cent followed by large farmers (32.07%) (**Table 3.16**). The interesting fact is that the proportion of land holdings held in the case of semi-medium and medium was more than that held by marginal and small farmer which was quite different in comparison to Agricultural Census of State (2010-11). This implied that more number of semi-medium and medium farmers availed the services of Varuna Mitra than marginal and small farmers. Among the high rainfall districts, Udupi and Shivamogga are presented a major share, both in terms of number of holdings and land held by them in all classes of holdings, while in the large farmer category, Kodagu accounted for a major share as the district area covered large holdings under plantation crops like coffee. In the moderate rainfall category, Bengaluru Urban and Bengaluru Rural districts had a high proportion in all categories of farmers and holdings and Kalaburagi accounted for a larger share in large farmer's category. In the low rain fall category districts, a larger proportion of marginal farmers were found in Mandya and Ramanagara. Chamarajanagar accounted for a major share in the small and semi-medium category. The highest proportion was reported in Raichur district in the case of medium farmers' category. While, Gadag district reported the highest in the case of the large farmers' category. The average size of land holding was 3.21 ha at the State level, which was greater than the agricultural census of 1.55 ha. Among the districts categorized by rainfall, there was only a slight difference except in the case of high rainfall district where the average size of holding was 2.67 ha. Across the districts, Kalaburagi (4.87 ha) and Gadag (4.16 ha) had the highest average size of holdings, while Bengaluru Urban, Mandya, Bengaluru Rural, Ramanagara and Mysuru had the lowest land holding size of about 2 ha (**Table 3.16**).

Table 3.15a: Percentage Distribution of Farmers by Sub-Sector of Agriculture

District	Agriculture		Horticulture		Animal Husbandry		Sericulture		Total Percentage		Absolute Numbers	
	No. of farmers	No. of call	No. of farmers	No. of call	No. of farmers	No. of call	No. of farmers	No. of call	No. of farmers	No. of call	No. of farmers	No. of call
High Rainfall												
Udupi	83.70	73.27	14.81	26.42	0.74	0.16	0.74	0.16	100.00	100.00	135	636
Dakshina Kannada	79.00	62.06	19.00	37.38	1.00	0.37	1.00	0.19	100.00	100.00	100	535
Uttara Kannada	84.66	76.16	15.34	23.84	0.00	0.00	0.00	0.00	100.00	100.00	176	776
Kodagu	78.68	67.95	20.13	31.37	0.46	0.09	0.73	0.59	100.00	100.00	1093	5420
Shivamogga	86.29	85.67	12.11	13.45	0.82	0.39	0.78	0.49	100.00	100.00	2444	11539
Total	83.84	79.12	14.74	20.13	0.68	0.28	0.73	0.48	100.00	100.00	3948	18906
Average	83.84	79.12	14.74	20.13	0.68	0.28	0.73	0.48	100.00	100.00	790	3781
Moderate Rainfall												
Chikkamagaluru	84.98	81.79	14.16	17.62	0.38	0.20	0.47	0.40	100.00	100.00	7817	43707
Bidar	92.74	95.46	6.34	4.03	0.27	0.28	0.65	0.41	100.00	100.00	5581	31034
Kalaburagi	92.57	95.68	6.38	3.78	0.51	0.27	0.55	0.27	100.00	100.00	11856	66818
Hassan	85.65	80.30	13.71	19.12	0.32	0.17	0.32	0.41	100.00	100.00	5936	41714
Bengaluru Rural	85.30	77.54	12.98	19.87	0.51	0.09	1.21	2.50	100.00	100.00	2149	16952
Bengaluru Urban	87.68	88.94	10.63	10.36	0.72	0.29	0.97	0.41	100.00	100.00	414	2414
Belagavi	89.48	89.68	9.62	9.70	0.45	0.31	0.45	0.31	100.00	100.00	9037	44882
Yadgir	93.49	96.43	5.65	3.11	0.45	0.24	0.41	0.22	100.00	100.00	4870	26219
Kolar	89.40	90.88	9.16	6.48	0.46	0.12	0.99	2.52	100.00	100.00	6356	50576
Total	89.59	89.29	9.40	9.72	0.43	0.22	0.58	0.79	100.00	100.00	54016	324316
Average	89.59	89.29	9.40	9.72	0.43	0.22	0.58	0.79	100.00	100.00	6002	36035
Low Rainfall												
Ramanagara	88.45	85.78	10.17	11.72	0.52	0.24	0.86	2.26	100.00	100.00	580	4122
Chikkaballapura	89.78	88.70	8.92	9.25	0.33	0.19	0.97	1.86	100.00	100.00	9070	73724
Tumakuru	88.40	85.43	10.61	13.79	0.38	0.24	0.61	0.54	100.00	100.00	14078	90775
Mandya	88.97	90.62	10.26	8.03	0.41	0.54	0.36	0.81	100.00	100.00	2203	14635
Dharwad	93.79	95.50	5.48	4.07	0.22	0.08	0.51	0.34	100.00	100.00	3557	18658
Davanagere	89.41	89.54	9.72	9.84	0.29	0.18	0.57	0.45	100.00	100.00	6809	36955
Raichur	93.09	95.54	5.91	3.79	0.38	0.22	0.62	0.44	100.00	100.00	14839	75373
Mysuru	89.05	91.42	10.06	8.11	0.31	0.21	0.57	0.25	100.00	100.00	1918	11782
Vijayapura	89.93	88.26	9.30	11.32	0.31	0.13	0.47	0.29	100.00	100.00	11425	64967
Haveri	90.32	92.73	8.99	6.74	0.35	0.29	0.35	0.24	100.00	100.00	2871	15528
Chamarajanagar	89.77	90.27	9.38	9.33	0.30	0.12	0.55	0.27	100.00	100.00	3667	26876
Koppal	91.91	93.11	7.06	6.09	0.47	0.41	0.56	0.39	100.00	100.00	6839	35696
Ballari	93.05	95.54	6.11	3.97	0.35	0.22	0.49	0.27	100.00	100.00	20887	115387
Bagalkot	91.97	93.27	7.21	6.04	0.42	0.33	0.40	0.37	100.00	100.00	6213	33698
Gadag	93.01	95.37	6.36	4.23	0.28	0.20	0.35	0.20	100.00	100.00	2862	15525
Chitradurga	89.28	87.30	9.71	12.08	0.53	0.24	0.48	0.38	100.00	100.00	10051	63248
Total	90.98	91.02	8.10	8.21	0.37	0.22	0.55	0.55	100.00	100.00	117869	696949
Average	90.98	91.02	8.10	8.21	0.37	0.22	0.55	0.55	100.00	100.00	7367	43560
Overall percentage	90.39	90.26	8.65	8.90	0.39	0.22	0.57	0.62	100.00	100.00	175833	1040171

Source: Data Compiled from KSNDMC Database, 2017

Note: Animal husbandry includes Aqua Culture, Dairy farming, poultry, Sheep farming and apiculture.

Table 3.15b: Sector Wise Distribution of Calls

District	Agriculture		Horticulture		Animal Husbandry		Sericulture		Grand Total	
	No. of farmers	No. of calls per farmer	No. of farmers	No. of calls per farmer	No. of farmers	No. of calls per farmer	No. of farmers	No. of calls per farmer	No. of farmers	No. of calls per farmer
High Rainfall										
Udupi	113	4	20	8	1	1	1	1	135	5
Dakshina Kannada	79	4	19	11	1	2	1	1	100	5
Uttara Kannada	149	4	27	7	0	0	0	0	176	4
Kodagu	860	4	220	8	5	1	8	4	1093	5
Shivamogga	2109	5	296	5	20	2	19	3	2444	5
Total	3310	5	582	7	27	2	29	3	3948	24
Average per District	662	5	116	7	5	2	6	3	790	5
Moderate Rainfall										
Chikkamagaluru	6643	5	1107	7	30	3	37	5	7817	6
Bidar	5176	6	354	4	15	6	36	4	5581	6
Kalaburagi	10975	6	756	3	60	3	65	3	11856	6
Hassan	5084	7	814	10	19	4	19	9	5936	7
Bengaluru Rural	1833	7	279	12	11	1	26	16	2149	8
Bengaluru Urban	363	6	44	6	3	2	4	3	414	6
Belagavi	8086	5	869	5	41	3	41	3	9037	5
Yadgir	4553	6	275	3	22	3	20	3	4870	5
Kolar	5682	8	582	6	29	2	63	20	6356	8
Total	48395	6	5080	6	230	3	311	8	54016	56
Average per District	5377	6	564	6	26	3	35	8	6002	6
Low Rainfall										
Ramanagara	513	7	59	8	3	3	5	19	580	7
Chikkaballapura	8143	8	809	8	30	5	88	16	9070	8
Tumakuru	12445	6	1493	8	54	4	86	6	14078	6
Mandya	1960	7	226	5	9	9	8	15	2203	7
Dharwad	3336	5	195	4	8	2	18	4	3557	5
Davanagere	6088	5	662	5	20	3	39	4	6809	5
Raichur	13813	5	877	3	57	3	92	4	14839	5
Mysuru	1708	6	193	5	6	4	11	3	1918	6
Vijayapura	10274	6	1062	7	35	2	54	4	11425	6
Haveri	2593	6	258	4	10	5	10	4	2871	5
Chamarajanagar	3292	7	344	7	11	3	20	4	3667	7
Koppal	6286	5	483	5	32	5	38	4	6839	5
Ballari	19435	6	1277	4	73	3	102	3	20887	6
Bagalkot	5714	6	448	5	26	4	25	5	6213	5
Gadag	2662	6	182	4	8	4	10	3	2862	5
Chitradurga	8974	6	976	8	53	3	48	5	10051	6
Total	107236	6	9544	6	435	4	654	6	117869	97
Average per District	6702	6	597	6	27	4	41	6	7367	6
Grand Total	158941	6	15206	6	692	3	994	7	175833	6

Source: Data Compiled from KSNDMC Database, 2017

Note: Animal husbandry includes Aqua Culture, Dairy farming, poultry, Sheep farming and apiculture.

Table 3.16: Distribution of Holdings and Land by Size Class of Holdings

District	Marginal Farmer (<1 Ha)		Small Farmer (1-2 Ha)		Semi-medium farmer (2-4 Ha)		Medium Farmer (4-10 Ha)		Large Farmer (>10 Ha)		Avg. land holding (Ha)	Total	
	No. of farmers	Total land holding	No. of farmers	Total land holding	No. of farmers	Total land holding	No. of farmers	Total land holding	No. of farmers	Total land holding		No. of farmers	Total land holding (Ha)
High Rainfall													
Udupi	41.48	9.69	9.63	6.28	24.44	27.83	22.96	48.70	1.48	7.50	2.20	135	296.63
Dakshina Kannada	42.00	9.28	17.00	11.38	19.00	21.89	19.00	38.35	3.00	19.09	2.31	100	231.08
Uttara Kannada	38.64	6.51	12.50	6.35	22.16	19.37	21.59	39.71	5.11	28.05	2.86	176	503.43
Kodagu	34.77	4.99	10.06	4.20	19.30	13.92	28.45	43.68	7.41	33.21	3.43	1093	3750.23
Shivamogga	41.28	8.25	12.27	7.08	22.83	22.12	20.66	39.94	2.95	22.60	2.54	2444	6198.17
High Rainfall Total	39.39	7.12	11.70	6.13	21.78	19.34	22.90	41.41	4.23	26.00	13.34	3948	10979.54
Average	311	156.29	92	134.68	172	424.76	181	909.33	33	570.85	2.67	790	2195.91
Moderate Rainfall													
Chikkamagaluru	36.93	6.70	13.04	6.73	24.80	21.80	21.36	38.60	3.86	26.18	2.81	7817	22000.75
Bidar	32.47	4.25	9.39	3.63	20.44	13.67	29.85	42.12	7.85	36.34	3.77	5581	21039.63
Kalaburagi	31.33	3.12	7.67	2.34	18.49	9.70	29.98	33.99	12.53	50.84	4.87	11856	57696.49
Hassan	37.95	7.39	14.91	8.26	24.85	23.48	19.07	37.61	3.22	23.27	2.59	5936	15401.14
Bengaluru Rural	43.14	11.30	17.31	12.08	24.80	29.86	13.31	32.09	1.44	14.67	2.03	2149	4368.18
Bengaluru Urban	56.28	13.95	9.90	7.10	18.12	20.85	13.53	34.61	2.17	23.49	2.00	414	826.77
Belagavi	35.51	5.59	11.55	5.30	22.60	17.63	25.17	41.99	5.17	29.48	3.19	9037	28823.36
Yadgir	33.35	4.04	8.73	3.26	22.07	14.35	27.37	37.89	8.48	40.46	3.94	4870	19200.33
Kolar	40.18	9.11	15.39	9.57	25.30	26.67	16.94	36.93	2.19	17.72	2.31	6356	14682.01
Moderate Rainfall Total	35.57	5.24	11.47	4.90	22.36	16.36	24.16	37.63	6.44	35.88	27.52	54016	184038.65
Average	2135	1071.25	689	1001.42	1342	3345.94	1450	7694.03	386	7336.10	3.06	6002	20448.74
Low Rainfall													
Ramanagara	44.83	11.24	12.76	8.62	25.34	29.50	15.69	37.69	1.38	12.96	2.11	580	1220.94
Chikkaballapura	40.19	9.24	16.13	10.29	25.05	27.26	16.62	36.92	2.02	16.28	2.25	9070	20364.20
Tumakuru	39.43	8.23	14.41	8.55	26.21	26.75	17.31	35.75	2.64	20.73	2.44	14078	34405.19
Mandya	47.62	12.26	14.25	10.28	23.38	28.67	12.76	32.33	2.00	16.45	2.02	2203	4455.59
Dharwad	36.52	4.75	9.19	3.68	19.76	13.49	26.90	38.79	7.62	39.29	3.75	3557	13355.45
Davanagere	37.01	6.40	11.47	5.84	24.12	21.12	23.38	42.32	4.02	24.32	2.85	6809	19415.22
Raichur	32.78	4.22	9.25	3.63	21.38	14.12	28.92	40.82	7.68	37.21	3.78	14839	56104.86
Mysuru	42.60	10.18	14.60	9.76	25.34	29.29	15.59	36.14	1.88	14.63	2.14	1918	4113.23
Vijayapura	33.94	4.30	9.28	3.57	20.63	13.75	27.84	39.57	8.31	38.81	3.84	11425	43826.28
Haveri	38.80	6.13	8.85	4.24	22.68	18.93	24.38	42.01	5.29	28.69	3.05	2871	8752.55
Chamarajanagar	35.83	7.73	16.31	9.98	28.47	29.38	16.88	35.60	2.51	17.31	2.37	3667	8707.22
Koppal	35.01	5.27	12.05	5.60	23.40	18.57	24.49	40.72	5.06	29.84	3.21	6839	21926.29
Ballari	34.46	5.09	10.41	4.61	22.86	17.35	26.52	42.05	5.75	30.89	3.32	20887	69369.25
Bagalkot	34.40	4.86	10.43	4.38	22.23	16.00	26.36	40.14	6.58	34.62	3.52	6213	21892.70
Gadag	33.79	3.97	9.71	3.43	18.97	11.72	27.74	36.61	9.78	44.26	4.16	2862	11915.98
Chitradurga	36.42	6.31	11.55	5.84	25.23	21.79	22.73	40.86	4.06	25.20	2.88	10051	28912.39
Low Rainfall Total	36.20	5.75	11.57	5.41	23.34	18.71	23.66	39.78	5.23	30.35	47.70	117869	368737.34
Average	2667	1325.14	852	1246.89	1720	4310.97	1743	9167.81	385	6995.28	2.98	7367	23046.08
Grand Total	36.08	5.61	11.54	5.26	23.01	17.95	23.80	39.11	5.58	32.07	3.21	175833	563755.52

Source: Data Compiled from KSNDMC Database, 2017

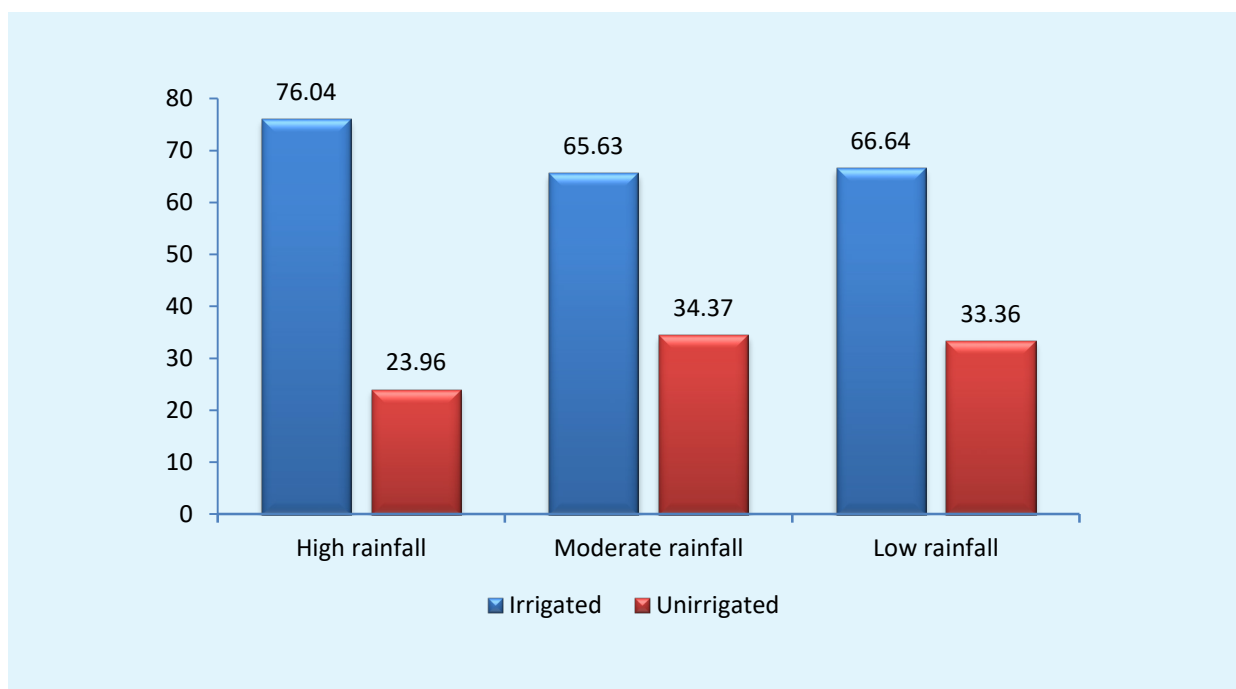
3.3.2. Irrigation Status of Callers

The distribution of farmers showed that a majority of them irrigated their crops in different rainfall category across the districts. The per cent of irrigated farmers ranged between 65.63 per cent in moderate rainfall and 76.04 per cent in high rainfall regions (Table 3.17 and Figure 3.7). Among the districts, Kodagu district had the highest percentage of irrigation (78.04%) followed by Mandya (76.17%), Shivamogga (75.70%) and Udupi (73.33%). While, farmers from Gadag (45.25%) followed by Kalaburagi (43.23%) and Dharwad (42.56%) had the highest unirrigated land. These results are contrary to the common perception that un-irrigated farmers are heavily dependent on rainfall than those who had irrigation facilities and were sure of their crop. It is inferred that perhaps the farmers who irrigate their crops availed Varuna Mitra services for input management.

Table 3.17: Distribution of Beneficiaries of Varuna Mitra Services by Irrigation Status during 2016-17

District	Irrigated Farmers		Un irrigated Farmers		Total
	No. of Beneficiaries	Percentage of Beneficiaries	No. of Beneficiaries	Percentage of beneficiaries	
High Rainfall					
Udupi	99	73.33	36	26.67	135
Dakshina Kannada	71	71	29	29	100
Uttara Kannada	129	73.3	47	26.7	176
Kodagu	853	78.04	240	21.96	1093
Shivamogga	1850	75.7	594	24.3	2444
Total	3002	76.04	946	23.96	3948
Average	600		189		790
Moderate Rainfall					
Chikkamagaluru	5392	68.98	2425	31.02	7817
Bidar	3317	59.43	2264	40.57	5581
Kalaburagi	6731	56.77	5125	43.23	11856
Hassan	4295	72.36	1641	27.64	5936
Bengaluru Rural	1558	72.5	591	27.5	2149
Bengaluru Urban	285	68.84	129	31.16	414
Belagavi	6281	69.5	2756	30.5	9037
Yadgir	2978	61.15	1892	38.85	4870
Kolar	4615	72.61	1741	27.39	6356
Total	35452	65.63	18564	34.37	54016
Average	3939		2063		6002
Low Rainfall					
Ramanagara	407	70.17	173	29.83	580
Chikkaballapura	6458	71.2	2612	28.8	9070
Tumakuru	9602	68.21	4476	31.79	14078
Mandya	1678	76.17	525	23.83	2203
Dharwad	2043	57.44	1514	42.56	3557
Davanagere	4514	66.29	2295	33.71	6809
Raichur	9689	65.29	5150	34.71	14839
Mysuru	1399	72.94	519	27.06	1918
Vijayapura	7513	65.76	3912	34.24	11425
Haveri	1934	67.36	937	32.64	2871
Chamarajanagar	2621	71.48	1046	28.52	3667
Koppal	4530	66.24	2309	33.76	6839
Ballari	13584	65.04	7303	34.96	20887
Bagalkot	4142	66.67	2071	33.33	6213
Gadag	1567	54.75	1295	45.25	2862
Chitradurga	6863	68.28	3188	31.72	10051
Total	78544	66.64	39325	33.36	117869
Average	4909		2458		7367
Grand Total	116998	66.54	58835	33.46	175833

Source: Data Compiled from KSNDMC Database, 2017

Figure 3.7: Percentage of Farmers of Varuna Mitra Services by Irrigation Status

3.3.3. Crops Benefitted from Calls

Calls by the farmers among the total callers were 1.75 lakh and they made 10.40 lakh calls to obtain information that would benefit several crops grown by them. Of the total farmers, as many as 0.70 lakh farmers made 2.02 lakh calls but did not report any crop. Although, 73 crops were reported, only 10 major crops were considered for analysis based on the area and the remaining crops were clubbed as minor crops. Although, the share of minor crops shares 23.93 per cent compared to major crops considered, the average area and total calls were smaller.

Among the major crops, maize accounted for highest share, both under irrigated and dry land areas with 14.41 per cent of the area, 10.71 per cent of the farmers and 13.80 per cent of the calls in the farm sector (**Table 3.18**). Owing to a decline in rainfall in the last few years, the area under the maize in the State has increased considerably. For instance, the growth rate (CAGR) of maize was 8.5 per cent and 7.2 per cent for production and area expansion, respectively, in the last 30 years and much higher than the growth of rice, which registered a 2.2 per cent and 1.1 per cent growth in production and area expansion respectively during the same period (1980-81 to 2010-11) (Komol Singha, Arpita Chakravorty, 2013).

Following, tur accounted for 14.64, 7.99 and 11.05 per cent of area, number of farmers and calls respectively. This signals that dry land crops have benefited far more from Varuna Mitra services than the other crops. Normally, one would have expected that horticulture crops growers would need more weather based information during application of pesticides and fertiliser. However, the results showed that only Chilli and Onion growers utilised Varuna Mitra Services more than others. Across different rainfall regions, maize growers benefited the most in all the three rainfall regions, whereas, tur was not prominent in districts under the high rainfall category as compared to other regions. Among the minor crops, the proportion of calls for plantation crops was 18.20 per cent followed by fruits (17.00 %) and flowers (2.25 %) (Refer **Annexure 3.4a, 3.4b, 3.4c, 3.4d, 3.4e and 3.4f** for District wise data).

Table 3.18: Crop wise distribution of Beneficiaries by Land and total calls (per cent)

Group	Irrigated			Unirrigated			Total		
	Total Land	No. of farmers	No. of calls	Total Land	No. of farmers	No. of calls	Total Land	No. of farmers	No. of calls
Chilli	4.15	3.13	4.51	4.13	3.37	4.18	4.15	3.21	4.41
Cotton	6.26	3.83	5.22	9.06	6.06	7.88	7.25	4.58	6.05
Groundnut	2.16	1.78	2.82	3.78	3.21	4.38	2.73	2.26	3.30
Jowar	2.18	2.82	1.70	2.05	2.39	1.72	2.13	2.68	1.71
Maize	14.39	9.75	13.06	14.45	12.63	15.43	14.41	10.71	13.80
Onion	3.58	2.70	3.96	3.02	2.55	3.60	3.38	2.65	3.85
Paddy	8.34	5.44	6.30	3.29	3.37	3.29	6.55	4.75	5.37
Ragi	2.33	2.18	3.89	3.16	4.13	5.93	2.62	2.83	4.52
Sugarcane	3.70	2.49	3.23	1.41	1.16	1.31	2.89	2.04	2.63
Tur	10.70	5.51	8.46	21.82	12.94	16.80	14.64	7.99	11.05
Minor crops (63 crops)	22.34	17.72	26.41	17.68	14.44	18.44	20.69	16.62	23.93
Crop not specified	19.87	42.66	20.45	16.14	33.76	17.04	18.55	39.68	19.39
Total (%)	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Total	364146.18	116998	716664	199609.35	58835	323507	563755.52	175833	1040171

Source: Data Compiled from KSNDMC Database, 2017

3.3.4. Use of Rainfall Information for Different Stages of Crop Growth

Of the total beneficiaries and number of calls, the agriculture and allied sector activities numbered 1.75 lakh and 10.40 lakh respectively. However, 19.39 per cent of the calls did not report the crops for which they sought rainfall information. Therefore, calls related to this category were not considered while analysing the number of farmers and calls made across various crops.

Reiterating the fact that rainfall is essential for choosing cropping patterns and also at different stages of each crop i.e., from land preparation to harvesting, yet the farmers' ability to accurately anticipate occurrence of rainfall has been uncertain at best. Under these circumstances, Varuna Mitra services have been helpful by providing rain forecast that minimises the uncertainty of rainfall events thereby assisting farmers to take timely mitigation measures.

Farmers made 10.40 lakh calls with regard to 73 crops grown by them during the reference period. Of which, over 19.39 per cent of the calls did not report any crop. Only ten major crops which accounted for 56.69 per cent were considered for analysis to understand the usefulness and effectiveness of these calls at different stages of crop growth. Of the calls reported, a majority of the calls were made during the germination stage (The period of growth between germination and flowering is known as the vegetative phase) of all the crops (37.35%) followed by harvesting (22.40%), sowing (12.45%) that include sowing, sowing completed and yet to sow, and vegetative phase (10.38%). The least number of calls were made at the transplantation stage (0.81%). During the germination stage (sprouting and development), a higher number of calls were made in the case of sugarcane (49.50%), followed by tur (45.72%) and ragi (41.81%) (Table 3.19 and Figure 3.8). In the vegetative phase, farmers growing chilly (28.50%), cotton (25.04%) and sugarcane (23.02%) accounted for a major share of the calls. In the harvesting stage (Harvesting is the process of removal of entire plant or specific parts of the crop after maturity) the specific economic product may be grain, seed leaf, root or the entire plant. The remaining portion of the crop that is left in the field after harvest is known as stubble, which includes harvesting and yet to harvest, a higher number of calls were reported in the case of Paddy (47.47%) followed by Ragi (33.84%)

and Ground nut (30.78%). Among the utilisation of calls for different stages, at the sowing stage, growers of Jowar crop made more calls (28.81%) that comprised of both sowing and sowing completed, followed by cotton (15.12%) and tur (13.92%).

Figure 3.8: Percentage Distribution of Calls by Stages of Crop Growth

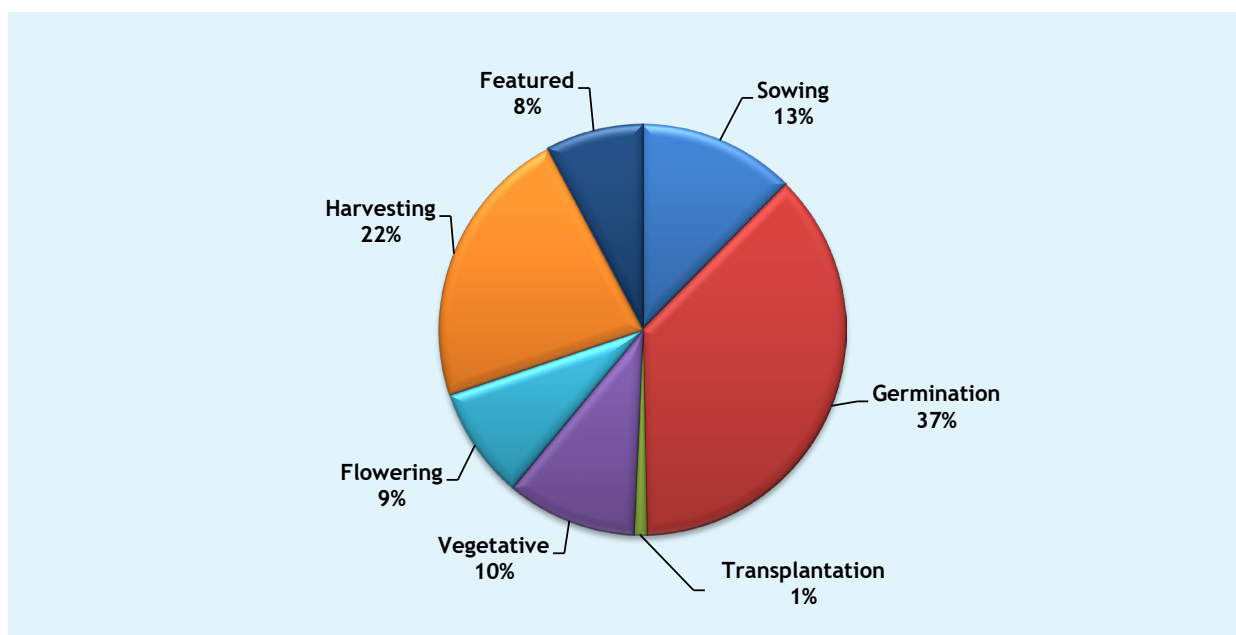


Table 3.19: Percentage distribution of Calls by Stages of Crop Growth

Crops	% to the total no. of calls							Total calls	Percentage to Total
	Sowing	Germination	Trans-plantation	Vegetative	Flowering	Harvesting	Featured		
Chilli	11.31	30.48	0.72	28.50	10.74	17.50	0.76	45850	4.41
Cotton	15.12	37.66	0.24	25.04	12.57	8.66	0.70	62903	6.05
Groundnut	11.71	28.27	0.23	20.52	7.74	30.78	0.75	37153	3.30
Jowar	28.81	35.01	0.65	3.40	2.05	23.20	6.88	17777	1.71
Maize	11.07	33.97	0.48	1.96	5.34	22.71	24.48	143512	13.80
Onion	12.14	38.62	0.30	17.41	1.93	29.12	0.49	40027	3.85
Paddy	11.54	30.31	4.08	0.94	0.96	47.47	4.71	55832	5.37
Ragi	9.42	41.81	1.12	1.63	1.90	33.84	10.29	47025	4.52
Sugarcane	7.22	49.50	0.50	23.02	1.77	17.57	0.42	27368	2.63
Tur	13.92	45.72	0.33	6.17	22.48	10.61	0.78	114941	11.05
Total	12.45	37.35	0.81	10.38	8.82	22.40	7.78	592388	56.69
Minor crops (62 crops)	-	-	-	-	-	-	-	248883	23.93
Crop not specified	-	-	-	-	-	-	-	201688	19.39
Grand Total	-	-	-	-	-	-	-	1040171	100.00

Source: Data Compiled from KSNDMC Database, 2017

3.3.5. Summary

“VARUNA MITRA” is a Helpdesk service that was launched by KSNDMC in Karnataka. The basic idea of this initiative has been to provide weather based information to farmers and the general public. The analysis has shown that the performance of the Programme has been impressive. This is evident from

the increase in number of beneficiaries and total calls since its inception from a meagre 6,565 in 2011 to 11.17 lakh in June 2017. Out of which, 0.75 lakh were not considered for analysis as they were disconnected calls and spurious number of calls made by 20 individuals. The remnant 10.42 lakh calls made by 1.76 beneficiaries were considered for the analysis. Going by the present trend of calls, it was projected that the calls would likely increase to 63.57 lakhs by the year 2020. This shows that the programme is advantageous to different stakeholders and particularly the farmers which substantiates its popularity in the State.

The utilization of the Varuna Mitra services in some of the districts was commendable. Particularly, callers from Ballari, Kolar, Raichur and Vijayapura benefited much more than those from the coastal and the urbanized districts. As these districts receive less rainfall and are frequently prone to droughts, farmers in these areas are in dire need of rainfall forecast. The majority number of calls made by beneficiaries was related to queries on rainfall during the kharif season as farmers cultivate the large extent of land in rainfed areas during this period. The proportion of irrigated land held by the beneficiaries during the reference period was more than 60 per cent as compared to dry land farmers which implied that a major proportion of the beneficiaries of Varuna Mitra were farmers who irrigated their crops. Notably, maize and tur growing farmers availed Varuna Mitra services to a large extent compared to the other crop growers. While, the agricultural and allied sector had not utilized Varuna Mitra services as much as the agriculture sector.

Among the total callers and total calls, the share of calls from the farming community was nearly 99 per cent and the most frequent query was on rainfall while the queries on the other weather parameters were few. Across districts, a large proportion of semi-medium and medium farmers benefited more than the other categories of farmers based on size of the land holding.

The average calls made by beneficiaries under the agriculture and horticulture sector was six, while the other sector like sericulture reported an average call rate of seven per beneficiary. Across the districts, minimal variations were observed in the number of calls and beneficiaries and only in the case of high rainfall districts, the progress was not as significant as compared to moderate and low rainfall regions. Another interesting fact was that urbanized districts have also extensively utilized the Varuna Mitra services. This may be attributed to the general public attempting to take preventive measures during heavy spells of rain that had caused inundation due to poor drainage systems.

With respect to agriculture, farmers sought information on rainfall for 73 crops. Among these crops, 56.95 per cent of the calls pertained to only ten crops. They include cotton, chilli, onion, ground nut, maize, Jowar, ragi, paddy, tur and sugarcane. Among them, the proportion of land, number of calls and the beneficiaries growing maize accounted for major proportion. Most farmers had called at different stages in the production of the crops. A majority of calls were made during the stage of germination (37.35%) followed by harvesting (22.40%), sowing stage (12.42%) and vegetative phase (10.38%). Particularly, Jowar crop growers made the maximum number of calls during sowing stage followed by cotton and tur, calls from growers of sugarcane, tur and ragi were more during germination stage. In vegetative stage, chilli, cotton and sugarcane accounted for a major share of the calls and a higher number of calls were registered from paddy, ragi and ground nut growers during harvesting stage.

Impact of Varuna Mitra - Stakeholder Analysis

04



Impact of Varuna Mitra – Stakeholder Analysis

CHAPTER 4

One of the major functions of the Varuna Mitra Help Desk is to disseminate weather related information to several stakeholders. The information is disseminated to those who call the Help Desk for weather based information on their mobile phones. The basic idea of Varuna Mitra is to create awareness among Government officials on the various weather parameters and their forecast and disseminate the information to Government functionaries. This would help them modify their decisions related to agriculture operations or take some precautionary measures to minimise or prevent loss of crops, livestock, fisheries and avoid natural disasters. In addition, the stakeholders also receive 24 hour rainfall alerts through e-mail and SMS messages that are sent to the mobile phones of personnel at Agriculture Departments, Disaster Management Department, Chief Minister Office and Gram Panchayat Officers in the State.

4.1. Distribution of Stakeholders

In most cases, it was found that the stakeholders such as department of agriculture, fisheries, horticulture, animal husbandry, KPTCL and other government agencies called the KSNDMC officers directly rather than via the Help Desk. Apart from these stakeholders, there were private agencies seeking forecast on various weather parameters and natural disasters for taking decisions in their domain. These stakeholders were print and electronic media personnel, Government officers, general public, industrialists and poultry farmers. Media personnel mainly belonged to Vijaya Karnataka, Indian Express, Udayavani and Prajavani etc., (Annexure 4.1) who called frequently to enquire about rainfall, wind and temperature. The total numbers of direct calls made by these departments and other stakeholders to Varuna Mitra during 2016-17 were 973 (Table 4.1). In addition to this, 1,614 officials from the agriculture department in the State comprised of Joint Directors of Agriculture, Assistant Directors of Agriculture, Agricultural Officers, Assistant Agricultural Officers and Assistant Horticultural Officers of Horticultural department, BBMP and RDPR across the State and staff working in Price Commission, Commissioner of Agriculture, Secretariat, Technical section, Animal Husbandry Department were sent frequent messages and updates on the weather and rainfall events (Table 4.2).

Table 4.1: Distribution of Stakeholders by Departments Who Contacted Varuna Mitra during 2016-17

Sectors	No. of calls made	Per cent
Government officers	341	35.04
Media (Electronics & Print)	288	29.59
Public	344	35.35
Total	973	100.00

Source: Compiled from KSNDMC Data, 2017

Table 4.2: Number of Government Officials who receive the Varuna Mitra Messages during 2016-17

Designation of the Stakeholders	Department	Number of Stakeholders	% to total
Agricultural Officer	Agriculture	209	12.95
Assistant Agricultural Officer	Agriculture	533	33.02
Assistant Director of Agriculture	Agriculture	319	19.76
Joint Director of Agriculture	Agriculture	47	2.91
Agricultural Officer	Watershed	5	0.31
Assistant Director of Agriculture	Watershed	4	0.25
Assistant Director of Horticulture	Horticulture	25	1.55
Assistant Horticulture Officer	Horticulture	2	0.12
Deputy Director of Horticulture	Horticulture	20	1.24
Panchayat Development Officer	RDPR	267	16.54
Secretary	RDPR	77	4.77
Assistant Engineer	BBMP	32	1.98
Assistant Executive Engineer	BBMP	35	2.17
Executive Engineer	BBMP	27	1.67
Joint Commissioner and Engineer	BBMP	12	0.74
Total		1614	100.00

Source: Compiled from KSNDMC Data, 2017

The SUJALA-III Watershed Development Programme also received weather related information forecast and advisory services from Varuna Mitra free of cost. This enabled farmers to plan their agricultural activities and minimise crop loss due to adverse weather conditions. In order to make an assessment of the impact of information that the stakeholders received from the Varuna Mitra help desk, a few stakeholders of different categories were interviewed directly and a few were contacted over the phone.

4.2. Selection of Stakeholders for the Survey

The stakeholders were identified for primary survey from a separate list as well as a few drawn from the list of farmer beneficiaries. These stakeholders were directly contacted and the rest interviewed over the phone. The total number of stakeholders contacted directly were 18 and 32 were contacted over phone. Altogether 50 stakeholders belonging to different sectors like Government, media and public were interviewed in 10 sample districts and 11 other districts. For selection of 32 Stakeholders over phone we contacted about 85 stakeholders, however many did not respond due to various reasons. Therefore, stakeholders other than sample district were interviewed as adequate numbers of stakeholders were not available. The Government officers contacted were mainly Agricultural Officers (AOs) at the village level (RSK) and Assistant Director of Agriculture (ADs) of the taluks selected for the survey. Among the 50 stakeholders, 44 per cent of them were Government officers, followed by Media personnel (32%) and Public (24 %) respectively (**Table 4.3**). The media personnel included both print and electronic and in this category, more than 11 different newspapers and electronic media channels contacted Varuna Mitra to obtain daily weather information (**Annexure 4.1**).

Table 4.3: Distribution of Stakeholders by Sectors

Sectors	Designation	No. of Stakeholders
Government	Agricultural Officers	14 (28.00)
	Assistant Agricultural Officers	3 (6.00)
	Forest Officers	3 (6.00)
	PDO	2 (4.00)
Media	Senior Reporters and District Correspondents	16 (32.00)
Public	Bricks Manufacturers	2 (4.00)
	Industrialists	2 (4.00)
	Agricultural Input Vendors	1 (2.00)
	Lawyers	2 (4.00)
	Traders	5 (10.00)
Grand Total		50 (100.00)

Source: Compiled from KSNDMC Data, 2017

Of the 50 stakeholders across 21 districts, 44 per cent were callers from the low rainfall regions followed by 32 per cent from moderate rainfall and 24 per cent from high rainfall districts (Table 4.4).

Table 4.4: District-wise Distribution of Sample Stakeholders

Districts	Number of Respondents
High Rainfall	
Dakshina Kannada	4 (8.00)
Kodagu	1 (2.00)
Shivamogga	4 (8.00)
Udupi	2 (4.00)
Uttara Kannada	1 (2.00)
Sub total	12 (24.00)
Moderate Rainfall	
Bengaluru	5 (10.00)
Belagavi	1 (2.00)
Chikkamagaluru	2 (4.00)
Kolar	4 (8.00)
Kalaburagi	1 (2.00)
Hassan	2 (4.00)
Yadgir	1 (2.00)
Sub total	16 (32.00)
Low Rainfall	
Ballari	2 (4.00)
Chamarajanagar	1 (2.00)
Chikkaballapura	2 (4.00)
Chitradurga	1 (2.00)
Dharwad	1 (2.00)
Haveri	2 (4.00)
Mysuru	3 (6.00)
Raichur	2 (4.00)
Tumakuru	8 (16.00)
Sub total	22 (44.00)
Total	50 (100.00)

Note: Figures in the parenthesis are percentage to the total D

Districts were classified as High rainfall districts (>1200 mm) Moderate rainfall districts (600-1200 mm) and Low rainfall districts (<600 mm) based on the actual rainfall during the reference period.

Source: Primary data collected during Aug-Sep, 2017

4.3. Gender and Age of the Respondents

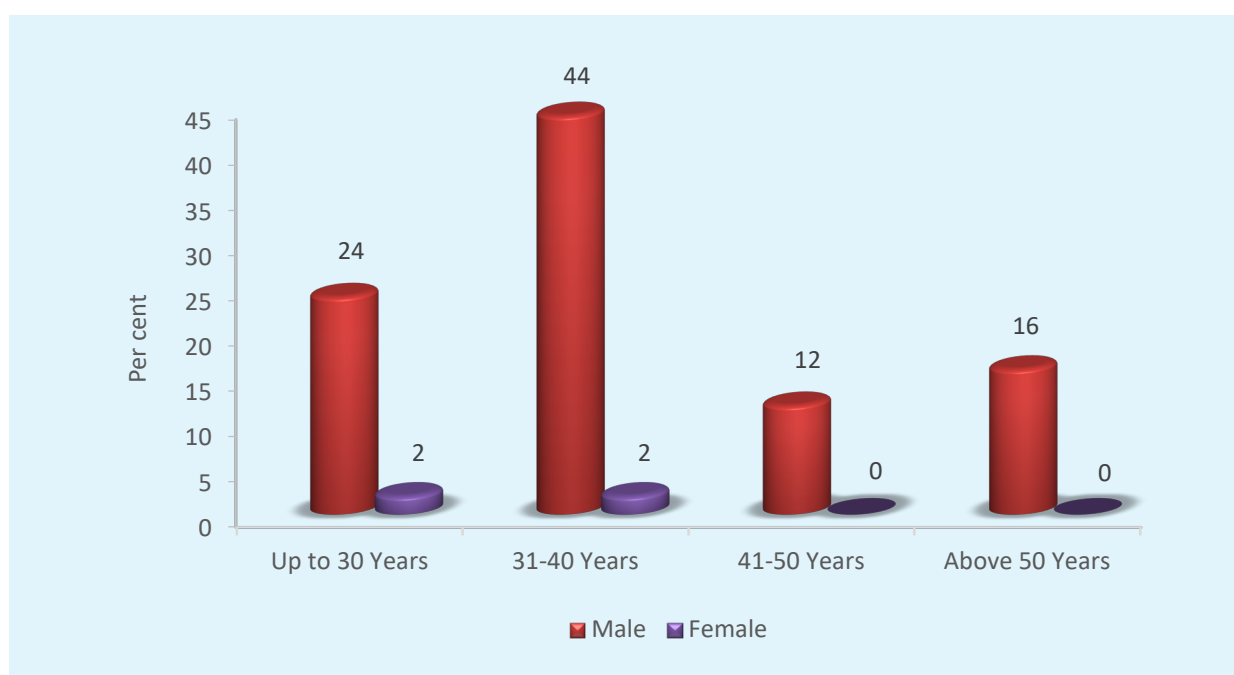
Among the total stakeholders, a majority of them were male (96.00%). About 44 per cent of the male stakeholders were in the age group of 31-40 years followed by 24 per cent in the age group of up to 30 years. (Table 4.5 and Figure 4.1).

Table 4.5: Classification of Stakeholders by Age and Sex Group

Age Group	Male	Female	Total
Up to 30 Years	12 (24.00)	1 (2.00)	13 (26.00)
31-40 Years	22 (44.00)	1 (2.00)	23 (46.00)
41-50 Years	6 (12.00)	0 (0.00)	6 (12.00)
Above 50 Years	8 (16.00)	0 (0.00)	8 (16.00)
Total	48 (96.00)	2(4.00)	50 (100.00)

Note: Figures in the parenthesis are percentage to the total
Source: Primary data collected during Aug-Sep, 2017

Figure 4.1: Classification of Stakeholders by Age



4.4. Education Level of Stakeholders

The education level of the stakeholders contacted was considerably high as most callers were officers heading agricultural department who are well educated. A larger proportion (82%) were graduates and above. Of them, the most (44%) were post-graduates and above (Table 4.6). Only 6 per cent of respondents studied up to high school. Stakeholders from the RSK and the Assistant Director of Agriculture were post graduates from those contacted. As such, one would expect that these highly educated officers would disseminate weather information to farmers promptly. Among the districts and rainfall category, a high proportion of stakeholders (22%) who were post graduates called from moderate rainfall regions.

Table 4.6: Distribution of Stakeholders by Education

Districts Based on Rainfall Category	High School	PUC	Graduate	Post Graduate & Above	Total Stakeholders
High Rainfall					
Dakshina Kannada	-	-	1 (2.00)	3 (6.00)	4
Kodagu	-	-	1 (2.00)	-	1
Shivamogga	-	-	2 (4.00)	2 (4.00)	4
Udupi	-	2 (4.00)	-	-	2
Uttara Kannada	-	-	1 (2.00)	-	1
Sub Total	-	2 (4.00)	5 (10.00)	5 (10.00)	12
Moderate Rainfall					
Bengaluru	-	-	1 (2.00)	4 (8.00)	5
Belagavi	-	-	1 (2.00)	-	1
Chikkamagaluru	1 (2.00)	-	-	1 (2.00)	2
Kolar	-	-	-	4 (8.00)	4
Kalaburagi	-	-	-	1 (2.00)	1
Hassan	-	1 (2.00)	1 (2.00)	-	2
Yadgir	-	-	-	1 (2.00)	1
Sub Total	1 (2.00)	1 (2.00)	3 (6.00)	11 (22.00)	16
Low Rainfall					
Ballari	-	-	1 (2.00)	1 (2.00)	2
Chamarajanagar	-	-	1 (2.00)	-	1
Chikkaballapura	-	-	-	2 (4.00)	2
Chitradurga	-	-	1 (2.00)	-	1
Dharwad	-	-	-	1 (2.00)	1
Haveri	-	-	1 (2.00)	1 (2.00)	2
Mysuru	-	2 (4.00)	1 (2.00)	-	3
Raichur	-	-	1 (2.00)	1 (2.00)	2
Tumakuru	2 (4.00)	1 (2.00)	5 (10.00)	-	8
Sub Total	2 (4.00)	3 (6.00)	11 (22.00)	6 (12.00)	22
Total	3 (6.00)	6 (12.00)	19 (38.00)	22 (44.00)	50 (100.00)

Note: Figures in Parenthesis are percentage to the total stakeholders
Source: Primary data collected during Aug-Sep, 2017

4.5. Sources of Awareness of Varuna Mitra

The agricultural officers at the village and taluk level ought to be aware of the services rendered by the Varuna Mitra, not only for undertaking their programmes on the Government farms, but also to deliver information on the Government programme and disseminate weather based information to the farmers in their jurisdiction. Unfortunately, many of the officers were completely aware of the programme and a few were aware of only one component of Varuna Mitra i.e. rainfall. On several occasions, the messages received from Varuna Mitra on rainfall and other parameter through SMS was not read by them properly. In most cases, they deleted these unread messages assuming they were advertisement or spam. This indicated that they neglected their duty to disseminate information to the farmers. This fact is also evident from the field data where only 8 per cent of the stakeholders (RSK and Agriculture Department) were aware of Varuna Mitra as compared to 46 per cent of the stakeholders who received information from friends (Table 4.7 and Figure 4.2). These findings were reiterated when they were contacted during the field survey in the sample districts. For instance, in Tumakuru (Chickkanayakanahalli Taluk)

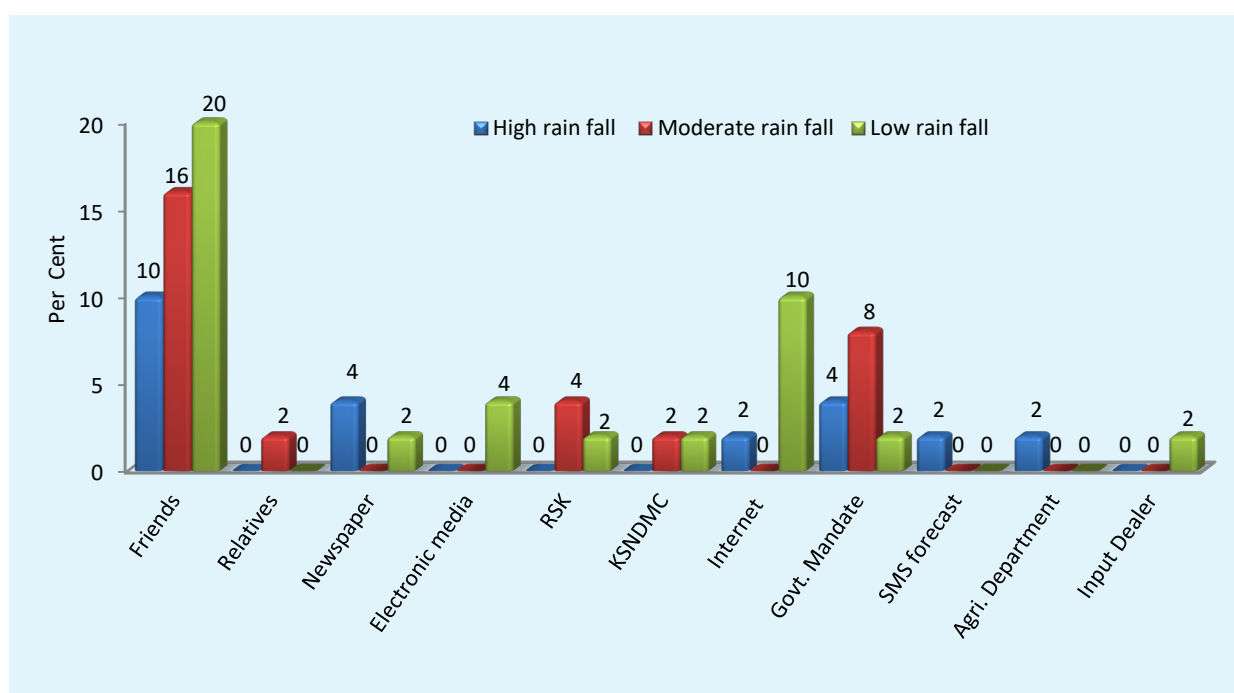
and Hassan (Channarayapatna) district, nine officials designated as AOs and ADAs were contacted to ascertain their view on the usage of Varuna Mitra services. However, it was surprising to find that except three officers, the others were not aware of Varuna Mitra. Those who received SMSs were neither disseminating the information to farmers nor using it while making decisions related to agricultural operations. Similarly, in Shivamogga and Chikkamagaluru districts, the stakeholders were not aware of other weather parameters such as temperature, humidity, wind speed and wind direction other than rainfall that Varuna Mitra services included. Further, most messages were unread and deleted, while none of them called the Varuna Mitra Help desk. A confounding fact was that, a majority of the agricultural officers (AOs & ADAs and PDOs) who received SMSs from Varuna Mitra were not aware of the sender or source/vendor of the weather information.

Table 4.7: Sources of Information to Stakeholders on Varuna Mitra Helpdesk

Source of information	High	Moderate	Low	Total
Friends	5 (10.00)	8 (16.00)	10 (20.00)	23 (46.00)
Relatives	-	1 (2.00)	-	1 (2.00)
News papers	2 (4.00)	-	1 (2.00)	3 (6.00)
Electronic and Print Media	-	-	2 (4.00)	2 (4.00)
Raitha Samparka Kendra (RSK)	-	2 (4.00)	1 (2.00)	3 (6.00)
KSNDMC	-	1 (2.00)	1 (2.00)	2 (4.00)
Internet	1 (2.00)	-	5 (10.00)	6 (12.00)
Government Mandate	2 (4.00)	4 (8.00)	1 (2.00)	7 (14.00)
SMS Messages on Forecast of Rainfall	1 (2.00)	-	-	1 (2.00)
Agricultural Department	1 (2.00)	-	-	1 (2.00)
Input Dealers	-	-	1 (2.00)	1 (2.00)
Total	12(24.00)	16 (32.00)	22 (44.00)	50 (100.00)

Source: Compiled from KSNDMC Data, 2017 Note: Figures in Parenthesis are percentage to the total.
Source: Primary data collected during Aug-Sep, 2017

Figure 4.2: Source of Information to the Stakeholders about Varuna Mitra



4.6. Information Sought By Stakeholders

It was presumed that the stakeholders sought forecasts on several weather based parameters to alter decisions on their farm or to disseminate information to farmers who in turn take follow up action to derive benefit from the forecast. The information gathered from the stakeholders clearly showed that the most sought information was on rainfall forecast that ranged between 14 per cent from callers in high rainfall districts to 42 per cent in Low rainfall districts (Table 4.8). Overall, 72 per cent of the stakeholders sought information on rainfall followed by 16 per cent of the stakeholders who sought information on both; rainfall and temperature. The rest (12%) sought information on other weather parameters including rainfall.

Table 4.8: Weather Based Information Sought by Stakeholders from Varuna Mitra Helpdesk during 2016-17

Weather Parameters	High Rainfall	Moderate Rainfall	Low Rainfall	Total
Rainfall forecast	7 (14.00)	8 (16.00)	21 (42.00)	36 (72.00)
Earthquake	1 (2.00)	-	-	1 (2.00)
Rainfall & Temperature	3 (6.00)	4 (8.00)	1 (2.00)	8 (16.00)
Rainfall forecast, Wind speed and Temperature	1 (2.00)	-	-	1 (2.00)
Rainfall, Relative humidity and Temperature	-	2 (4.00)	-	2 (4.00)
Rainfall forecast Wind direction and Temperature	-	1 (2.00)	-	1 (2.00)
Rainfall, Relative humidity and Wind speed	-	1 (2.00)	-	1 (2.00)
Total	12 (24.00)	16 (32.00)	22 (44.00)	50 (100.00)

Note: Figures in Parenthesis are percentage to the total number of stakeholders

Source: Primary data collected during Aug-Sep, 2017

4.7. Mode of Preference for Information

Over 64 per cent of the stakeholders were preferred direct interaction to seek information from the Varuna Mitra Help desk services while around 16 per cent preferred both mobile phone calls and text messages. Only 10 per cent preferred text messages and 4 per cent each of the stakeholders preferred both voice & text messages and both Mobile phone calls & voice messages (Table 4.9). A majority of them also preferred that direct interaction and messages should be in the local language i.e. Kannada (80.00%). However, 20 per cent would like to receive the information both in Kannada and English.

Table 4.9: Stakeholders Preference of Modes and Language of Information

Different Modes	No. of stakeholders
Preference Mode	
Direct Interaction with Help desk by Mobile Phone	32 (64.00)
Both Mobile Phone calls and Voice messages	2 (4.00)
Both Mobile Phone call and Text messages	8 (16.00)
Text messages	5 (10.00)
Both voice and text message	2 (4.00)
Any other (WhatsApp)	1 (2.00)
Total	50 (100.00)
Language preferred	
Kannada	40 (80.00)
Both Kannada and English	10 (20.00)
Total	50 (100.00)

Note: Figures in Parenthesis are percentage to the total

Source: Primary data collected during Aug-Sep, 2017

4.8. Seasons Wise Calls made by Stakeholders

The number of calls made by 50 stakeholders in three rainfall category districts during the reference year was 1,787 (Table 4.10). Of this, 284 calls that accounted for 15.89 per cent of the total were made use of for either taking decisions on agricultural operation or altering the agricultural operations. This indicated that a large segment of calls (79.69 per cent) were not considered in decision making due to the low expected prediction by the Varuna Mitra. Across the regions also the utilisation of calls was minimal except in the case of high rainfall regions where a higher proportion of calls (36.07 per cent) were utilised, when compared to other regions. The average calls made by each stakeholder were 36 and the calls that were utilised were six and dropped calls were about two.

Half of the stakeholders (50%) have called in all seasons. Barring this, a significant proportion of calls were made during Kharif season (23.00%) followed by Rabi (17.91%) and summer (9.23%). A similar trend has been observed across districts categorized by rainfall.

Table 4.10: Stakeholders Phone Calls Details for Different Seasons

Particulars	Season wise call details and percentage				
	Kharif	Rabi	Summer	All Seasons	Total
High Rainfall (n=12)					
Number of calls made	37(100.00)	1(100.00)	-	84(100.00)	122(100.00)
Number of calls dropped	1(2.70)	0(0.00)	-	6(7.14)	7(5.74)
Number of calls used for taking decision	16(43.24)	1(100.00)	-	27(32.14)	44(36.07)
Number of calls Ignored	20(54.05)	0(0.00)	-	51(60.71)	71(58.20)
Moderate Rainfall (n=16)					
Number of calls made	159(100.00)	114(100.00)	10(100.00)	315(100.00)	598(100.00)
Number of calls dropped	21(13.21)	10(8.77)	0(0.00)	31(9.84)	62(10.37)
Number of calls used for taking decision	17(10.69)	6(5.26)	4(40.00)	44(13.97)	71(11.87)
Number of calls Ignored	121(76.10)	98(85.96)	6(60.00)	240(76.19)	465(77.76)
Low Rainfall (n=22)					
Number of calls made	215(100.00)	205(100.00)	155(100.00)	492(100.00)	1067(100.00)
Number of calls dropped	1(0.47)	1(0.49)	1(0.65)	7(1.42)	10(0.94)
Number calls used for taking decision	19(8.84)	12(5.85)	2(1.29)	136(27.64)	169(15.84)
Number of calls Ignored	195(90.70)	192(93.66)	152(98.06)	349(70.93)	888(83.22)
Total (n=50)					
Total Number of calls made	411(100.00)	320(100.00)	165(100.00)	891(100.00)	1787(100.00)
Number of calls dropped	23(5.60)	11(3.44)	1(0.61)	44(4.94)	79(4.42)
Number of calls used for taking decision	52(12.65)	19(5.94)	6(3.64)	207(23.23)	284(15.89)
Number of calls Ignored	336(81.75)	290(90.63)	158(95.76)	640(71.83)	1424(79.69)

Note: Figures in Parenthesis are percentages to total number of calls made

Source: Primary data collected during Aug-Sep, 2017

4.9. Utilisation of Forecast Calls for Decision Making

As mentioned above, only 284 calls were utilised for some kind of decision making at different stages of crop growth as well as other purposes. The distribution of purposes for which they had used the forecast information has been listed in Table 4.11. A larger proportion of calls (19.72%) made by

agricultural department stakeholders were used for sowing related operations. This was followed by media reporters (15.49%), who used the information for publishing weather and rainfall bulletin in various local newspapers. The other purposes included - conducting field demonstration in the farmer's field by the agriculture department (10.56%) and application of plant protection chemicals (9.86%). The least proportion of calls was used in the case of transportation of goods by traders (0.70%). Among the rainfall regions, most stakeholders used a larger proportion of calls while harvesting in moderate rainfall region (11.27 per cent). Beside this, a few stakeholders used the forecast information to ensure adequate burning in brick kilns, filling of tanks, control of forest fires etc.

Table 4.11: Distribution of Respondents by Type of Usage of Information

Purpose of Usage	High rainfall				Moderate rainfall				Low rainfall				Total			
	Govt. Officers	Media	Public	Total	Govt. Officers	Media	Public	Total	Govt. Officers	Media	Public	Total	Govt. Officers	Media	Public	Total
Ploughing stage	-	-	-	-	4 (7.55)	-	-	4 (5.63)	21 (17.95)	-	-	21 (12.43)	25 (12.32)	-	-	25 (8.80)
Crop sowing	15 (45.45)	-	-	15 (34.09)	15 (28.30)	-	-	15 (21.13)	18 (15.38)	-	8 (34.78)	26 (15.38)	48 (23.65)	-	8 (21.62)	56 (19.72)
Fertilizer application	5 (15.15)	-	-	5 (11.36)	4 (7.55)	-	-	4 (5.63)	7 (5.98)	-	-	7 (4.14)	16 (7.88)	-	-	16 (5.63)
Harvesting	2 (6.06)	-	-	2 (4.55)	8 (15.09)	-	-	8 (11.27)	9 (7.69)	-	2 (8.70)	11 (6.51)	19 (9.36)	-	2 (54.41)	21 (7.39)
Plant protect cultivation	6 (18.18)	-	-	6 (13.64)	6 (11.32)	-	-	6 (8.45)	12 (10.26)	-	4 (17.39)	16 (9.47)	24 (11.82)	-	4 (10.81)	28 (9.86)
Man-made tank filling	1 (3.03)	-	-	1 (2.27)	3 (5.66)	-	-	3 (4.23)	5 (4.27)	-	-	5 (2.96)	9 (4.43)	-	-	9 (3.17)
Planting sapling in forest	-	-	-	-	1 (1.89)	-	-	1 (1.41)	15 (12.82)	-	-	15 (8.88)	16 (7.88)	-	-	16 (5.63)
Dissemination of information	2 (6.06)	-	-	2 (4.55)	6 (11.32)	-	-	6 (8.45)	8 (6.84)	-	-	8 (4.73)	16 (7.88)	-	-	16 (5.63)
Field demonstration	2 (6.06)	-	-	2 (4.55)	6 (11.32)	-	-	6 (8.45)	22 (18.80)	-	-	22 (13.02)	30 (14.78)	-	-	30 (10.56)
To Publish in news paper	-	5 (100)	-	5 (11.36)	-	10 (100)	-	10 (14.08)	-	29 (100)	-	29 (17.16)	-	44 (100)	-	44 (15.49)
To burn Bricks	-	-	4 (66.67)	4 (9.09)	-	-	-	-	-	-	8 (34.78)	8 (4.73)	-	-	12 (32.43)	12 (4.23)
Transportation	-	-	2 (33.33)	2 (4.55)	-	-	-	-	-	-	-	-	-	-	2 (5.41)	2 (0.70)
At the time of fire in forest	-	-	-	-	-	-	8 (100)	8 (11.27)	-	-	1 (4.35)	1 (0.59)	-	-	9 (24.32)	9 (3.17)
Total	33 (100)	5 (100)	6 (100)	44 (100)	53 (100)	10 (100)	8 (100)	71 (100)		117 (100)	29 (100)	23 (100)	169 (100)	203 (100)	44 (100)	37 (100)

Note: Figures in parenthesis are percentages to total decision-making calls

Source: Primary data collected during Aug-Sep, 2017

4.10. Perceptions of Stakeholders on the Quality of Calls

The stakeholders were happy and satisfied with the quality of calls and the response received from the Varuna Mitra help desk services. Irrespective of rainfall regions, an overwhelming majority of stakeholders (80%) indicated that the quality of calls was good stood. About 16 per cent were neutral and only a negligible per cent of callers (4%) were unsatisfied with the quality of calls (Table 4.12).

Table 4.12: Perception of Stakeholders on the Quality of Calls

Particulars	Good	Neutral	Poor	Total
High Rainfall area	8 (66.67)	3 (25.00)	1 (8.33)	12 (100.00)
Moderate Rainfall area	13 (81.25)	3 (18.75)	0 (0.00)	16 (100.00)
Low Rainfall area	19 (86.36)	2 (9.09)	1 (4.54)	22 (100.00)
Total	40 (80.00)	8 (16.00)	2 (4.00)	50 (100.00)

Note: Figures in Parenthesis are percentages to number of stakeholders

Source: Primary data collected during Aug-Sep, 2017

4.11. Accuracy Level of Information

According to the stakeholders, there were differences in the accuracy levels of forecast. About 52 per cent of the stakeholders have indicated that the prediction was accurate to the extent of 90-100 per cent. About 22 per cent indicated that the accuracy levels were between 70-80 per cent and an equal number of stakeholders were of the opinion that the accuracy levels were between 50-60 per cent (Table 4.13). A negligible proportion (4%) of the stakeholders indicated that the forecast was very poor i.e. between 30 to 40 per cent.

Table 4.13: Distribution of Stakeholders by Accuracy of the Information

Accuracy level (%)	No. of Respondents	Percentage to No. of Respondents
10-20	0	0.00
30-40	2	4.00
50-60	11	22.00
70-80	11	22.00
90-100	26	52.00
Total	50	100.00

Source: Primary data collected during Aug-Sep, 2017

4.12. Usefulness of Information Provided by Varuna Mitra

The forecast information provided by Varuna Mitra to the stakeholders has not been utilized for altering of decisions related to their respective activities. However, an overwhelming proportion of stakeholders of all categories (94.00%) opined that the rainfall forecast provided was very useful. Almost all stakeholders, the general public category of callers indicated that the information was useful. Only one person in the media and two persons in the Government officers' category indicated that the information was not useful (Table 4.14).

Table 4.14: Perception of Stakeholders on Phone Calls

Different sectors	Designation	Level of usefulness		
		Useful	Not useful	Total
Government	Agricultural Officers	13 (92.86)	1 (7.14)	14 (100.00)
	Assistant Agricultural Officers	3 (100.00)	-	3 (100.00)
	Forest Officers	2 (66.67)	1 (33.34)	3 (100.00)
	PDO	2 (100.00)	-	2 (100.00)
Media	Senior Reporters and District Correspondents	15 (93.75)	1 (6.25)	16 (100.00)
Public	Bricks Industry	2 (100.00)	-	2 (100.00)
	Industrialists	2 (100.00)	-	2 (100.00)
	Agricultural Inputs Vendors	1 (100.00)	-	1 (100.00)
	Lawyers	2 (100.00)	-	2 (100.00)
	Traders	5 (100.00)	-	5 (100.00)
Total		47 (94.00)	3 (6.00)	50.00 (100.00)

Note: Figures in Parenthesis are percentage to total calls

Source: Primary data collected during Aug-Sep, 2017

4.13. Constraints

Out of the 50 sample stakeholders, 43 indicated particular constraints that they encountered while availing the services of Varuna Mitra. Several (52.54%) stakeholders expressed that the information provided Varuna Mitra on rain forecast was not wholly accurate at the aggregate level as well as across the rainfall regions (Table 4.15). The other important problems that they indicated were call dropping (15.25%) followed by the irregularity in sending SMSs (13.56%). The other problems were poor response of calls, busy line, delay in getting information and poor voice clarity were also mentioned by a few stakeholders.

Table 4.15: Constraints Reported by Stakeholders

Constraints	High Rainfall (n=12)	Moderate Rainfall (n=16)	Low Rainfall (n=22)	Total (n=50)
Sometimes information is not accurate	7 (43.75)	8 (50.00)	16 (59.26)	31 (52.54)
Not getting SMS Regularly	2 (12.5)	3 (18.75)	3 (11.11)	8 (13.56)
Call dropping	2 (12.5)	3 (18.75)	4 (14.81)	9 (15.25)
Line busy	3 (18.75)	2 (12.50)	1 (3.70)	6 (10.16)
Delay in getting Information	1 (6.25)	-	-	1 (1.69)
Voice clarity	1 (6.25)	-	1 (3.70)	2 (3.38)
Poor response to call	-	-	2 (7.41)	2 (3.38)
Total	16 (100.00)	16 (100.00)	27 (100.00)	59 (100.00)

Note: Figures in Parenthesis are percentage to total

Source: Primary data collected during Aug-Sep, 2017

4.14. Suggestions

Few suggestions were offered by 88 per cent of the stakeholders for the improvement of Varuna Mitra services and they have been listed in **Table 4.16**. The most persistent suggestion by 34.92 per cent of the stakeholders was to upgrade the accuracy of the information provided to derive utility from the forecast information. More than 19 per cent have indicated the calls were charged and had to be made toll-free as they would call frequently at different stages of crop growth. An important suggestion was that apart from weather information, they require agro advisory services (23.81%) otherwise the utility of the forecast would have little impact in enhancing the production and reducing the cost. The suggestions across the different rainfall category districts were almost homogeneous.

Table 4.16: Suggestions Offered by the Stakeholders

Constraints	High Rainfall (n=12)	Moderate Rainfall (n=16)	Low Rainfall (n=22)	Total (n=50)
Need more accuracy	5 (29.41)	4 (22.22)	13 (46.43)	22 (34.92)
Toll free call	3 (17.65)	4 (22.22)	5 (17.86)	12 (19.04)
Awareness programme on Varuna Mitra Services	2 (11.76)	3 (16.67)	-	5 (7.93)
Maintain checker boards at every Panchayath and RSK level regarding weather related information	2 (11.76)	-	-	2 (3.17)
Increase in number of Tele Lines	1 (5.88)	2 (11.11)	3 (10.71)	6 (9.52)
Information through E-mails	1 (5.88)	-	-	1 (1.58)
Add Agro-Advisory Services	3 (17.64)	5 (27.78)	7 (25.00)	15 (23.81)
Total	17 (100)	18 (100)	28 (100)	63 (100)

*Note: Figures in Parenthesis are percentage to total
Source: Primary data collected during Aug-Sep, 2017*

In addition, the following suggestions were given by the districts' Deputy Director of Agriculture in various districts for the improvement of Varuna Mitra.

- Weekly Advisories of weather based information is essential to farmers rather than the long term forecast as the latter are not reliable.
- The rainfall information during kharif season is very important for the farmers and likewise during rabi season, availability of water for livestock prompts them to call for forecasts.
- The elected representatives at all levels and departments need to be sent the rainfall information, so that they can communicate this information at relevant points of interaction.

- The weather information is essential for taking up sowing, plant protection activities on the agriculture departmental farms.
- During the harvesting stage, the rainfall information is required for harvesting of ground nut, crop cutting, drying the crop etc.
- Apart from the weather based information, additional services have to be provided to take up agricultural operations from seed to seed.
- The information should be region and crop specific instead of forecast for entire State and all crops.
- A group of agricultural scientists from the Universities of Agriculture, Horticulture, Veterinary and KVK'S should collaborate with Varuna Mitra to impart effective advisories to farmers.

4.15. Case Studies

1. **Mr. Lakshmipathi** of Tumakuru district (07022133507) was an NGO worker who distributed 150 free SIM Cards to farmers to help them obtain information on agriculture. He later changed his profession and started agriculture. As an agriculturist, he contacted Varuna Mitra help desk service to enquire about the occurrence of rainfall before proceeding with harvesting of crops and sowing of ragi. The information was to enable him to get an idea on when he has to prepare the land, arrange for seeds and apply of fertilizers. Based on rainfall information obtained, he had taken precautionary measures during harvest season and had commenced harvesting irrespective of rainfall events forecasted by Varuna Mitra. Owing to this, he incurred crop loss considerably. Nonetheless, he was satisfied with the forecast information that he considered to have an accuracy of 80 per cent accurate and indicated that the information was useful and the quality of the calls were good. He opined that direct calling were better than SMS as messages were likely to be deleted unread. He recalls have calling Varuna Mitra 30-35 times last year and disseminating the information received to nearly 10-15 members. He also conveyed the Varuna Mitra telephone number to nearly 5-6 members in his neighborhood.

2. **Mr. Kumar** of Raichur district (9611933482) works as a contractor who undertakes road works such as asphaltting and metaling. Prior to undertaking any assignment, he called Varuna Mitra to enquire on the rainfall forecast. If rainfall was predicted, he halted road asphaltting and employed the labourers in construction activities.

3. **Mr. Vijayaprasad** (7760291456) is an Assistant Executive Engineer in the irrigation department in Sirguppa taluk of Ballari district. At the district level meeting of political leaders and officials of the department, it was decided to release water to paddy expecting rain would come sooner. However, it did not rain which resulted in a decrease in storage (80TMC) in the dam. Following which, the concerned irrigation supervisor of the department decided to ration the water distribution for the crops. The farmers were unhappy with the rationing of the water and demanded more water for their crop. In order to appease the farmers, the officer contacted Varuna Mitra help desk service twice in September 2016 and once in November 2016 to obtain the rainfall forecast to inform the awaiting farmers in the command area of Tungabhadra dam farmers. Mr. Vijayaprasad opined that the response from Varuna Mitra was quick and rainfall was predicated to occur in 1 or 2 days due to the depression in the Bay of Bengal. As

60-70% of the forecasted rainfall occurred, it helped farmers save their paddy crop during that season as only 42 TMC of water remained in the dam. For dissemination of weather based information, he suggested establishment of a wing comprising of horticulture, agriculture and allied sectors to broadcast weather based information in villages covering 3-4 panchayats.

4. Mr. Prashanth (8056560286), an officer in the horticulture department in Bengaluru Urban district has been gathering rainfall information from Varuna Mitra help desk and passed it to the cabinet minister. However, he was unaware of the purpose for which it was sought.

5. Mr. Jayadeep Ray (9902775577) of Dakshina Kannada (Ujire) learnt about Varuna Mitra from a website that he accessed to ascertain whether tremors felt by his employees in the firm were validated. In the process, he found that the KSNDMC also provided information on earthquakes in the state, and therefore contacted this agency. Post enquiring about the probability that tremors could also be attributed to mining and blasting around the area from the caller, KSNDMC contacted the Seismological Centre which provides real time earthquake information in the state and informed Mr. Ray that there are no earthquakes in the area. This confirmation of an unlikely possibility of earthquake relieved his employees' anxiety at the firm. Mr. Ray was happy with the prompt delivery of information and also suggested that a seismological centre be set up in the Western Ghats region of Karnataka.

6. Mr. Parks, a Briklin industrialist in Mysore consulted Varuna Mitra approximately 10-15 times in the last reference period (2016-17) for rainfall information. The purpose of consulting was to take precautionary measures prior to firing up the brick kiln. On receiving confirmation of the possibility of rainfall from Varuna Mitra, he covered the whole unit using a tarpaulin. Assuming he had not covered the unit, he would have incurred a loss of Rs. 70,000. He is satisfied with the 80-90 per cent accuracy of forecast of rainfall. This positive experience prompted him to pass on the Varuna Mitra number to his friends. One of them was a farmer contemplating harvesting paddy, while another was experiencing leaf crop of his papaya crop due to a dry spell.

7. Mr. Nijaguni, a press reporter in Dharwad sought rainfall forecast information to publish weather bulletins in the newspaper. Prior to this, he was sourced the information from the University of Agricultural Science, Dharwad. As the information was old and inaccurate he switched over to Varuna Mitra that was comparatively up-to-date and more accurate (80-90%). He suggested that Varuna Mitra should provide the forecast of a particular day along with information related to that day/s in the last three years which would help callers review the accuracy levels.

8. Veena, a Post Graduate student of Dharwad Agricultural University approached the Indian Institute of Statistical Institute, Bangalore and the Directorate of Economics and Statistics, Government of Karnataka for rainfall data on normal years and drought years to prepare her dissertation on fodder availability. As she could not obtain the required information, a web search led her to seek information from KSNDMC. She wrote to KSNDMC and promptly received the information that helped her complete her dissertation on time.



Post-harvest
management of onion
crop at Raichur district

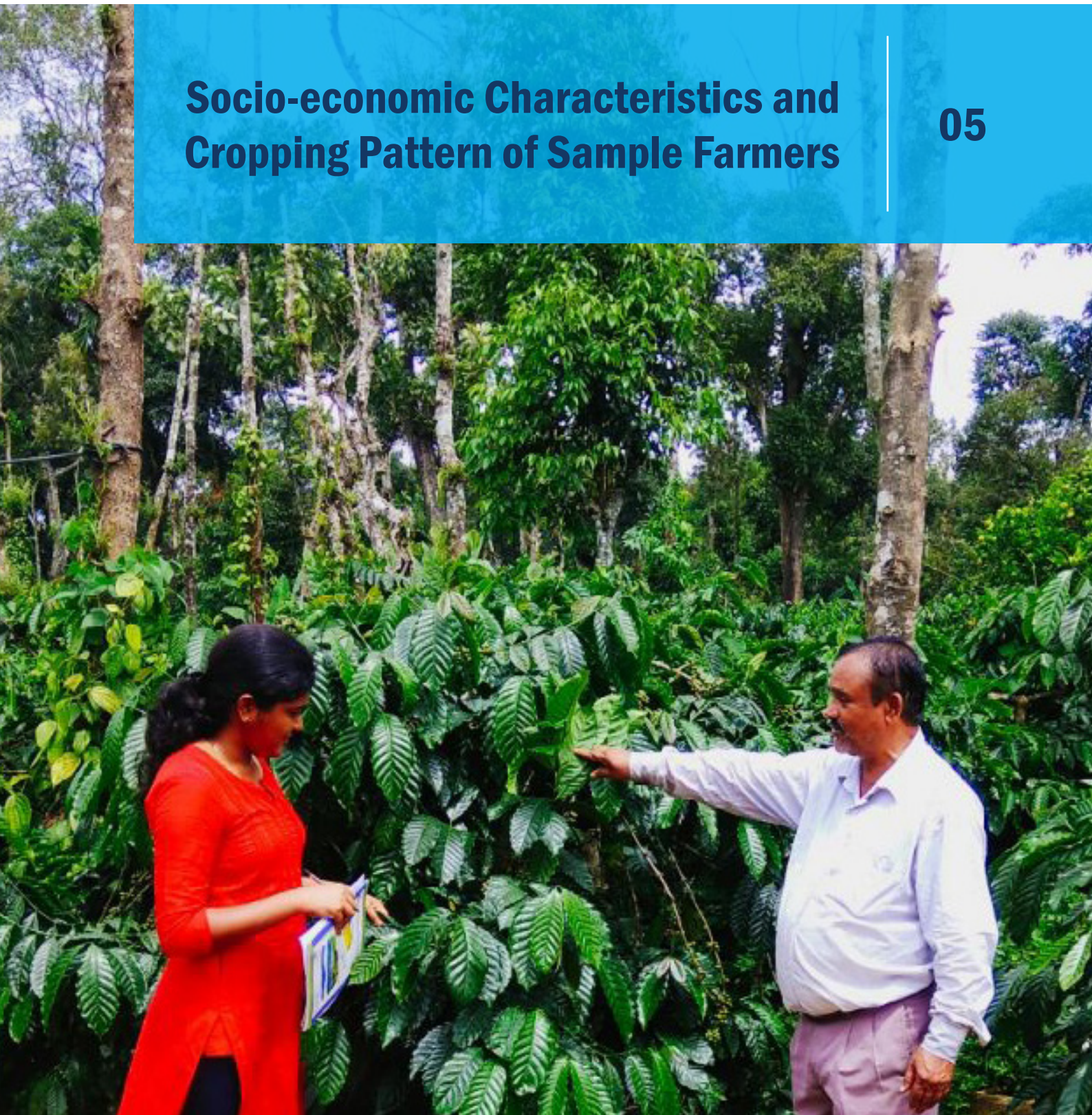


PPC application in cotton
plot of sample farmer in
Raichur district



Socio-economic Characteristics and Cropping Pattern of Sample Farmers

05



Socio-economic Characteristics and Cropping Pattern of Sample Farmers

CHAPTER 5

5.1. Socio-economic profile

The sample farmers were interviewed for demographic information like, gender, social status, literacy level and family size to characterize the sample. Information on their net income from different sources, operational holding, cropping pattern and irrigation details were also collected. The results of the analysis on these indicators have been presented below.

5.1.1. Gender and Social category

The district-wise classification of farmers based on gender and social status is provided in **Table 5.1**. All the farmers were male and there were no female farmers in six out of the nine districts. Female farmers were identified in Dakshina Kannada and Udupi (2.67%), Shivamogga (0.67%) and Chikkamagaluru (1.33%) from high and moderate rainfall regions. At the aggregate level, 99.48 per cent were male and remaining was female.

Table 5.1: Distribution of farmers by Gender and Social category

Region/District	% to the total						Total No. of farmers
	Gender		Social category				
	Male	Female	SC	ST	OBC	General	
Dakshina Kannada & Udupi	97.33	2.67	4.67	2.67	54.67	38.00	150
Kodagu	100.00	0.00	0.00	12.00	66.67	21.33	150
Shivamogga	99.33	0.67	1.33	6.67	54.67	37.33	150
High rainfall region Total	98.89	1.11	2.00	7.11	58.67	32.22	450
Chikkamagaluru	98.67	1.33	4.00	8.67	39.33	48.00	150
Hassan	100.00	0.00	1.33	26.00	66.67	6.00	150
Kolar	100.00	0.00	12.67	3.33	62.00	22.00	150
Moderate rainfall region Total	99.56	0.44	6.00	12.67	56.00	25.33	450
Tumakuru	100.00	0.00	6.67	7.33	58.00	28.00	150
Ballari	100.00	0.00	12.67	14.00	45.33	28.00	150
Raichur	100.00	0.00	11.33	8.00	60.67	20.00	150
Low rainfall region Total	100.00	0.00	10.22	9.78	54.67	25.33	450
Grand Total (%)	99.48	0.52	6.07	9.85	56.45	27.63	100.00
Grand Total (Nos.)	1343	7	82	133	762	373	1350

Source: Primary data collected during Aug-Sep, 2017

In terms of social status of sample farmers, the Scheduled Caste (SC) farmers were highest (12.67%) in Kolar as well as in Ballari, while the lowest were in Shivamogga and Hassan (1.33%). Scheduled Tribe (ST) farmers in Hassan accounted for the highest (26%) and the lowest (2.67%) was in Dakshina Kannada and Udupi. The OBC farmers ranged between 39.33 in per cent in Chikkamagaluru to 66.67 per cent in Kodagu and Hassan. The general category farmers were lowest at 6 per cent in Hassan and highest was 48 per cent in Chikkamagaluru.

Across rainfall regions, the maximum number of SC farmers (10.22%) was in the low rainfall region and lowest (2.00 %) was in high rainfall region. At state level, OBC farmers accounted for the highest percentage. At the aggregate level, 56.45 per cent of the farmers were OBC followed by general (27.63%), SC and ST (16%) farmers.

5.1.2. Family size

The district-wise family size of farmers is given in **Table 5.2**. The family size of a farmer, at the aggregate level was six. It is implied that a typical representation of farm family observed in the survey comprised of husband, wife, children and parents. However, smaller families consisting of four members were prevalent among the farm households of Kodagu and Tumakuru districts. Kolar, Raichur and Ballari had a family size of seven members.

The farmers with family size of four to six members were highest in moderate rainfall region accounting for 37 per cent of the total number of farmers falling under this group. The lowest of 27 per cent of farmers falling under this group were located in low rainfall region. The remaining 36 per cent were in high rainfall region. Overall at state level, the family size of 5 was reported.

Nearly, half of the adult family members were engaged in agriculture at aggregate level. The similar trend was observed in all rainfall regions. District level results indicate that, Tumakuru topped the list wherein, 80 per cent of adult family members were engaged in agriculture, followed by Kodagu (75%) and Kolar (62%). In the remaining districts, the family members engaged in agriculture varied from 40 to 46 per cent. It is noted that, large household sizes no longer translate into family labour as unlike the past, family members are also engaged in off-farm activities, children attend schools and there has been significant out-migration. Thus indicating lack of interest in agriculture alone which is also in line with the National Sample Survey results (NSSO, 2003), which shows that 40% of the farmers would like to quit agriculture if given an alternate choice because it is risky and no more profitable.

Table 5.2 Distribution of gender, Family size and Proportion of farmers depending on agriculture

Region/District	Gender (% to the total)			Average family size (Nos.)	Per cent of adult family members engaged in agriculture to the total
	Male (>15years)	Female (>15years)	Children (<15years)		
Dakshina Kannada & Udupi	42.44	39.52	18.04	5.25	43.72
Kodagu	37.20	34.78	28.02	4.14	75.17
Shivamogga	38.87	35.50	25.63	5.54	45.95
High rainfall region Total	39.66	36.71	23.63	4.98	52.75
Chikkamagaluru	42.10	36.91	20.99	5.53	46.56
Hassan	40.56	39.89	19.55	5.01	41.98
Kolar	39.59	36.24	24.16	6.57	62.38
Moderate rainfall region Total	40.69	37.53	21.78	5.70	51.07
Tumakuru	32.20	31.22	36.59	4.10	79.74
Ballari	38.1	34.76	27.14	7.00	41.18
Raichur	32.57	34.57	32.86	7.00	44.11
Low rainfall region Total	34.62	33.89	31.49	6.03	50.38
Grand Total (%)	38.19	35.97	25.84	5.57	51.35
Grand Total (Nos.)	2872	2705	1943	7520	2864

Source: Primary data collected during Aug-Sep, 2017

5.1.3. Classification of farmers by age group

The district-wise distribution of farmers by age group is given in **Table 5.3**. The minimum age was 18 years and around 4 per cent of the farmers were above 60 years. Ballari had the highest number of farmers in the age group of 18 to 35 years and the lowest in this age group were from DK and Udupi (26%). The farmers between the age group of 36 to 60 years were highest in Dakshina Kannada & Udupi (63.33%) and the lowest was from Ballari (48%). The farmers above 60 years were highest in Dakshina Kannada and Udupi (10.67%) and a few farmers in this district were also over 80 years. While in Hassan, interestingly farmers comprised of young and middle aged members with none above 60 years.

Across the rainfall regions, farmers in the age group of 36 to 60 years were highest and at the aggregate level, this group constituted 57 per cent of total farmers.

Table 5.3: Distribution of farmers by age group

Region/District	Per cent to the total farmers		
	18-35 years	36-60 years	Above 60 years
Dakshina Kannada & Udupi	26.00	63.33	10.67
Kodagu	43.33	55.33	1.34
Shivamogga	30.00	62.67	7.33
High rainfall region Total	33.11	60.44	6.45
Chikkamagaluru	36.00	56.00	8.00
Hassan	43.33	56.67	0.00
Kolar	42.00	53.33	4.67
Moderate rainfall region Total	40.44	55.33	4.23
Tumakuru	38.00	61.33	0.67
Ballari	50.00	48.00	2.00
Raichur	44.67	54.00	1.33
Low rainfall region Total	44.22	54.44	1.34
Grand Total (%)	39.26	56.74	4.00
Grand Total (Nos.)	530	766	54

Source: Primary data collected during Aug-Sep, 2017

5.1.4. Educational Status

The district-wise distribution of farmers by education level is given in **Table 5.4**. A sizeable number of farmers had graduation and post-graduation in several districts. While, graduates were present in all the nine districts, post-graduate farmers were only in a few districts. Of them, Chikkamagaluru district had the highest per cent (7.33) of post-graduate farmers.

On the other hand, the absolute illiterate farmers were only 3 per cent of the total number of farmers. The highest illiteracy rate of 7.33 per cent was found in Ballari district. In the remaining districts, the illiteracy rate ranged from 2.67 per cent in Chikkamagaluru to 5.33 per cent in Hassan. All the farmers of Dakshina Kannada and Udupi, Kodagu and Tumakuru districts were literates.

The illiterate farmers were lowest in High rainfall region (1.11%) and highest in low rainfall region (4%). Highest per cent of farmers with education up to primary level were in low rainfall region (6%)

and lowest was in moderate rainfall region (1.33%). The farmers with secondary education were in the range of 77 to 78 per cent in all the three regions. Graduates were in higher number in high rainfall and moderate regions. At the state level, farmers with up to secondary education constitute 78 per cent and graduates at 14 per cent to the total farmers.

Table 5.4: Educational status

Region/District	(Per cent to the total farmers)				
	Illiterates	Up to primary	Up to Secondary	Up to Graduate	Above graduate
Dakshina Kannada and Udupi	0.00	0.00	78.67	18.67	2.67
Kodagu	0.00	0.00	92.00	8.00	0.00
Shivamogga	3.33	12.67	65.33	17.33	1.33
High rainfall region total	1.11	4.22	78.67	14.67	1.33
Chikkamagaluru	2.67	3.33	66.00	20.67	7.33
Hassan	5.33	0.00	91.33	3.33	0.00
Kolar	3.33	0.67	74.00	20.00	2.00
Moderate rainfall region total	3.78	1.33	77.11	14.67	3.11
Tumakuru	0.00	4.00	92.67	3.33	0.00
Ballari	7.33	8.00	65.33	17.33	2.00
Raichur	4.67	6.00	76.00	13.33	0.00
Low rainfall region total	4.00	6.00	78.00	11.33	0.67
Grand Total (%)	2.96	3.85	77.93	13.56	1.70
Grand Total (Nos.)	40	52	1052	183	23

Source: Primary data collected during Aug-Sep, 2017

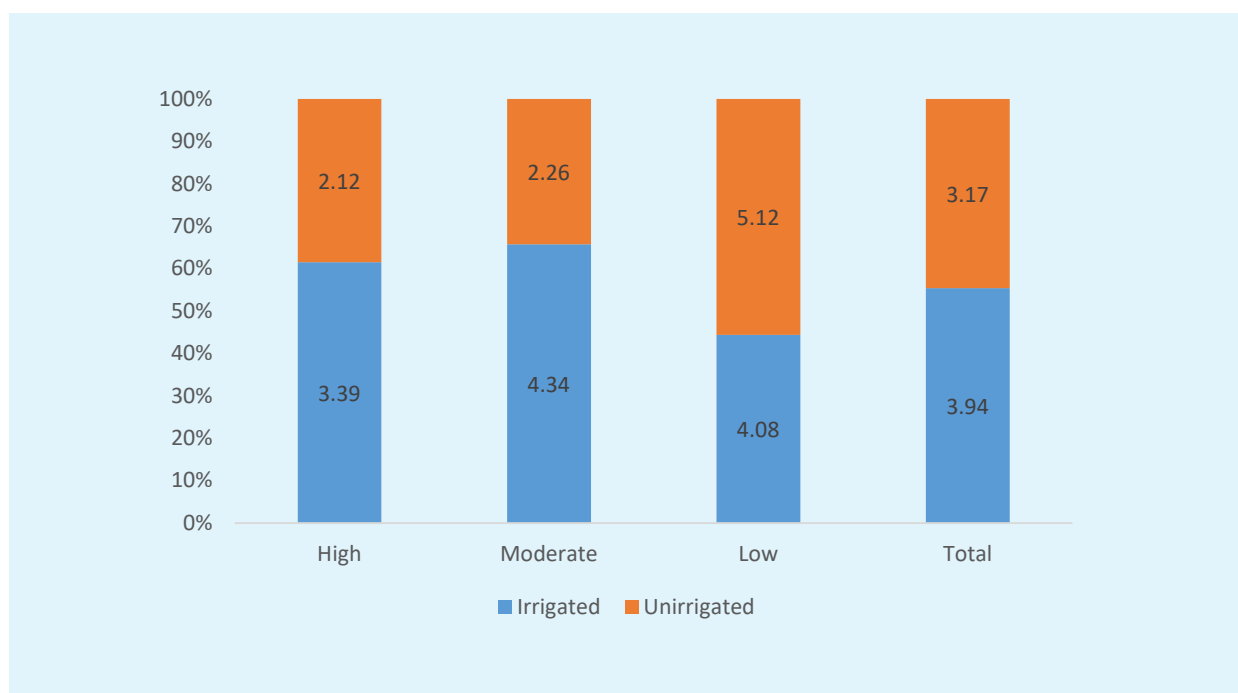
5.2. Characteristics of operational holdings

The district-wise distribution of farmers by operational holding is given in **Table 5.5**. The total operational land holding of the farmers in the study area was around 9588 acres with around 55 per cent of total operational area was under irrigation. The average area worked out to 7.11 acres per farmer at aggregate level. The highest operational farm size was in Raichur (13.64 acres) and the lowest was in Hassan (3.48 acres). On the basis of irrigated land, the highest irrigated area per farmer was in Chikkamagaluru (7.86 acres) and lowest irrigated area per farmer was in Tumakuru (1.12 acres).

Across the rainfall regions, the low rainfall region had the highest per farmer operational holding (9.20 acres) followed by moderate rainfall area (6.60 acres). However, the moderate rainfall region farmers operated the highest irrigated area (4.34 acres). The distribution of operational land by irrigation status is depicted in **Figure 5.1**.

At aggregate level 55 per cent of the operated area was irrigated either from surface water or ground water and remaining area depends mainly on rainfall. The estimates are closer to the state figures.

Percentage of drip/ sprinkler to the total irrigated area across districts indicates that, Kodagu has the highest drip/sprinkler area (97%), followed by Hassan (87%), Chikkamagaluru (82%) and Kolar (77%). It is strange to note that, highest micro-irrigated area was reported in Moderate rainfall region (81%) followed by High rainfall region (71%) and Low rainfall region (2%). The lower micro-irrigated area reported in low rainfall region specifically Raichur and Ballari because of access to surface water irrigation.

Figure 5.1: Distribution of operational land by irrigation status**Table 5.5: Operational land owned by sample farmers**

Region/District	Total operational area in acres			Per Household area in acres			Percentage of drip/ sprinkler to the total irrigated area
	Irrigated	Un-irrigated	Total	Irrigated	Un-irrigated	Total	
Dakshina Kannada & Udupi	440.00	224.50	664.50	2.95	1.51	4.46	55.25
Kodagu	588.50	276.50	865.00	3.92	1.84	5.77	97.45
Shivamogga	494.33	451.68	946.00	3.30	3.01	6.31	54.85
High rainfall region Total	1522.83	952.68	2475.50	3.39	2.12	5.51	71.39
Chikkamagaluru	1178.88	232.50	1411.38	7.86	1.55	9.41	82.95
Hassan	188.00	334.50	522.50	1.25	2.23	3.48	87.20
Kolar	586.88	450.43	1037.30	3.91	3.00	6.92	77.75
Moderate rainfall region Total	1953.75	1017.43	2971.18	4.34	2.26	6.60	81.80
Tumakuru	168.00	380.50	548.50	1.12	2.54	3.66	20.54
Ballari	852.60	693.70	1546.30	5.68	4.62	10.31	1.06
Raichur	817.00	1229.50	2046.50	5.45	8.20	13.64	0.37
Low rainfall region Total	1837.60	2303.70	4141.30	4.08	5.12	9.20	2.45
Grand Total	5314.18	4273.80	9587.98	3.94	3.17	7.11	51.52

Source: Primary data collected during Aug-Sep, 2017

5.2.1. Classification of farmers based on operational holdings

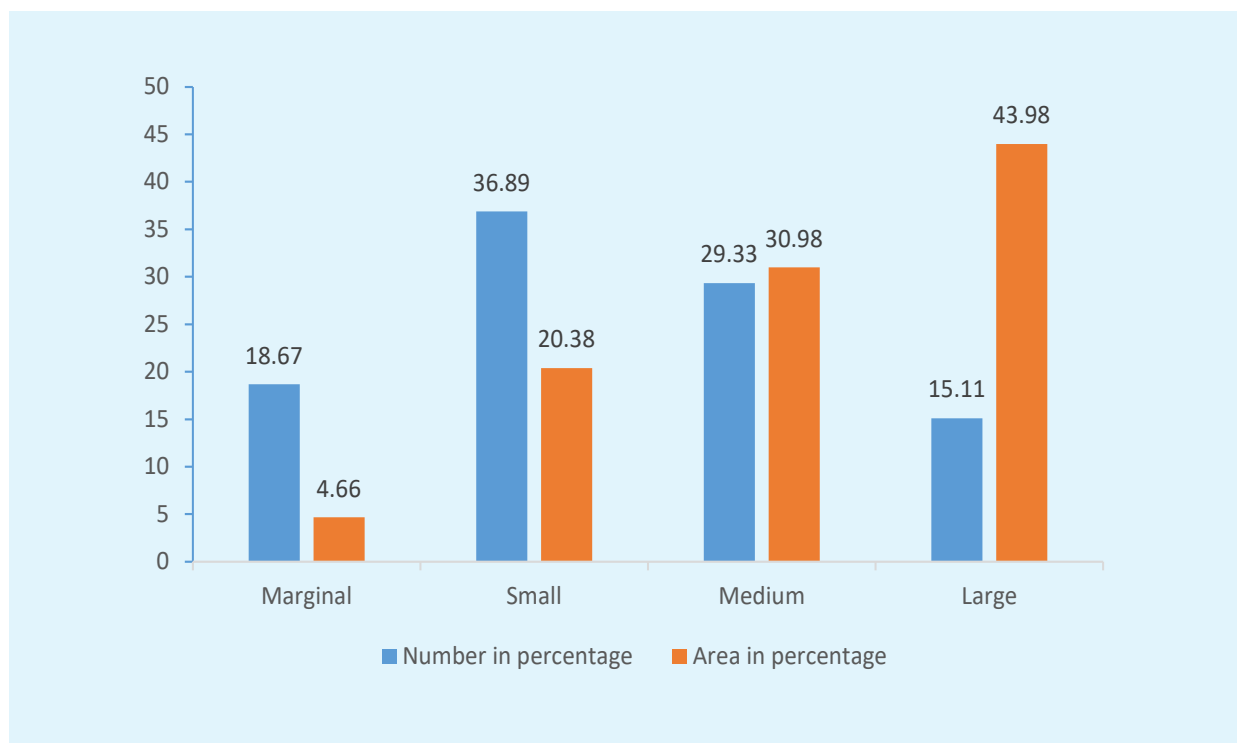
The farmers were classified as marginal, small, medium and large based on the size of the operational holdings. The farmers who have operated up to 2.50 acres were classified as marginal, 2.51 to 5 acres as small, 5.01 to 10 as medium and above 10 acres as large farmers. **Table 5.6** presents the number of farmers in each of these categories and their corresponding operational land.

The number of marginal farmers were highest in Dakshina Kannada and Udupi (47%), followed by Hassan (40%) and Tumakuru (29%), while small farmers were highest in Tumakuru (55%) followed by Kodagu (51%), Shivamogga (46%) and Hassan (45%). The percentage of Medium farmers was highest in Chikkamagaluru (52%), followed by Kodagu (46%) and Raichur (41%), while large farmers were found to be highest in Ballari (35%), and followed by Raichur (33%) and Chikkamagaluru (27%).

Across regions, marginal farmers were found to be highest in High and Moderate rainfall region (20% each), while small farmers were found to be highest in High rainfall region (44%). Medium farmers were relatively higher in Moderate rainfall region (30%) and large farmers in low rainfall region (23%).

At the aggregate level, 19 per cent of the marginal farmers were operated 4.66 per cent of the area, 37 per cent of the small farmers operated 20 per cent of the area, 30 per cent of the medium farmers operated 31 per cent of the area and 15 per cent of the large farmers operated 44 per cent of the area. Thus, indicating in-equity in distribution of operational land among marginal, small, medium and large farmers, which is clearly depicted in **Figure 5.2**. The inequity was found to be higher in low rainfall region as compared to moderate and high rainfall region.

Figure 5.2. Distribution of land by number and size of the holdings



The average operated area was highest in Raichur (13.64 acres) followed by Ballari (10.31 acres), Chikkamagaluru (9.41 acres) and Kolar (6.92 acres) across districts. The average operated area was higher in low rainfall region (9.2 acres) followed by moderate rainfall region (6.6 acre) and high rainfall region (5.5 acre). At state level the average operated area worked out to 7.11 acres.

Table 5.6: Classification of farmers based on operational land holdings

Region/District	Marginal farmer			Small farmer			Medium farmer			Large farmer			Total operated area	Total operated area Per sample farmer
	No of farmers to the total (%)	Area (% to total)	Avg. operation area (Acres)	No of farmers to the total (%)	Area (% to total)	Avg. operation area (Acres)	No of farmers to the total (%)	Area (% to total)	Avg. operation area (Acres)	No of farmers to the total (%)	Area (% to total)	Avg. operation area (Acres)		
Dakshina Kannada & Udupi	47.33	17.08	1.60	34.67	31.23	3.99	10.00	17.61	7.80	8.00	34.09	18.88	664.50	4.46
Kodagu	0.00	0.00	0.00	51.33	39.08	4.39	46.00	54.68	6.86	2.67	6.24	13.50	865.00	5.77
Shivamogga	11.33	3.30	1.84	46.00	27.59	3.78	28.67	35.10	7.72	14.00	34.01	15.32	946.00	6.31
High rainfall Total	19.56	5.85	1.64	44.00	32.58	4.07	28.22	37.25	7.26	8.22	24.33	16.28	2475.50	5.51
Chikkamagaluru	1.33	0.35	2.50	20.00	8.93	4.20	52.00	41.09	7.43	26.67	49.63	17.51	1411.38	9.41
Hassan	40.00	21.72	1.89	44.67	48.42	3.78	13.33	22.97	6.00	2.00	6.89	12.00	522.50	3.48
Kolar	20.00	5.40	1.87	39.33	21.90	3.85	26.00	29.36	7.81	14.67	43.35	20.44	1037.30	6.92
Moderate rainfall Total	20.44	5.87	1.90	34.67	20.40	3.89	30.44	33.80	7.33	14.44	39.92	18.25	2971.18	6.60
Tumakuru	29.33	14.13	1.76	55.33	52.87	3.49	14.67	30.81	7.68	0.67	2.19	12.00	548.50	3.66
Ballari	12.00	2.04	1.75	21.33	8.35	4.03	32.00	23.20	7.47	34.67	66.42	19.75	1546.30	10.31
Raichur	6.67	0.90	1.85	19.33	5.96	4.21	41.33	25.24	8.33	32.67	67.90	28.36	2046.50	13.64
Low rainfall Total	16.00	3.08	1.77	32.00	13.07	3.76	29.33	25.21	7.91	22.67	58.64	23.81	4141.30	9.20
TOTAL	18.67	4.66	1.77	36.89	20.38	3.92	29.33	30.98	7.50	15.11	43.98	20.67	9587.98	7.10

Note: Marginal= Up to 2.5 acres; Small = 2.5 to 5 acres; Medium = 5 to 10 acres; Large = above 10 acres

Source: Primary data collected during Aug-Sep, 2017

5.3. Sources of irrigation

The district-wise area irrigated from ground water and surface water sources have been given in **Table 5.7**. Ground water included open wells and Tube wells whereas surface water included canal, tank and ponds.

Most of the area was irrigated using ground water in districts like Hassan (100%), Tumakuru (100%), Kolar (98%), Dakshina Kannada & Udupi (86%) and Shivamogga (83%). In the remaining districts it was dominated by either surface water or both ground water and surface water (Conjunctive use).

Out of the irrigated area, 48 per cent was irrigated through ground water, 43 per cent using surface water and 9 per cent using both surface and ground water (Conjunctive use) at aggregate level. The percentage of ground water irrigated area was relatively higher in moderate rainfall region followed by high and low rainfall region. Interestingly, the surface water irrigation was relatively higher in low rainfall region because of the access to canal water. Conjunctive use was relatively higher in moderate and low rainfall region because of physical and economic scarcity of water.

Table 5.7: Sources of irrigation

Region / District	Ground water		Surface water		Both surface water and Ground water		Average irrigated area in acres
	Per cent of irrigated area out of total irrigated area	Per sample farmer (Acres)	Per cent of irrigated area out of total irrigated area	Per sample farmer (Acres)	Per cent of irrigated area out of total irrigated area	Per sample farmer (Acres)	
Dakshina Kannada & Udupi	85.57	2.51	12.16	0.36	2.27	0.07	2.95
Kodagu	1.27	0.05	98.73	3.87	0.00	0.00	3.92
Shivamogga	82.96	2.73	1.52	0.05	15.53	0.51	3.30
High rainfall Total	52.14	1.76	42.16	1.43	5.70	0.19	3.39
Chikkamagaluru	31.13	2.45	45.45	3.57	23.42	1.84	7.86
Hassan	100.00	1.25	0.00	0.00	0.00	0.00	1.25
Kolar	97.87	3.83	1.45	0.06	0.68	0.03	3.91
Moderate rainfall Total	57.81	2.51	27.86	1.21	14.34	0.62	4.34
Tumakuru	100.00	1.12	0.00	0.00	0.00	0.00	1.12
Ballari	39.30	2.23	47.91	2.72	12.78	0.73	5.68
Raichur	13.40	0.73	86.60	4.72	0.00	0.00	5.45
Low rainfall Total	33.34	1.36	60.73	2.48	5.93	0.24	4.08
Grand Total	47.72	1.88	43.32	1.71	8.95	0.35	3.94

Source: Primary data collected during Aug-Sep, 2017

5.3.1. Investment on functioning wells

The district-wise number of functioning wells and investment per well and per farmer has been presented in Table 5.8. Around 58 per cent of the functional wells were installed after 2010 and 33 per cent during 2000-2010. Few farmers' drilled/dug open wells and tube wells as recent as 2017 in all the districts except Kodagu. As surface water is more dependable, farmers in Kodagu were not keen on drilling of new wells. A fact worthy of mention was that, a few wells that were dug during the 1960s are still functional

in Ballari, Chikkamagaluru, Kolar and Udupi. While, Hassan was the only district where there were no functional wells prior to the year 2000 and only after 2010 farmers started investing on open wells and tube wells. Hence, around three-fourth of the total number of wells in Hassan among the farmers were installed after 2010.

In most of the districts the depth of wells and investment has increased by several folds. For instance, during the 1970s, in Kolar district, farmers could access water at a depth of 200 to 250 feet, which increased to 1000 feet and above after 2010 due to high probability of well failure and lack of access to surface water irrigation. Similarly in Tumakuru, the water table which was at around 150 feet in 1982 has further deepened to 1200 feet in 2016 and later. Due to the increasing depth to reach ground water, the investment towards ground water resources has significantly escalated. This increase was mainly due to increase in cost of drilling and installation and maintenance cost.

Table 5.8: Number of functioning wells and investment

Region/District	Wells dug before the year 2000			Wells dug between the years 2000 to 2010			Wells dug after the year 2010		
	No. of wells	Invest per well in Rs. thousands	Investment per farmer in Rs. Thousands	No. of wells	Invest per well in Rs. Thousands	Investment per farmer in Rs. Thousands	No. of wells	Invest per well in Rs. thousands	Investment per farmer in Rs. thousands
Dakshina Kannada & Udupi	17	81.59	9.25	35	85.71	20.00	43	106.3	30.47
Kodagu	1	50.00	0.33	1	80.00	0.53	1	200	1.33
Shivamogga	2	37.50	0.50	40	110.88	29.57	120	144.13	115.30
High rainfall Total	20	75.60	3.36	76	98.88	16.70	164	134.55	49.04
Chikkamagaluru	2	2.50	0.03	34	132.65	30.07	49	159.71	52.17
Hassan	0	0.00	0.00	18	161.67	19.40	55	260.91	95.67
Kolar	17	68.41	7.75	58	222.86	86.17	97	313.69	202.85
Moderate rainfall Total	19	61.47	2.60	110	184.96	45.21	201	261.71	116.90
Tumakuru	10	62.20	4.15	42	141.90	39.73	65	287.69	124.67
Ballari	16	9.69	1.03	37	60.54	14.93	41	113.91	31.13
Raichur	6	16.00	0.64	12	35.00	2.80	16	73.13	7.80
Low rainfall Total	32	27.28	1.94	91	94.73	19.16	122	201.15	54.53
Grand Total	71	50.04	2.63	277	131.70	27.02	487	203.72	73.49

Source: Primary data collected during Aug-Sep, 2017

5.4. Sources of income

The district-wise per farmer net income from different sources has been presented in **Table 5.9**. The net income from Agriculture, Allied activities and non-agriculture sources for the period from July, 2016 to June, 2017 worked out to approximately Rs.3.52 lakhs per farmer. Agriculture was the main source of income for farmers in all the districts. It constituted around 89 per cent of their total income. The income for farmers of Kodagu and Hassan was mostly from Agriculture.

Allied activities like dairy, poultry and fishery formed only around 2.5 per cent of the total income of farmers. However, dairy constituted around 5.1 per cent of total income in Dakshina Kannada & Udupi and 5.8 per cent in Kolar. The contribution of poultry and fishery to net income was negligible in all the districts, thus indicating lack of enterprise diversification such as dairy, poultry, fisheries etc.

Average net income was highest at Rs.8.87 lakh per farmer in Chikkamagaluru and lowest in Tumakuru (Rs.1.32 Lakh). Per farmer net income of farmers from Kolar, Raichur, Kodagu, Dakshina Kannada & Udupi and Ballari was almost similar.

Table 5.9: Income of farmers from different sources (Per farmer)

Region/District	Percentage to the total average net income						Average net income (Rs.)
	Agriculture (Rs.)	Dairy (Rs.)	Poultry (Rs.)	Fisheries (Rs.)	Other allied activities (Rs.)	Non-agriculture (Rs.)	
Dakshina Kannada & Udupi	60.95	5.10	0.00	2.01	0.15	31.80	265603
Kodagu	99.94	0.00	0.06	0.00	0.00	0.00	284094
Shivamogga	90.58	0.84	0.00	0.00	0.97	7.60	601823
High rainfall region Total	86.05	1.61	0.01	0.46	0.54	11.31	383840
Chikkamagaluru	91.32	0.58	0.53	0.00	0.04	7.53	887004
Hassan	97.17	2.83	0.00	0.00	0.00	0.00	140053
Kolar	83.62	5.80	0.15	0.00	0.22	10.21	306593
Moderate rainfall region Total	90.16	2.02	0.38	0.00	0.07	7.36	444550
Tumakuru	92.24	3.95	0.00	0.00	0.00	3.81	132082
Ballari	93.40	0.67	0.00	0.00	0.63	5.30	263134
Raichur	91.11	0.47	0.00	0.00	1.92	6.50	295306
Low rainfall region Total	92.20	1.21	0.00	0.00	1.06	5.53	230174
Grand Total	89.12	1.70	0.17	0.17	0.46	8.39	352855

Source: Primary data collected during Aug-Sep, 2017

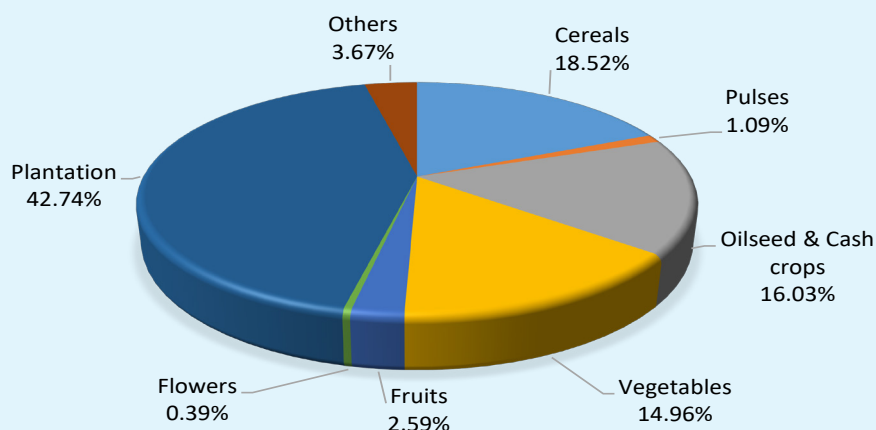
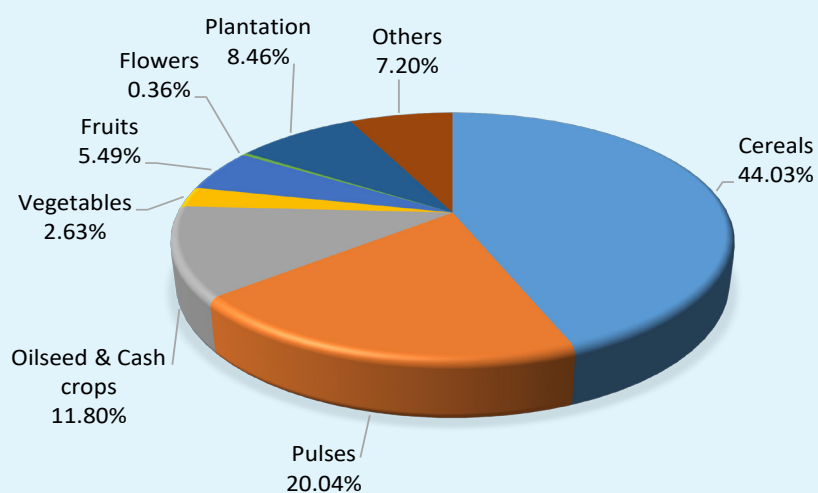
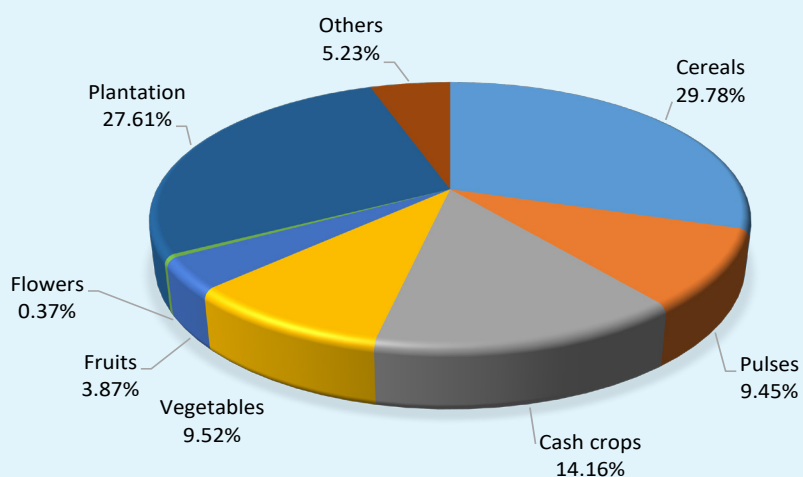
5.5. Cropping pattern

The cropping pattern depends on access to irrigation. The cropping pattern presented in the **Table 5.10**, **Table 5.11** and **Table 5.12** for irrigated, un-irrigated and overall.

The primary data pertaining to cropping pattern of the farmers was collected for one year from July 2016 to June 2017 period. Within this reference period, the crops sown during July 2016 and harvested during October 2016 have been considered as Kharif crops. Rabi crops refer to those crops that were sown in November 2016 and harvested in February 2017 or even before that. All the crops sown during March 2017 and harvested during June 2017 have been grouped under summer crops. However, the sowing and harvesting months and duration of each season varied slightly from district to district. Apart from these three seasonal crops, the cropping pattern included annual and perennial crops. Cultivation of intercrops was noticed in annual or perennial crops.

The farmers were cultivating as many as 72 different types of crops. Few crops were being cultivated as inter-crop also. All these crops have been broadly classified into eight groups. They are cereals, pulses, oil seeds & cash crops, fruits, vegetables, flowers, plantation and other crops.

The per cent share of these crop groups out of GCA in irrigated, un-irrigated and both irrigated and un-irrigated area is given in **Figure 5.3**, **Figure 5.4** and **Figure 5.5** respectively.

Figure 5.3: Per cent share of different crop groups out of GCA in irrigated area**Figure 5.4: Per cent share of different crop groups out of GCA in un-irrigated area****Figure 5.5: Per cent share of different crop groups out of GCA in both irrigated and un-irrigated area**

Around half of the gross irrigated area was occupied by plantation crops and oil seeds & cash crops. Coffee and Arecanut as main crop and pepper as intercrop were the important plantation crops. Kodagu and Chikkamagaluru districts were the chief coffee growing areas. There were several coffee farmers in Shivamogga district also. Among un-irrigated crops, cereals, pulses and oil seeds & cash crops accounted for around three-fourth of gross un-irrigated area. At aggregate level, around 60 per cent of GCA was under Cereals, Plantation crops, Oil seeds and cash crops.

Arecanut is the most preferred crop in Dakshina Kannada & Udupi followed by Shivamogga and Chikkamagaluru. In these two districts paddy is cultivated during the Kharif season. However, they produce paddy mainly for their self-consumption than for commercial purposes. The farmers of Hassan district were more inclined towards coconut as per the per cent of area under coconut out of its GCA during the reference period. Mango cultivation was the most important crop of Kolar. Thus, annual crops occupied relatively higher proportion of their respective GCA in all the three districts of moderate rainfall. The farmers of low rainfall area confined themselves to Kharif crops which is evident from the fact that around 90 per cent GCA of low rainfall area was under Kharif.

Cereal crops were being cultivated in all the study districts. Hence, Cereal crops had occupied highest area of around 30 per cent of the GCA of study area. Cultivation of Paddy, Ragi, Jowar and Maize were the chief cereal crops. In fact, at aggregate level, as a per cent to GCA of study area, the cultivated area of Paddy was next only to Coffee. Paddy, excepting Kolar, was one of the top 10 crops of every district measured as a per cent to GCA of respective districts. However, instead of paddy, Ragi was one of the top 10 crops in Kolar district. The districts of Chikkamagaluru and Kodagu are known primarily for coffee cultivation. As such, these two districts had lowest cereal area of around 14 per cent and 10 per cent of their GCA respectively. Kolar, which is moving towards horticulture, also had only 16 per cent of its GCA under cereal crops.

Plantation crops gained second position with around 28 per cent area out of aggregate GCA. But, cultivation of plantation crops was confined mainly to districts belonging to High rainfall and Moderate rainfall regions. Even among these two regions, there was absolutely no plantation crop area in Kolar district of moderate rainfall zone. The farmers of Tumakuru district owned coconut and arecanut trees. These two plantation crops accounted for around 28 per of its GCA. The other two districts of low rainfall area had virtually no plantation crops. Therefore, at rainfall region level, the low rainfall region had only around 5 per cent of its GCA under plantation. This is a negligible area as compared to high and moderate rainfall zones. Coffee in Chikkamagaluru and Kodagu, Arecanut in Dakshina Kannada & Udupi, Coconut in Tumakuru were the important districts of study area as far the plantation crops are concerned in the study. While arecanut and coconut were main crop in few districts, these two plantation crops were cultivated as inter crops in few districts. The coffee cultivators were cultivating pepper as an intercrop invariably.

The cash crops or commercial crops like Cotton, Ginger and Sugarcane together accounted for around 14 per cent of sum of GCA of all study districts. This share of cultivated area qualifies commercial crops to be the third most preferred crop of farmers. However, barring Raichur district, the per cent of area to GCA is not conspicuously visible in any of the study districts. At the most, Shivamogga and Ballari can be accorded some credit for pushing.

Pulses have not gained importance in any of the sample districts excluding Tumakuru and Raichur which are low rainfall areas. Kolar had devoted almost 72 per cent of its GCA for fruits and vegetable crops. No other districts had fruits and vegetables area worth mentioning. Jasmine and marigold were the only

two types of flowers that were observed in Kolar and Ballari districts with an area less than 2 per cent of their GCA.

In irrigated area at aggregate level, plantation crops (42.7%) occupied the highest area followed by cereals (19%), cash crops (16%) and vegetables (15%). In the case of low rainfall region cash crops (39%) accounted for the highest share, followed by cereals (34%) and vegetables (15%), where as in case of high rainfall region plantation crops (76%) occupied highest area, followed by cereals (15%) and others (7%). In moderate rainfall region, plantation crops (55%) occupied highest share in the cropping area followed by vegetables (26%) and cereals (7%). Overall it can be clearly seen from the **Table 5.10** that plantation, cereals, vegetables and cash crops are major.

Table 5.10: Cropping pattern in irrigated area

Region/District	% to the total irrigated area								Total area (acre)
	Cereals	Pulses	Oilseed & Cash crops	Vegetables	Fruits	Flowers	Plantation	Others	
D. Kannada & Udupi	58 (71.55)	-	9.25 (0)	-	9.25 (37.84)	-	348 (76.21)	7 (0)	431.5 (71.89)
Kodagu	26 (0)	-	-	3 (0)	-	-	529 (100)	-	558 (94.8)
Shivamogga	133.5 (70.56)	-	7 (0)	-	7 (85.71)	-	253.63 (58.35)	104.5 (100)	505.63 (69.76)
High rainfall Total	217.5 (62.39)	-	16.25 (0)	3 (0)	16.25 (58.46)	-	1130.63 (83.33)	111.5 (93.72)	1495.13 (79.72)
Chikkamagaluru	65.5 (96.95)	-	2 (100)	68.5 (96.35)	2 (0)	-	905.5 (87.05)	9 (100)	1052.5 (88.24)
Hassan	2 (0)	-	-	8 (100)	-	-	211.75 (92.18)	-	221.75 (91.63)
Kolar	65.25 (86.97)	7.5 (13.33)	89 (67.42)	447.75 (84.48)	89 (6.74)	20.25 (14.81)	-	46.5 (38.71)	765.25 (68.34)
Moderate rainfall Total	132.75 (90.58)	7.5 (13.33)	91 (68.13)	524.25 (86.27)	91 (6.59)	20.25 (14.81)	1117.25 (88.02)	55.5 (48.65)	2039.5 (81.14)
Tumakuru	34 (91.18)	-	21 (0)	9 (88.89)	35 (97.14)	-	104 (40.38)	-	203 (56.65)
Ballari	449 (75.06)	8 (0)	224 (66.52)	204 (96.32)	-	1 (0)	-	-	886 (77.03)
Raichur	186 (61.56)	44.5 (91.19)	530 (97.74)	83 (98.8)	-	-	-	35 (0)	878.5 (89.58)
Low rainfall Total	669 (72.12)	52.5 (82.86)	775 (86.06)	296 (96.79)	35 (97.14)	1 (0)	104 (40.38)	35	1967.5 (80.53)
Grand Total	1019.25 (74.9)	60 (77.37)	882.25 (82.63)	823.25 (89.74)	142.25 (38.31)	21.25 (14.12)	2351.88 (83.64)	202 (78.74)	5502.13 (80.37)

Note: Figures in parenthesis indicates percentage of area to the respective total for which farmers have been benefited using Varuna Mitra information.

Source: Primary data collected during Aug-Sep, 2017

In un-irrigated area at state level, cereals (44%) covered highest area followed by pulses (20%), cash crops (12%), plantation crops (7%) and others (8%). It is interesting to note that cereals (64%) occupied highest area to the total area in high rainfall region. (**Table 5.11**).

It was further noticed that farmers in moderate rainfall area have followed higher diversification as compared to low and high rainfall region.

Table 5.11: Cropping pattern in Un-irrigated area

Region/District	% to the total unirrigated area								Total area (acre)
	Cereals	Pulses	Oilseed & Cash crops	Vegetables	Fruits	Flowers	Plantation	Others	
D. Kannada & Udipi	141 (64.89)	27.5 (3.64)	7.5 (93.33)	1.5 (0)	2.5 (100)	0.5 (0)	60.25 (76.35)	-	240.75 (61.47)
Kodagu	51 (49.02)	-	-	-	3 (0)	-	111 (95.5)	-	165 (79.39)
Shivamogga	344.53 (64.21)	-	3.25 (7.69)	-	0.5 (0)	-	35 (65.71)	49.75 (98.49)	433.03 (67.77)
High rainfall Total	536.53 (62.94)	27.5 (3.64)	10.75 (67.44)	1.5 (0)	6 (41.67)	0.5 (0)	206.25 (84.85)	49.75 (98.49)	838.78 (68.25)
Chikkamagaluru	120.63 (88.8)	3 (0)	14.5 (93.1)	54.5 (110.09)	-	-	6 (58.33)	12.75 (47.06)	211.38 (89.94)
Hassan	201.5 (91.32)	35 (0)	-	-	-	-	96 (84.38)	5.5 (100)	338 (80.03)
Kolar	109 (96.79)	6.5 (0)	3 (33.33)	38.5 (40.26)	227.5 (26.24)	-	-	30 (10)	414.5 (44.56)
Moderate rainfall Total	431.13 (92)	44.5 (0)	17.5 (82.86)	93 (81.18)	227.5 (26.24)	-	102 (82.84)	48.25 (30.05)	963.88 (66.95)
Tumakuru	247.5 (84.24)	94 (23.94)	2 (0)	-	-	-	59.5 (78.99)	-	403 (68.98)
Ballari	574 (46.88)	23 (17.39)	49.5 (62.63)	18 (100)	5 (90)	15 (0)	-	-	684.5 (47.71)
Raichur	124.5 (47.39)	682 (49.56)	433 (96.77)	2 (100)	-	-	-	215 (66.89)	1456.5 (66.04)
Low rainfall Total	946 (56.72)	799 (50.63)	484.5 (92.88)	20 (100)	5 (90)	15 (0)	59.5 (78.99)	215 (66.89)	2544 (61.57)
Grand Total	1913.65 (65.11)	871 (46.56)	512.75 (92)	114.5 (82.53)	238.5 (27.97)	15.5 (0)	367.75 (83.34)	313 (66.24)	4346.65 (64.31)

Note: Figures in parenthesis indicates percentage of area to the respective total for which farmers have been benefited using Varuna Mitra information.

Source: Primary data collected during Aug-Sep, 2017

Considering both irrigated and unirrigated area (Table 5.12), cereals (30%) covered the highest area followed by plantation (28%), cash crops (14%), vegetables (10%) and pulses (9%). Cereals, cash crops and pulses are the major crops grown in low rainfall region; plantation, vegetables, cereals and fruits in moderate rainfall region; plantation and cereals in high rainfall region.

At aggregate level, 73 per cent of the total area is being used with the Varuna Mitra information for taking farming related decisions in irrigated area, whereas in unirrigated area, it is 58 per cent. Considering both irrigated and un-irrigated the percentage worked out to 69. Among crop categories vegetables ranked first place with 89%, followed by cash crops (82%), plantation (74%), cereals (68%) and pulses (47%).

Table 5.12: Cropping pattern in both irrigated and unirrigated area

Region / District	% to the total irrigated and unirrigated area								Total area (acre)
	Cereals	Pulses	Oilseed & Cash crops	Vegetables	Fruits	Flowers	Plantation	Others	
Dakshina Kannada & Udupi	199 (66.83)	27.5 (3.64)	16.75 (41.79)	1.5 (0)	11.75 (51.06)	0.5 (0)	408.25 (76.23)	7 (0)	672.25 (68.16)
Kodagu	77 (32.47)	-	-	3 (0)	3 (0)	-	640 (99.22)	-	723 (91.29)
Shivamogga	478.03 (65.98)	-	10.25 (2.44)	-	7.5 (80)	-	288.63 (59.25)	154.25 (99.51)	938.65 (68.84)
High rainfall Total	754.03 (62.78)	27.5 (3.64)	27 (26.85)	4.5 (0)	22.25 (53.93)	0.5 (0)	1336.88 (83.57)	161.25 (95.19)	2333.9 (75.6)
Chikkamagaluru	186.13 (91.67)	3 (0)	16.5 (93.94)	123 (102.44)	2 (0)	-	911.5 (86.86)	21.75 (68.97)	1263.88 (88.53)
Hassan	203.5 (90.42)	35 (0)	-	8 (100)	-	-	307.75 (89.75)	5.5 (100)	559.75 (84.63)
Kolar	174.25 (93.11)	14 (7.14)	92 (66.3)	486.25 (80.98)	316.5 (20.76)	20.25 (14.81)	-	76.5 (27.45)	1179.75 (59.99)
Moderate rainfall Total	563.88 (91.66)	52 (1.92)	108.5 (70.51)	617.25 (85.5)	318.5 (20.63)	20.25 (14.81)	1219.25 (87.59)	103.75 (40)	3003.38 (76.59)
Tumakuru	281.5 (85.08)	94 (23.94)	23 (0)	9 (88.89)	35 (97.14)	-	163.5 (54.43)	-	606 (64.85)
Ballari	1023 (59.25)	31 (12.9)	273.5 (65.81)	222 (96.62)	5 (90)	16 (0)	-	-	1570.5 (64.25)
Raichur	310.5 (55.88)	726.5 (56.5)	963 (97.3)	85 (98.82)	-	-	-	250 (57.53)	2335 (74.9)
Low rainfall Total	1615 (63.1)	851.5 (51.32)	1259.5 (88.69)	316 (96.99)	40 (96.25)	16 (0)	163.5 (54.43)	250 (57.53)	4511.5 (69.84)
Grand Total	2932.9 (68.51)	931 (47.15)	1395 (86.08)	937.75 (88.96)	380.75 (30.52)	36.75 (8.16)	2719.63 (83.62)	515 (65.79)	9848.78 (73.28)

Note: Figures in parenthesis indicates percentage of area to the respective total for which farmers have been benefited using Varuna Mitra information.

Source: Primary data collected during Aug-Sep, 2017.

As farmers reported decision making using Varuna Mitra information only for major crops, this percentage in reality is even higher because farmers have used information for taking decision in case of other crops also.

The cropping pattern considering major crops in irrigated and un-irrigated area presented in the **Table 5.13**. In case of cereals, paddy and maize are the major crops in the irrigated area, where as Maize, Ragi and paddy in un-irrigated area and Paddy, Maize and Ragi in both irrigated and un-irrigated area.

Table 5.13: Cropping pattern in irrigated and un-irrigated area by crops

Crop category	Crops	Irrigated area	Un-irrigated area	Both irrigated and un-irrigated area
Cereals	Jowar	85.5 (65.5)	155.5 (27.01)	241 (40.66)
	Maize	261 (76.32)	702.5 (41.82)	963.5 (51.17)
	Paddy	596.5 (73.26)	493.15 (74.95)	1089.65 (74.03)
	Ragi	68.75 (97.09)	521.5 (100)	590.25 (99.66)
	Others *	7.5 (60)	41 (46.34)	48.5 (48.45)
	Sub total	1019.25 (74.9)	1913.65 (65.11)	2932.9 (68.51)
Pulses	Bengal gram	9 (27.78)	276 (54.35)	285 (53.51)
	Red gram	45 (66.67)	428 (54.21)	473 (55.39)
	Others *	6 (16.67)	167 (14.07)	173 (14.16)
	Sub total	60 (55.83)	871 (46.56)	931 (47.15)
Oil seeds & Cash crops	Cotton	674 (98.07)	419 (99.28)	1093 (98.54)
	Ground nut	102 (66.67)	69.75 (74.19)	171.75 (69.72)
	Others *	106.25 (0)	24 (16.67)	130.25 (3.07)
	Sub total	882.25 (82.63)	512.75 (92)	1395 (86.08)
Fruits	Mango	78 (0)	224 (26.88)	302 (19.93)
	Others *	64.25 (84.82)	14.5 (24.14)	78.75 (73.65)
	Sub total	142.25 (38.31)	238.5 (26.71)	380.75 (31.04)
Flowers	Jasmine	1 (0)	9.5 (0)	10.5 (0)
	Marigold	20.25 (14.81)	6 (0)	26.25 (11.43)
	Sub total	21.25 (14.12)	15.5 (0)	36.75 (8.16)
Planation crops	Arecanut	864.625 (71.24)	45.5 (45.05)	910.125 (69.94)
	Coffee	1199.5 (96.02)	111 (95.5)	1310.5 (95.97)
	Others *	287.75 (69.3)	211.25 (85.21)	499 (76.03)
	Sub total	2351.875 (83.64)	367.75 (83.34)	2719.625 (83.6)
Vegetables	Tomato	261 (100)	13.5 (0)	274.5 (95.08)
	Chilli	273 (95.42)	20.5 (87.8)	293.5 (94.89)
	Others *	289.25 (75.45)	80.5 (95.03)	369.75 (79.72)
	Sub total	823.25 (89.86)	114.5 (82.53)	937.75 (88.96)
Others *		202 (65.1)	313 (66.24)	515 (65.79)
Grand total		5502.125 (80.37)	4346.65 (64.31)	9848.78 (73.28)

Note: Figures in parenthesis indicates % of area to the respective total for which farmers have been benefited using Varuna Mitra information.

* Others include Avare, Bajra, Banana, Beans, Bengal gram, Blackgram, Bottle gourd, Brinjal, Cabbage, Capsicum, Cashewnut, Cauliflower, Coriander, Dhawana, Ginger, Greengram, Ground nut, Horse gram, Jasmin, Marigold, Mulberry, Onion, Papaya, Pepper, Pine apple, Pomegranate, Potato, Radish, Rubber, Soybean, Sugar cane, Sun flower.

In case of Pulses, Red gram is the major crop in both irrigated and un-irrigated area. In Oil seeds and cash crops category, Cotton is the major crop in both irrigated and un-irrigated area. In Fruit category, mango is the major crop in irrigated and un-irrigated area. In Flowers, Marigold is the major crop in both irrigated and un-irrigated area.

With respect to plantation crops, both Coffee and Arecanut area major crops in irrigated area and others crops are major in un-irrigated area. In vegetables others are the major crops in both irrigated and unirrigated area. The crop-wise cropping pattern is given in **Annexure 5.1, 5.2 and 5.3.**

5.6. Crop insurance

Status of crop insurance across districts is presented in **Table 5.14.** Shivamogga (29.33%) has the highest number of farmers who have availed crop insurance followed by Kolar (18.67%), Raichur (12%), and Ballari (11.33%). The farmers in the remaining districts are in negligible numbers (<10%). Despite the effort of Central and State government, still maximum number of farmers are not availing crop insurance due to lack of awareness. Hence, special efforts from government needed to create the awareness for insuring their crop to cover risk associated with farming.

Table 5.14: Crop insurance status

Region / District	% to the total farmers		Total no. of farmers
	Availed	Not Availed	
Dakshina Kannada & Udupi	2.67	97.33	150
Kodagu	0.00	100.00	150
Shivamogga	29.33	70.67	150
High rainfall Total	10.67	89.33	450
Chikkamagaluru	8.67	91.33	150
Hassan	1.33	98.67	150
Kolar	18.67	81.33	150
Moderate rainfall Total	9.56	90.44	450
Tumakuru	1.33	98.67	150
Ballari	11.33	88.67	150
Raichur	12.00	88.00	150
Low rainfall Total	8.22	91.78	450
Grand Total	9.48	90.52	1350

Source: Primary data collected during Aug-Sep, 2017

Varuna Mitra - Opinions and Perceptions

06



Varuna Mitra - Opinions and Perceptions

CHAPTER 6

This chapter presents various dimensions of Varuna Mitra relating to awareness, number of calls made, utilized, perceptions about the information provided by Varuna Mitra, types of information provided, constraints or problems faced by the farmers and suggestions that they offered.

6.1. Sources of Awareness of Varuna Mitra

Information on Varuna Mitra help desk services were publicized by different modes of communication such as Friends, Relatives, Electronic Media, News Paper, RSK, Extension Workers, Gram Panchayat, Internet, Kisan Seva Kendra, Krishi Mela, SMS Forecast etc. A result in the **Table 6.1** demonstrates that, in case of high rainfall region, most farmers learnt about the weather related information provided by Varuna Mitra through friends (47.12%). Within this region, farmers from Kodagu particularly, were also informed by RSK (49.34%). Similarly, most farmers in the moderate and low rainfall regions were familiarized with Varuna Mitra by friends followed by RSK. While the other sources of local information played a minor role in disseminating information on the services provided by Varuna Mitra. Overall, across region and districts friends and RSKs are the major source of awareness.

KSNMDC has to put special efforts by using Grass root level bodies like, Gram Panchayat, RSK and local extension workers to create more awareness about Varuna Mitra help desk services.

6.2. Information Sought by Farmers

Farmers mostly sought weather based information at specific time periods to alter decisions on their farming and/or allied activities. The information gathered from farmers clearly showed that a majority of them sought information on rainfall forecast in low (99.78%), moderate (93.34%) and high (91.34%) rainfall. The other weather parameter that received queries from farmers was temperature. Around 9 per cent of the farmers in high rainfall region, 3.34 per cent in moderate rainfall region and 0.23 per cent in low rainfall regions enquired about the temperature at their locations. Overall, 94.82 per cent of the farmers sought information on rainfall forecast followed by temperature 4.08 per cent and the other weather parameters, namely relative humidity, wind speed and wind direction formed only a small number of the queries by the farmers (**Table 6.2**). This clearly indicates that rainfall and temperature are two major parameters for which information is sought by farmers.

6.3. Initial call made since inception of Varuna Mitra

Table 6.3 shows the percentage of farmers who have contacted Varuna Mitra help-desk from 2011 to 2017. There has been a gradual increase in the number of farmers contacting Varuna Mitra help-desk over this period. The number of calls rose in the year 2016 (29.49%) as it was considered a drought year and farmers had to cope with irregularities in seasonal rainfall which forced them to seek weather information frequently to make subsequent decisions on their crop cycle. In the initial years of its inception; 2011 and 2012 there were fewer calls to Varuna Mitra help-desk owing to the novelty of the initiative and the lack of publicity of its services among farmers.

Table 6.1: Awareness of Sample Households Regarding Varuna Mitra Helpdesk Services

Region / District	Friends	Relatives	Electronic media	Newspaper	RSK	Extension workers	Gram Panchayath	Internet	Kissan Seva Kendra	Krishi Mela	SMS Forecast	Any Other Source	Total No. of Farmers	No. of responses	Ratio of total response to the total number of farmers
Dakshina Kannada & Udupi	65 (43.34)	9 (6.00)	8 (5.34)	28 (18.67)	23 (15.34)	0 (0)	13 (8.67)	0 (0)	0 (0)	1 (0.67)	0 (0)	5 (3.34)	150 (100)	152	1.01
Kodagu	59 (39.34)	12 (8.00)	5 (3.34)	0 (0)	74 (49.34)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	150 (100)	150	1
Shivamogga	88 (58.67)	23 (15.34)	17 (11.34)	24 (16.00)	9 (6.00)	0 (0)	2 (1.34)	0 (0)	1 (0.67)	3 (2)	0 (0)	2 (1.34)	150 (100)	169	1.13
High rainfall Total	212 (47.12)	44 (9.78)	30 (6.67)	52 (11.56)	106 (23.56)	0 (0)	15 (3.34)	0 (0)	1 (0.23)	4 (0.89)	0 (0)	7 (1.56)	450 (100)	471	1.05
Chikkamagaluru	79 (52.67)	26 (17.34)	13 (8.67)	16 (10.67)	7 (4.67)	2 (1.34)	5 (3.34)	1 (0.67)	0 (0)	9 (6)	1 (0.67)	3 (2)	150 (100)	162	1.08
Hassan	147 (98.00)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (2.00)	0 (0)	0 (0)	150 (100)	150	1
Kolar	107 (71.34)	5 (3.34)	7 (4.67)	8 (5.34)	23 (15.34)	0 (0)	3 (2.00)	2 (1.34)	0 (0)	1 (0.67)	1 (0.67)	1 (0.67)	150 (100)	158	1.05
Moderate rainfall Total	333 (74.00)	31 (6.89)	20 (4.45)	24 (5.34)	30 (6.67)	2 (0.45)	8 (1.78)	3 (0.67)	0 (0)	13 (2.89)	2 (0.45)	4 (0.89)	450 (100)	470	1.04
Tumakuru	73 (48.67)	10 (6.67)	1 (0.67)	1 (0.67)	65 (43.34)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	150 (100)	150	1
Ballari	122 (81.34)	46 (30.67)	2 (1.34)	0 (0)	6 (4.00)	0 (0)	6 (4.00)	5 (3.34)	0 (0)	1 (0.67)	3 (2.00)	1 (0.67)	150 (100)	192	1.28
Raichur	113 (75.34)	42 (28.00)	4 (2.67)	2 (1.34)	10 (6.67)	1 (0.67)	1 (0.67)	0 (0)	0 (0)	0 (0)	1 (0.67)	0 (0)	150 (100)	174	1.16
Low rainfall Total	308 (68.45)	98 (21.78)	7 (1.56)	3 (0.67)	81 (18.00)	1 (0.23)	7 (1.56)	5 (1.12)	0 (0)	1 (0.23)	4 (0.89)	1 (0.23)	450 (100)	516	1.15
Grand Total	853 (63.19)	173 (12.82)	57 (4.23)	79 (5.86)	217 (16.08)	3 (0.23)	30 (2.23)	8 (0.6)	1 (0.08)	18 (1.34)	6 (0.45)	12 (0.89)	1350 (100)	1457	1.08

Note: Figures in the parenthesis indicates percentage to the total
Source: Primary data collected during Aug-Sep, 2017

Across the study districts, the increase in calls was swift in the case of Kodagu, a high rainfall region, where the calls were almost nil between the years 2011 to 2014, and increased to 104 calls in early mid-2017. A similar hike was witnessed in Tumakuru, a low rainfall region district, where no farmers made calls in the initial four years and in 2016, 76 calls were registered. Observing the pattern of calls made by the sample farmers, it is evident that there is bound to be acceleration in the rate of calls made by farmers across all the districts in the near future. The trend in initial calls since inception of Varuna Mitra is depicted in Fig 6.1.

Table 6.2: Services availed by farmers

Region / District	Rainfall Forecast	Relative humidity	Wind speed	Wind direction	Temperature	No Response	Total No. of Farmers	Total Responses	Ratio of total response to the total number of farmers
Dakshina Kannada & Udupi	147 (98)	1 (0.67)	4 (2.67)	2 (1.34)	3 (2)	2 (1.34)	150 (100)	159	1.06
Kodagu	114 (76)	0 (0)	0 (0)	0 (0)	36 (24)	0	150 (100)	150	1
Shivamogga	150 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0	150 (100)	150	1
High rainfall Total	411 (91.34)	1 (0.23)	4 (0.89)	2 (0.45)	39 (8.67)	2 (0.45)	450 (100)	458	1.02
Chikkamagaluru	150 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0	150 (100)	150	1
Hassan	121 (80.67)	0 (0)	0 (0)	0 (0)	0 (0)	29 (19.34)	150 (100)	150	1
Kolar	149 (99.34)	6 (4)	7 (4.67)	3 (2)	15 (10)	0	150 (100)	180	1.2
Moderate rainfall Total	420 (93.34)	6 (1.34)	7 (1.56)	3 (0.67)	15 (3.34)	29 (6.45)	450 (100)	480	1.07
Tumakuru	150 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0	150 (100)	150	1
Ballari	149 (99.34)	9 (6)	0 (0)	0 (0)	0 (0)	1 (0.67)	150 (100)	159	1.06
Raichur	150 (100)	5 (3.34)	0 (0)	0 (0)	1 (0.67)	0	150 (100)	156	1.04
Low rainfall Total	449 (99.78)	14 (3.12)	0 (0)	0 (0)	1 (0.23)	1 (0.23)	450 (100)	465	1.03
Grand Total	1280 (94.82)	21 (1.56)	11 (0.82)	5 (0.38)	55 (4.08)	32 (2.38)	1350 (100)	1403	1.04

Note: Figures in the parenthesis indicates percentage to the total

Source: Primary data collected during Aug-Sep, 2017

Fig 6.1. Trend of initial calls made since inception of Varuna Mitra from 2010

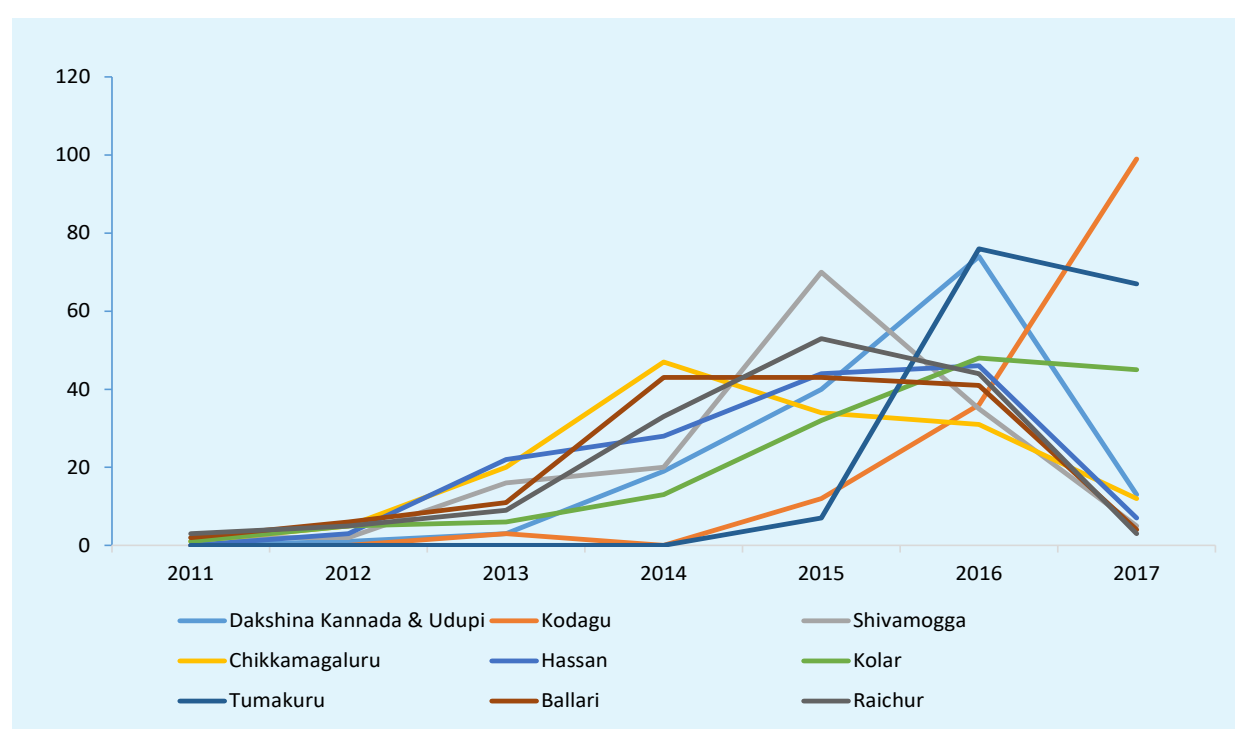


Table 6.3: Initial Calls made Since Inception of Varuna Mitra in 2010

Region / District	2011	2012	2013	2014	2015	2016	2017	Not indicated	Total
Dakshina Kannada & Udupi	1 (0.67)	1 (0.67)	3 (2)	18 (12)	36 (24)	73 (48.67)	6 (4)	12 (8)	150 (100)
Kodagu	0 (0)	0	3 (2)	0	12 (8)	31 (20.67)	104 (69.34)	0	150 (100)
Shivamogga	2 (1.34)	2 (1.34)	16 (10.67)	42 (28)	54 (36)	34 (22.67)	0 (0)	0	150 (100)
High rainfall Total	3 (0.67)	3 (0.67)	22 (4.89)	60 (13.34)	102 (22.67)	138 (30.67)	110 (24.45)	12 (2.67)	450 (100)
Chikkamagaluru	1 (0.67)	5 (3.34)	32 (21.34)	47 (31.34)	34 (22.67)	31 (20.67)	0 (0)	0	150 (100)
Hassan	0 (0)	3 (2)	30 (20)	57 (38)	44 (29.34)	9 (6)	0 (0)	7 (4.67)	150 (100)
Kolar	2 (1.34)	3 (2)	7 (4.67)	26 (17.34)	46 (30.67)	59 (39.34)	7 (4.67)	0	150 (100)
Moderate rainfall Total	3 (0.67)	11 (2.45)	69 (15.34)	130 (28.89)	124 (27.56)	99 (22)	7 (1.56)	7 (1.56)	450 (100)
Tumakuru	0 (0)	0	0	0	7 (4.67)	76 (50.67)	67 (44.67)	0	150 (100)
Ballari	4 (2.67)	6 (4)	11 (7.34)	41 (27.34)	43 (28.67)	41 (27.34)	3 (2)	1 (0.67)	150 (100)
Raichur	3 (2)	5 (3.34)	9 (6)	33 (22)	53 (35.34)	44 (29.34)	3 (2)	0	150 (100)
Low rainfall Total	7 (1.56)	11 (2.45)	20 (4.45)	74 (16.45)	103 (22.89)	161 (35.78)	73 (16.23)	1 (0.23)	450 (100)
Grand Total	13 (0.97)	25 (1.86)	111 (8.23)	264 (19.56)	329 (24.38)	398 (29.49)	190 (14.08)	20 (1.49)	1350 (100)

Note: Figures in the parenthesis indicates percentage to the total

Source: Primary data collected during Aug-Sep, 2017

6.4. Expected Mode of Information from Varuna Mitra

The farmer's mode of preference for getting information from Varuna Mitra is varied in nature. A large segment of the farmers preferred direct interaction with Varuna Mitra over the phone (88.67%). This is because the direct interaction would facilitate to clarify doubts and gives some kind of satisfaction and have more confidence in the information. About 8.38 per cent were preferred both mobile and voice message. The text messages were preferred by 10.75 per cent (Table 6.4). They indicated these are useful whenever they need to refer and pass the information to other very easily. Among the districts, the proportion of farmers preferring the mobile phones for direct interaction is found to be highest in high rainfall and Moderate rainfall districts than the low rainfall districts. Among the districts the preference of mobile for information found to be 100 per cent in Hassan.

Table 6.4: Farmers Choice for Contacting Varuna Mitra

Region / District	Percentage to the Total Number of Farmers					Total Responses	Ratio of total response to the total number of farmers
	Mobile phone call	Voice message	Text message	Both voice and text message	Total number of farmers		
Dakshina Kannada & Udupi	141 (94.00)	0 (0)	9 (6.00)	0 (0)	150 (100)	150	1
Kodagu	149 (99.34)	0	1 (0.67)	0	150 (100)	150	1
Shivamogga	127 (84.67)	12 (8.00)	24 (16.00)	9 (6.00)	150 (100)	172	1.15
High rainfall total	417 (92.67)	12 (2.67)	34 (7.56)	9 (2)	450 (100)	472	1.05
Chikkamagaluru	130 (86.67)	6 (4.00)	42 (28.00)	25 (16.67)	150 (100)	203	1.35
Hassan	150 (100)	0	0	0	150 (100)	150	1
Kolar	130 (86.67)	13 (8.67)	29 (19.34)	3 (2.00)	150 (100)	175	1.17
Moderate rainfall total	410 (91.12)	19 (4.23)	71 (15.78)	28 (6.23)	450 (100)	528	1.17
Tumakuru	148 (98.67)	0	5 (3.34)	0	150 (100)	153	1.02
Ballari	102 (68.00)	9 (6.00)	26 (17.34)	47 (31.34)	150 (100)	184	1.23
Raichur	120 (80.00)	8 (5.34)	9 (6.00)	29 (19.34)	150 (100)	166	1.11
Low rainfall total	370 (82.23)	17 (3.78)	40 (8.89)	76 (16.89)	450 (100)	503	1.12
Grand Total	1197 (88.67)	48 (3.56)	145 (10.75)	113 (8.38)	1350 (100)	1503	1.11

Note: Figures in the parenthesis indicates percentage to the total

Source: Primary data collected during Aug-Sep, 2017

6.5. Expected Language for communicating the information from Varuna Mitra

An overwhelming majority of farmers (88.38%) preferred direct interaction with Varuna Mitra in local language i.e. Kannada (Table 6.5), so that they can understand the advice and information properly for taking decisions on agricultural operations. However, a small proportion of farmers preferred both English as well as Kannada (10.23%). A negligible proportion of Farmers preferred English language (1.34). Only one respondent in Kolar district expected Telugu. Among the districts, Kodagu and Tumakuru almost all the farmers (100%) preferred local language. Across the districts, the highest rainfall district farmer's preferred local language.

Table 6.5: Expected Language for Communication by Varuna Mitra

Region / District	Kannada	English	Both Kannada & English	Other language	Total
Dakshina Kannada & Udupi	148 (98.67)	2 (1.34)	0 (0)	0 (0)	150 (100)
Kodagu	150 (100)	0	0 (0)	0	150 (100)
Shivamogga	125 (83.34)	2 (1.34)	23 (15.34)	0	150 (100)
High rainfall Total	423 (94)	4 (0.89)	23 (5.12)	0 (0)	450 (100)
Chikkamagaluru	77 (51.34)	2 (1.34)	71 (47.34)	0	150 (100)
Hassan	145 (96.67)	5 (3.34)	0 (0)	0	150 (100)
Kolar	145 (96.67)	1 (0.67)	3 (2)	1 (0.67)	150 (100)
Moderate rainfall Total	367 (81.56)	8 (1.78)	74 (16.45)	1 (0.23)	450 (100)
Tumakuru	150 (100)	0	0 (0)	0	150 (100)
Ballari	118 (78.67)	5 (3.34)	27 (18)	0	150 (100)
Raichur	135 (90)	1 (0.67)	14 (9.34)	0	150 (100)
Low rainfall Total	403 (89.56)	6 (1.34)	41 (9.12)	0 (0)	450 (100)
Grand Total	1193 (88.38)	18 (1.34)	138 (10.23)	1 (0.08)	1350 (100)

Note: Figures in the parenthesis indicates percentage to the total

Source: Primary data collected during Aug-Sep, 2017

6.6. Choice of Contacting Mode

It is believed that the farmers would collectively call the Varuna Mitra for knowing the weather information. However, it was found that a large number of farmers contacted individually by using their mobiles (84%). This shows they are individualistic rather than a community. Only a small proportion i.e. (21.78%) contacted the Varuna Mitra collectively (Table 6.6). Among the districts, Kodagu, Hassan, Tumakuru we find 100 per cent of the farmers individually contacted.

Table 6.6: Preference of farmers for calling Varuna Mitra Services

Region / District	Individual call	Collective / Group call	Total no. of farmers	Total responses	Ratio of total response to the total number of farmers
Dakshina Kannada & Udupi	146 (97.34)	4 (2.67)	150	150 (100)	1.00
Kodagu	150 (100)	0 (0)	150	150 (100)	1.00
Shivamogga	145 (96.67)	13 (8.67)	150	158 (100)	1.05
High rainfall Total	441 (98)	17 (3.78)	450	458 (100)	1.02
Chikkamagaluru	121 (80.67)	40 (26.67)	150	161 (100)	1.07
Hassan	150 (100)	0 (0)	150	150 (100)	1.00
Kolar	105 (70)	47 (31.34)	150	152 (100)	1.01
Moderate rainfall Total	376 (83.56)	87 (19.34)	450	463 (100)	1.03
Tumakuru	150 (100)	0 (0)	150	150 (100)	1.00
Ballari	85 (56.67)	96 (64)	150	181 (100)	1.21
Raichur	82 (54.67)	94 (62.67)	150	176 (100)	1.17
Low rainfall Total	317 (70.45)	190 (42.23)	450	507 (100)	1.13
Grand Total	1134 (84)	294 (21.78)	1350	1428 (100)	1.06

Note: Figures in the parenthesis indicates percentage to the total

Source: Primary data collected during Aug-Sep, 2017

6.7. Extent of Sharing of Varuna Mitra Information by Sample Farmers

Every farmer needs forecasts on rainfall to plan and implement their decision different activities in farming. However, due to low levels of literacy and lack of mobile/phone accessibility and poor mobile network, several farmers shared information gathered from contacted Varuna Mitra helpdesk services amongst members in their farming community, village. On an average across all the districts, a farmer who contacts Varuna Mitra help desk Services conveyed the information at least seven farmers (**Table 6.7**). In Dakshina Kannada and Udupi district, the average number of farmers with whom the information was shared was low (3 farmers) as all sample farmers in these districts had mobile phones and were aware of the services leading them to directly contact Varuna Mitra. While, in Kodagu, it was found higher (10 farmers), Due to poor mobile/phone network connectivity in Kodagu, the information was communicated in person by the most number of people compared to other sample districts. At state level, each farmer shares the rainfall information to 7 farmers, help desk number to 5 farmers totaling to 12 farmers. Region-wise comparison also indicates that each farmer has disseminated rainfall information to about 12 farmers which was reflected in the aggregate estimates.

Table 6.7: Extent of Sharing of Varuna Mitra Information by Sample Farmers

Region / District	Individual call	Collective / Group call	Total no. of farmers
Dakshina Kannada & Udupi	2.53	1.61	4.13
Kodagu	9.57	9.74	19.31
Shivamogga	5.71	3.19	8.89
High rainfall Total	5.93	4.84	10.78
Chikkamagaluru	6.38	4.01	10.39
Hassan	7.54	6.36	13.90
Kolar	6.91	6.26	13.17
Moderate rainfall Total	6.94	5.54	12.49
Tumakuru	7.20	6.12	13.32
Ballari	7.28	4.94	12.22
Raichur	7.23	5.58	12.81
Low rainfall Total	7.24	5.55	12.78
Grand Total	6.70	5.31	12.02

Note: Figures in the parenthesis indicates percentage to the total

Source: Primary data collected during Aug-Sep, 2017

6.8. Key consideration by Farmers before Calling Varuna Mitra Help Desk

Rain plays a very important role in various stages of the crop cycle and when there are timely seasonal rains, the chances of a good yield are higher. Therefore, farmers call Varuna Mitra help-desk to enquire about rain forecasts depending on the stage of the crop cycle by looking at the current crop in the field and the necessity for moisture or not. The farmer also gauges the cloud cover before calling Varuna Mitra to confirm their opinions with valid forecasts. These two key attributes are taken into account by the sample farmers preceding their queries to the help desk. Overall, **Table 6.8** showed that more than half (58.75%) of the farmers have called help-desk based on the cloud cover and the others in the sample (49.26%) have called help-desk by observing their crop in the field. This revealed that cloud cover plays a decisive role in contacting Varuna Mitra help-desk to get information in time and make informed decisions in agricultural operations.

Table 6.8: Key consideration by farmers before calling Varuna Mitra help desk

Region / District	Crop field	Cloud cover	Message from Agri. Dept.	Others	No response	Total No. of farmers	Total no. of response	Ratio of total response to the total number of farmers
Dakshina Kannada & Udupi	88 (58.67)	60 (40)	0 (0)	2 (1.34)	1 (0.67)	150 (100)	151	1.01
Kodagu	63 (42)	85 (56.67)	0 (0)	0 (0)	2 (1.34)	150 (100)	150	1
Shivamogga	81 (54)	97 (64.67)	0 (0)	0 (0)	0 (0)	150 (100)	178	1.19
High rainfall Total	232 (51.56)	242 (53.78)	0 (0)	2 (0.45)	3 (0.67)	450 (100)	479	1.06
Chikkamagaluru	61 (40.67)	115 (76.67)	0 (0)	0 (0)	0 (0)	150 (100)	176	1.17
Hassan	61 (40.67)	76 (50.67)	0 (0)	0 (0)	13 (8.67)	150 (100)	150	1
Kolar	81 (54)	78 (52)	0 (0)	0 (0)	0 (0)	150 (100)	159	1.06
Moderate rainfall Total	203 (45.12)	269 (59.78)	0 (0)	0 (0)	13 (2.89)	450 (100)	485	1.08
Tumakuru	6 (4)	143 (95.34)	0 (0)	0 (0)	2 (1.34)	150 (100)	151	1.01
Ballari	122 (81.34)	60 (40)	3 (2)	15 (10)	1 (0.67)	150 (100)	201	1.34
Raichur	102 (68)	79 (52.67)	0 (0)	0 (0)	0 (0)	150 (100)	181	1.21
Low rainfall Total	230 (51.12)	282 (62.67)	3 (0.67)	15 (3.34)	3 (0.67)	450 (100)	533	1.18
Grand Total	665 (49.26)	793 (58.75)	3 (0.23)	17 (1.26)	19 (1.41)	1350 (100)	1497	1.11

Note: Figures in the parenthesis indicates percentage to the total

Source: Primary data collected during Aug-Sep, 2017

6.9. Phone call details

Table 6.9 indicates the Calls made, Calls dropped, Calls used for taking decision and Calls ignored. Among the districts categorized on rainfall, farmers from the moderate rainfall regions made the highest number of calls (27) and of them, 12 calls were used to take farming related decisions. While, districts that were grouped as low rainfall region, made on an average 15 calls per household to Varuna Mitra, of which 4 calls were used. In the high rainfall regions, the number of calls made was 11, of which 4 calls were used for decision making. In total, each household made 17 calls, of them information received from 6 calls materialized into assessable action during the farmer's cropping cycle, while 11 calls were ignored or rather no decisions were made or altered post receipt of weather information.

It is obvious that, farmers have made higher number of calls in Kharif as compared to Rabi and summer season. It is further to note that, a large number of farmers have called in all seasons. Over time, number of calls has increased; accordingly number of calls dropped is also increased due to busy lines. In view of this, there is need for increasing the additional phone lines and tele callers.

Table 6.9: Phone Call Details for Different Seasons

Region / District	Particulars	Kharif	Rabi	Summer	All seasons	Total	Calls per household
High rainfall region (n=450)							
Dakshina Kannada & Udupi	Calls Made	94 (100)	2 (100)	4 (100)	1291 (100)	1391 (100)	9
	Calls Dropped	0 (0)	0 (0)	0 (0)	99 (7.67)	99 (7.12)	0.66
	Calls used for taking decision	16 (17.02)	2 (100)	4 (100)	279 (21.61)	301 (21.64)	2.01
	Calls Ignored	78 (82.98)	0 (0)	0 (0)	913 (70.72)	991 (71.24)	6.61
Kodagu	Calls Made	159 (100)	106 (100)	181 (100)	1658 (100)	2104 (100)	14.03
	Calls Dropped	15 (9.43)	10 (9.43)	8 (4.42)	4 (0.24)	37 (1.76)	0.25
	Calls used for taking decision	59 (37.11)	10 (9.43)	25 (13.81)	449 (27.08)	543 (25.81)	3.62
	Calls Ignored	85 (53.46)	86 (81.13)	148 (81.77)	1205 (72.68)	1524 (72.43)	10.16
Shivamogga	Calls Made	557 (100)	289 (100)	282 (100)	359 (100)	1487 (100)	9.91
	Calls Dropped	1 (0.18)	1 (0.35)	1 (0.35)	0 (0)	3 (0.2)	0.02
	Calls used for taking decision	303 (54.4)	147 (50.87)	156 (55.32)	250 (69.64)	856 (57.57)	5.71
	Calls Ignored	253 (45.42)	141 (48.79)	125 (44.33)	109 (30.36)	628 (42.23)	4.19
Total	Calls Made	810 (100)	397 (100)	467 (100)	3308 (100)	4982 (100)	11.07
	Calls Dropped	16 (1.98)	11 (2.77)	9 (1.93)	103 (3.11)	139 (2.79)	0.31
	Calls used for taking decision	378 (46.67)	159 (40.05)	185 (39.61)	978 (29.56)	1700 (34.12)	3.78
	Calls Ignored	416 (51.36)	227 (57.18)	273 (58.46)	2227 (67.32)	3143 (63.09)	6.98
Moderate rainfall region (n=450)							
Chikkamagaluru	Calls Made	323 (100)	205 (100)	705 (100)	475 (100)	1708 (100)	11.39
	Calls Dropped	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0
	Calls used for taking decision	236 (73.07)	141 (68.78)	479 (67.94)	354 (74.53)	1210 (70.84)	8.07
	Calls Ignored	87 (26.93)	64 (31.22)	226 (32.06)	121 (25.47)	498 (29.16)	3.32
Hassan	Calls Made	0	0	0	2202 (100)	2202 (100)	14.68
	Calls Dropped	0	0	0	132 (5.99)	132 (5.99)	0.88
	Calls used for taking decision	0	0	0	499 (22.66)	499 (22.66)	3.33
	Calls Ignored	0	0	0	1571 (71.34)	1571 (71.34)	10.47
Kolar	Calls Made	579 (100)	10 (100)	17 (100)	7507 (100)	8113 (100)	54.09
	Calls Dropped	24 (4.15)	0	0	219 (2.92)	243 (3)	1.62
	Calls used for taking decision	206 (35.58)	5 (50)	11 (64.71)	3513 (46.8)	3735 (46.04)	24.9
	Calls Ignored	349 (60.28)	5 (50)	6 (35.29)	3775 (50.29)	4135 (50.97)	27.57
Total	Calls Made	902 (100)	215 (100)	722 (100)	10184 (100)	12023 (100)	26.72
	Calls Dropped	24 (2.66)	0 (0)	0 (0)	351 (3.45)	375 (3.12)	0.83
	Calls used for taking decision	442 (49.00)	146 (67.91)	490 (67.87)	4366 (42.87)	5444 (45.28)	12.1
	Calls Ignored	436 (48.34)	69 (32.09)	232 (32.13)	5467 (53.68)	6204 (51.6)	13.79

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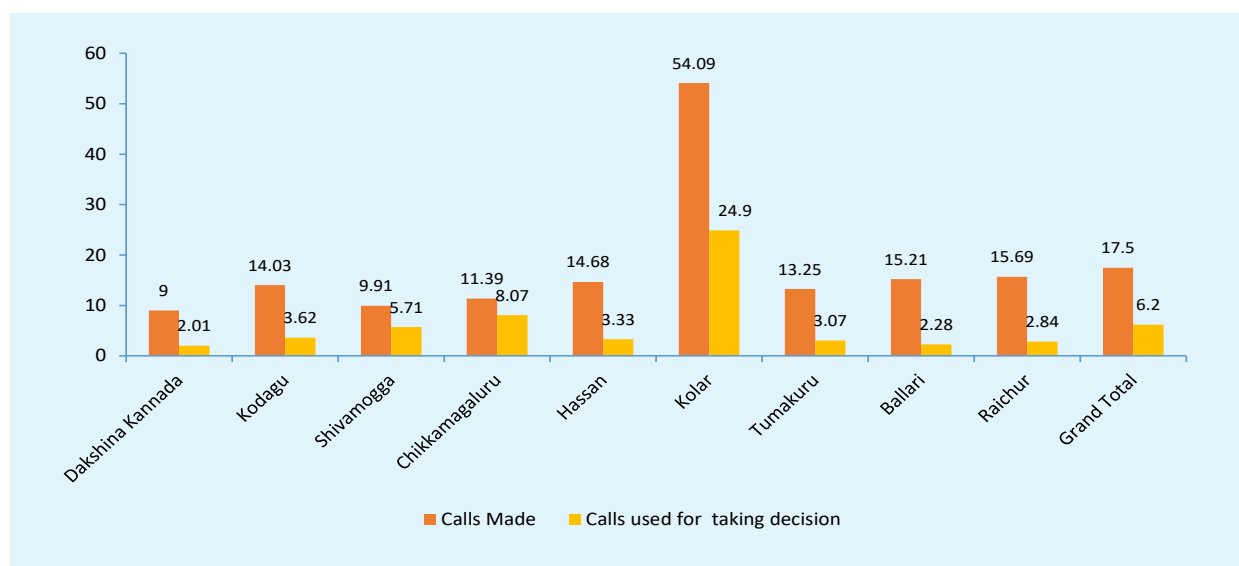
Region / District	Particulars	Kharif	Rabi	Summer	All seasons	Total	Calls per household
Low rainfall region (n=450)							
Tumakuru	Calls Made	2 (100)	0	0	1986 (100)	1988 (100)	13.25
	Calls Dropped	0 (0)	0	0	6 (0.3)	6 (0.3)	0.04
	Calls used for taking decision	0 (0)	0	0	460 (23.16)	460 (23.14)	3.07
	Calls Ignored	2 (100)	0	0	1520 (76.54)	1522 (76.56)	10.15
Ballari	Calls Made	1807 (100)	112 (100)	39 (100)	324 (100)	2282 (100)	15.21
	Calls Dropped	41 (2.27)	8 (7.14)	0 (0)	14 (4.32)	63 (2.76)	0.42
	Calls used for taking decision	243 (13.45)	16 (14.29)	8 (20.51)	75 (23.15)	342 (14.99)	2.28
	Calls Ignored	1523 (84.28)	88 (78.57)	31 (79.49)	235 (72.53)	1877 (82.25)	12.51
Raichur	Calls Made	1738 (100)	365 (100)	8 (100)	243 (100)	2354 (100)	15.69
	Calls Dropped	101 (5.81)	38 (10.41)	0 (0)	27 (11.11)	166 (7.05)	1.11
	Calls used for taking decision	293 (16.86)	80 (21.92)	8 (100)	45 (18.52)	426 (18.1)	2.84
	Calls Ignored	1344 (77.33)	247 (67.67)	0 (0)	171 (70.37)	1762 (74.85)	11.75
Total	Calls Made	3547 (100)	477 (100)	47 (100)	2553 (100)	6624 (100)	14.72
	Calls Dropped	142 (4.00)	46 (9.64)	0 (0)	47 (1.84)	235 (3.55)	0.52
	Calls used for taking decision	536 (15.11)	96 (20.13)	16 (34.04)	580 (22.72)	1228 (18.54)	2.73
	Calls Ignored	2869 (80.89)	335 (70.23)	31 (65.96)	1926 (75.44)	5161 (77.91)	11.47
Grand Total	Calls Made	5259 (100)	1089 (100)	1236 (100)	16045 (100)	23629 (100)	17.5
	Calls Dropped	182 (3.46)	57 (5.23)	9 (0.73)	501 (3.12)	749 (3.17)	0.55
	Calls used for taking decision	1356 (25.78)	401 (36.82)	691 (55.91)	5924 (36.92)	8372 (35.43)	6.2
	Calls Ignored	3721 (70.75)	631 (57.94)	536 (43.37)	9620 (59.96)	14508 (61.4)	10.75

Note: Data in parenthesis are percentages to the total

Source: Primary data collected during Aug-Sep, 2017

Calls made and calls used for taking decision are depicted in **Figure 6.2**. It can be clearly seen from the Figure, being drought prone area, Kolar has made highest number of calls (54), followed by Raichur (15), Ballari (15), Hassan (14), Kodagu (14) and Chikkamagaluru (11).

Figure 6.2: Calls made and calls used for taking decisions



6.10. Duration of Call

On an average each farmer has made 17.5 calls in the reference year. The duration of each call varied across the farmers. A majority of farmers taken 61-120 seconds (16.60 per cent) followed by 9.78 per cent in the range of 121-180 seconds i.e. 2 to 3 minutes (**Table 6.10**). The surprising fact is that 68.08 per cent of the farmers have not indicated the time may be due to they never bother about time as the calls are free. Among the regions, higher proportion (25.56%) of farmers in low rainfall region has taken 2-3 minutes.

Table 6.10: Duration of calls made by farmers

Region / District	Low (1-60sec)	Medium (61-120 sec)	High (121-180 sec)	Very High (> 181 sec)	Time is not indicated	Total
Dakshina Kannada & Udupi	7 (4.67)	5 (3.34)	1 (0.67)	0 (0)	137 (91.34)	150 (100)
Kodagu	3 (2)	1 (0.67)	0	0	146 (97.34)	150 (100)
Shivamogga	12 (8)	71 (47.34)	8 (5.34)	1 (0.67)	58 (38.67)	150 (100)
High rainfall Total	22 (4.89)	77 (17.12)	9 (2)	1 (0.23)	341 (75.78)	450 (100)
Chikkamagaluru	5 (3.34)	35 (23.34)	7 (4.67)	1 (0.67)	102 (68)	150 (100)
Hassan	0	0	0	0	150 (100)	150 (100)
Kolar	10 (6.67)	13 (8.67)	1 (0.67)	2 (1.34)	124 (82.67)	150 (100)
Moderate rainfall Total	15 (3.34)	48 (10.67)	8 (1.78)	3 (0.67)	376 (83.56)	450 (100)
Tumakuru	0	0	0	0	150 (100)	150 (100)
Ballari	11 (7.34)	43 (28.67)	60 (40)	8 (5.34)	28 (18.67)	150 (100)
Raichur	4 (2.67)	56 (37.34)	55 (36.67)	11 (7.34)	24 (16)	150 (100)
Low rainfall Total	15 (3.34)	99 (22)	115 (25.56)	19 (4.23)	202 (44.89)	450 (100)
Grand Total	52 (3.86)	224 (16.6)	132 (9.78)	23 (1.71)	919 (68.08)	1350 (100)

Note: Figures in the parenthesis indicates percentage to the total

Source: Primary data collected during Aug-Sep, 2017 6.11. Cost incurred on calls

6.11. Cost incurred on calls

The calls made to Varuna Mitra are not toll free. As such the farmers while contacting the Varuna Mitra has incurred some cost. Among them a larger proportion of farmers (25.34%) incurred Rs.1 to 2 per call followed (total amount Rs.511.60) by 4.23 per cent who incurred below Rs.1 per call (Rs.26) (**Table 6.11**). The remaining 1.34 per cent of the farmers incurred Rs.2 to 5 per call (Rs.57). The surprising thing is that 69.12 per cent of the farmers have not indicated the cost incurred. This shows that many have not incurred cost, may be due to free services offered by some mobile companies. This supports the finding mentioned above, where we found that 68.08 per cent of the farmers have not indicated the duration of call. In the low rainfall region, 51.12 per cent of the farmers incurred Rs. 1 to 2 per call which is highest to the state average 25.34 per cent.

Table 6.11: Cost Incurred by farmers on calls

Region / District	Below 1 Rs.	1 Rs. to 2 Rs.	>2 Rs. to <5 Rs.	Cost is not indicated	Total
Dakshina Kannada & Udupi	5 (3.34)	3 (2)	0 (0)	142 (94.67)	150 (100)
Kodagu	0	4 (2.67)	0	146 (97.34)	150 (100)
Shivamogga	24 (16)	65 (43.34)	1 (0.67)	60 (40)	150 (100)
High rainfall Total	29 (6.45)	72 (16)	1 (0.23)	348 (77.34)	450 (100)
Chikkamagaluru	8 (5.34)	38 (25.34)	1 (0.67)	103 (68.67)	150 (100)
Hassan	0	0	0	150 (100)	150 (100)
Kolar	20 (13.34)	2 (1.34)	0	128 (85.34)	150 (100)
Moderate rainfall Total	28 (6.23)	40 (8.89)	1 (0.23)	381 (84.67)	450 (100)
Tumakuru	0	0	0	150 (100)	150 (100)
Ballari	0	121 (80.67)	0	29 (19.34)	150 (100)
Raichur	0	109 (72.67)	16 (10.67)	25 (16.67)	150 (100)
Low rainfall Total	0 (0)	230 (51.12)	16 (3.56)	204 (45.34)	450 (100)
Grand Total	57 (4.23)	342 (25.34)	18 (1.34)	933 (69.12)	1350 (100)

Note: Figures in the parenthesis indicates percentage to the total

Source: Primary data collected during Aug-Sep, 2017

6.12. Perception of farmers on the quality of calls by seasons

A majority of farmers across seasons opined that the quality of calls were good (79.3%) and only a small number of farmers stated that the quality of their calls were poor (2.8%). The reason for the latter was due to poor network problem and busy server by Tele advisor to their queries (Table 6.12). Some farmers were neutral (18.6%) on the subject of quality. It is noticeable that over 71 per cent of the farmers from the high rainfall region were the most satisfied with the quality of the call compared to farmers from the moderate rainfall region (84%) and Low rainfall region (83%).

6.13. SMS Received from Varuna Mitra

Apart from directly informing the farmers about the weather forecast, the Varuna Mitra used to send or forward the messages which have been received from agriculture department. But as many as 990 farmers (73.34%) have reported that they have not received any messages from Varuna Mitra. Among the rainfall regions, low rainfall region farmers have received more SMS messages than other regions (Table 6.13).

Table 6.12: Perception of Farmers on the Quality of Calls by Seasons

Region / District	Kharif				Rabi				Summer				Annual				Total				Total No. of Beneficiaries
	Poor	Neutral	Good	Total	Poor	Neutral	Good	Total	Poor	Neutral	Good	Total	Poor	Neutral	Good	Total	Poor	Neutral	Good	Total	
Dakshina Kannada & Udupi	0 (0)	0 (0)	13 (8.7)	13	0 (0)	0 (0)	2 (1.4)	2	0 (0)	0 (0)	2 (1.4)	2	1 (0.7)	2 (1.4)	129 (86)	132	1 (0.7)	2 (1.4)	146 (97.4)	149	150 (100)
Kodagu	0	0	4 (2.7)	4	0	0	3 (2)	3	0	0	8 (5.4)	8	0	0	0	0	0	0	15 (10)	15	150 (100)
Shivamogga	1 (0.7)	18 (12)	73 (48.7)	92	1 (0.7)	11 (7.4)	36 (24)	48	1 (0.7)	15 (10)	29 (19.4)	45	1 (0.7)	5 (3.4)	20 (13.4)	26	4 (2.7)	49 (32.7)	158 (105.4)	211	150 (100)
High rainfall Total	1 (0.3)	18 (4)	90 (20)	109	1 (0.3)	11 (2.5)	41 (9.2)	53	1 (0.3)	15 (3.4)	39 (8.7)	55	2 (0.5)	7 (1.6)	149 (33.2)	158	5 (1.2)	51 (11.4)	319 (70.9)	375	450 (100)
Chikkamagaluru	2 (1.4)	22 (14.7)	24 (16)	48	6 (4)	18 (12)	16 (10.7)	40	7 (4.7)	31 (20.7)	47 (31.4)	85	1 (0.7)	19 (12.7)	13 (8.7)	33	16 (10.7)	90 (60)	100 (66.7)	206	150 (100)
Hassan	0	0	0	0	0	0	0	0	0	0	0	0	0	2 (1.4)	134 (89.4)	136	0	2 (1.4)	134 (89.4)	136	150 (100)
Kolar	0	3 (2)	23 (15.4)	26	0	0	1 (0.7)	1	0	0	2 (1.4)	2	1 (0.7)	3 (2)	117 (78)	121	1 (0.7)	6 (4)	143 (95.4)	150	150 (100)
Moderate rainfall Total	2 (0.5)	25 (5.6)	47 (10.5)	74	6 (1.4)	18 (4)	17 (3.8)	41	7 (1.6)	31 (6.9)	49 (10.9)	87	2 (0.5)	24 (5.4)	264 (58.7)	290	17 (3.8)	98 (21.8)	377 (83.8)	492	450 (100)
Tumakuru	0	0	0	0	0	0	0	0	0	0	0	0	7 (4.7)	92 (61.4)	50 (33.4)	149	7 (4.7)	92 (61.4)	50 (33.4)	149	150 (100)
Ballari	6 (4)	4 (2.7)	112 (74.7)	122	0	0	14 (9.4)	14	0	0	4 (2.7)	4	0	0	25 (16.7)	25	6 (4)	4 (2.7)	155 (103.4)	165	150 (100)
Raichur	1 (0.7)	5 (3.4)	120 (80)	126	1 (0.7)	1 (0.7)	31 (20.7)	33	0	0	4 (2.7)	4	0	0	14 (9.4)	14	2 (1.4)	6 (4)	169 (112.7)	177	150 (100)
Low rainfall Total	7 (1.6)	9 (2)	232 (51.6)	248	1 (0.3)	1 (0.3)	45 (10)	47	0	0	8 (1.8)	8	7 (1.6)	92 (20.5)	89 (19.8)	188	15 (3.4)	102 (22.7)	374 (83.2)	491	450 (100)
Grand Total	10 (0.8)	52 (3.9)	369 (27.4)	431	8 (0.6)	30 (2.3)	103 (7.7)	141	8 (0.6)	46 (3.5)	96 (7.2)	150	11 (0.9)	123 (9.2)	502 (37.2)	636	37 (2.8)	251 (18.6)	1070 (79.3)	1358	1350 (100)

Note: Figures in the parenthesis indicates percentage to the total;

Source: Primary data collected during Aug-Sep, 2017

Table 6.13: SMS Received by Farmers from Varuna Mitra

Region / District	1 to 10 SMS Received	11 to 50 SMS Received	51 to 100 SMS Received	110 to 300 SMS Received	SMS not Received	Total
Dakshina Kannada & Udupi	1 (0.67)	2 (1.34)	3 (2)	1 (0.67)	143 (95.34)	150 (100)
Kodagu	1 (0.67)	1 (0.67)	0	0	148 (98.67)	150 (100)
Shivamogga	55 (36.67)	22 (14.67)	0	0	73 (48.67)	150 (100)
High rainfall Total	57 (12.67)	25 (5.56)	3 (0.67)	1 (0.23)	364 (80.89)	450 (100)
Chikkamagaluru	29 (19.34)	7 (4.67)	0	0	114 (76)	150 (100)
Hassan	0	0	0	0	150 (100)	150 (100)
Kolar	2 (1.34)	12 (8)	2 (1.34)	0	134 (89.34)	150 (100)
Moderate rainfall Total	31 (6.89)	19 (4.23)	2 (0.45)	0 (0)	398 (88.45)	450 (100)
Tumakuru	0	0	0	0	150 (100)	150 (100)
Ballari	24 (16)	75 (50)	5 (3.34)	8 (5.34)	38 (25.34)	150 (100)
Raichur	28 (18.67)	60 (40)	22 (14.67)	0	40 (26.67)	150 (100)
Low rainfall Total	52 (11.56)	135 (30)	27 (6)	8 (1.78)	228 (50.67)	450 (100)
Grand Total	140 (10.38)	179 (13.26)	32 (2.38)	9 (0.67)	990 (73.34)	1350 (100)

Note: Figures in the parenthesis indicates percentage to the total

Source: Primary data collected during Aug-Sep, 2017

6.14. Opinion of Farmers on Risk Reduction in Farming

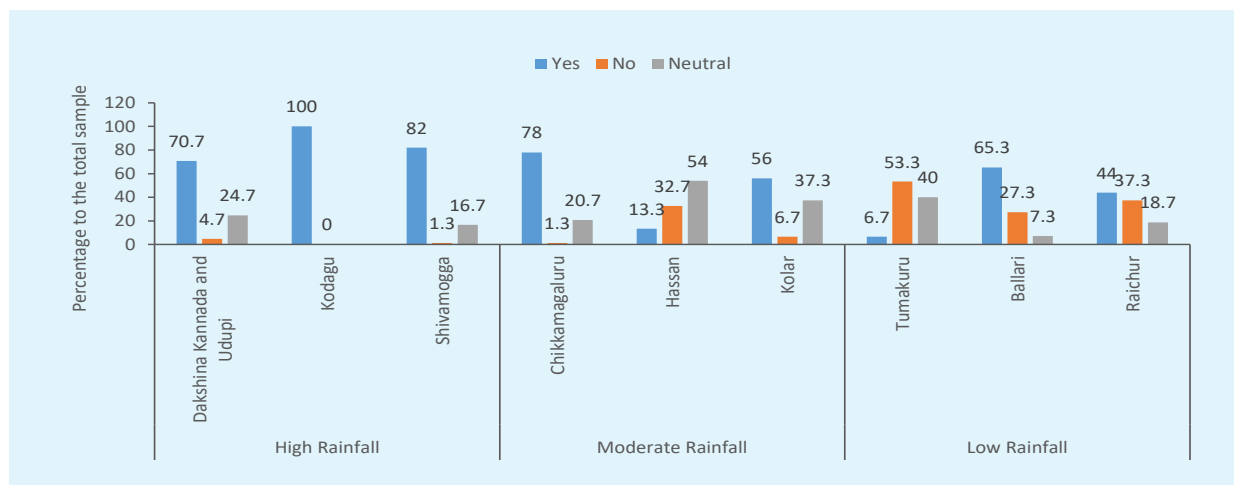
It can be clearly seen from Table 6.14 and Figure 6.3 that the weather information obtained from Varuna Mitra has reduced the risk in their farming operations. Across rainfall regions, 84 per cent of farmers from high rainfall districts, 49 per cent of farmers from moderate rainfall districts and 38.67 per cent of farmers from low rainfall districts have concurred that information received from Varuna Mitra help-desk reduced the risk. All sample farmers from Kodagu commented that risks involved in their farming operations have reduced owing to the introduction of weather forecast services, while 32.67 per cent of the farmers from Hassan, a moderate rainfall region had a contrasting opinion. On the whole, 57 per cent of the farmers were certain about the benefits of risk reduction from weather forecast services, while 18.30 per cent differed in their opinion on risk reduction and 24.38 per cent of the farmers were neutral on the subject. All the farmers in Kodagu (100%) opined risk reduction followed by Shivamogga (82%), Chikkamagaluru (78%) and Dakshina Kannada & Udupi (70%).

Table 6.14: Opinion of farmers on risk reduction in farming

Region / District	Yes	No	Neutral	Grand Total
Dakshina Kannada & Udupi	106 (70.67)	7 (4.67)	37 (24.67)	150 (100)
Kodagu	150 (100)	0	0	150 (100)
Shivamogga	123 (82)	2 (1.34)	25 (16.67)	150 (100)
High rainfall Total	379 (84.22)	9 (2)	62 (13.78)	450 (100)
Chikkamagaluru	117 (78)	2 (1.34)	31 (20.67)	150 (100)
Hassan	20 (13.33)	49 (32.67)	81 (54)	150 (100)
Kolar	84 (56)	10 (6.67)	56 (37.34)	150 (100)
Moderate rainfall Total	221 (49.11)	61 (13.56)	168 (37.34)	450 (100)
Tumakuru	10 (6.67)	80 (53.34)	60 (40)	150 (100)
Ballari	98 (65.33)	41 (27.34)	11 (7.34)	150 (100)
Raichur	66 (44)	56 (37.34)	28 (18.67)	150 (100)
Low rainfall Total	174 (38.67)	177 (39.34)	99 (22)	450 (100)
Grand Total	774 (57.33)	247 (18.3)	329 (24.38)	1350 (100)

Note: Figures in the parenthesis indicates percentage to the total

Source: Primary data collected during Aug-Sep, 2017

Figure 6.3 Opinion of the farmers on risk reduction in farming

6.15. Details on the Purpose other than Agriculture

Farmers contact help-desk Service to obtain rainfall forecasts to undertake activities other than agriculture such as socio-cultural activities, fishing, sericulture, transportation of produce and construction activities.

Though the present study has not quantified the economic benefits of weather forecast for allied sectors of agriculture, the information appears to be equally important for fishery, sericulture, poultry, livestock and other allied sectors. Fishermen can decide on the schedule of fishing based on the wind forecast in the region.

In the case of sericulture, optimum temperature and relative humidity is a must for growth of silkworm and formation of cocoons. Based on the weather forecast, conducive condition for rearing of worms can be maintained. In the case of rainfall forecast for the next day, mulberry can be harvested beforehand since post rain, the moisture content would increase which is not suitable for silkworms.

Poultry birds require warm temperature for growth especially in the initial stages of rearing. Fall in the temperature and cloudy weather is conducive for the growth of pathogens that affect poultry. With the rainfall forecast, the farmer can maintain warm environment by covering the rearing structures and providing artificial heat. The low temperature is fatal for the birds at earlier growth stages.

Weather forecast is also crucial in rearing of milch animals. With the forecast of rain, the farmer can safeguard the animals in the shed rather than letting graze in open. Incidence of rain while grazing in open can cause illness in animals thereby reducing the milk yield by upto 5 litres. The illness would also result in medical expenses of around Rs.500 which is an additional cost. With rain forecast, the farmer can also gather green fodder and stack in advance so as to avoid moisture and can protect the animal from illness. Thus forecast information becomes crucial in agricultural allied activities as well.

The farmers who sought weather information for purposes other than crop cultivation constituted around three per cent of total farmers. These farmers represented all the study districts except Kodagu. It can be seen from **Table 6.15** that 55 per cent of farmers, out of those who called for other purposes, had called Varuna Mitra to finalize a particular day for conducting social functions. All the farmers of Hassan and Raichur had called exclusively for this purpose. Construction was the other purpose for which the farmers had availed the weather forecast services of Varuna Mitra. Apart from these two purposes, the farmers of Dakshina Kannada and Udupi farmers used weather forecast information before going into sea for fishing purposes. There was an instance of farmer in Kolar who wanted to ensure possibility of rain before he keeps his chandrike for drying purpose. With the help of Table it can be said that the farmers have utility of rain forecast information not only for crop cultivation, but also for other purposes.

Table 6.15: Purpose-wise distribution of farmers
(Those who called for purposes other than crop cultivation)

Region / District	Purposes as a per cent to those who enquired				Number of farmers who called up
	Transportation of produce	Construction	Social functions and village festivals	To know wind direction (by fisher men and sericulture farmers)	
Dakshina Kannada & Udupi	0	20	20	60	5 (3.33)
Kodagu	0	0	0	0	0 (0.00)
Shivamogga	0	80	20	0	5 (3.33)
High rainfall Total	0	50	20	30	10 (2.22)
Chikkamagaluru	0	33.33	66.67	0	3 (2.00)
Hassan	0	0	100	0	10 (6.67)
Kolar	0	54.55	36.36	9.09	11 (7.33)
Moderate rainfall Total	0	29.17	66.67	4.17	24 (5.33)
Tumakuru	33.33	0	66.67	0	3 (2.00)
Ballari	0	50	50	0	2 (1.33)
Raichur	0	0	100	0	1 (0.67)
Low rainfall Total	16.67	16.67	66.67	0	6 (1.33)
Grand Total (%)	2.5	32.5	55.0	10.0	40 (2.96)
Total no. of farmers (Nos.)	1	13	22	4	40

Note: Figures in bracket indicate per cent to total farmers of respective district

Source: Primary data collected during Aug-Sep, 2017

6.16. Type of the Information received for other purposes

The type of information received by farmers confined mainly to rain forecast, wind speed and wind direction. There were no instances of farmers who enquired about information pertaining to relative humidity and temperature. District-wise distribution of farmers with respect to type of information they received is given in Table 6.16.

Table 6.16: Details on type of information received by Farmers
(Per cent to those who called for other purposes)

Region / District	Rainfall forecast	Relative humidity	Wind Speed	Wind Direction	Temperature	Farmers who believed and took action accordingly
Dakshina Kannada & Udupi	40.00	0.00	40.00	20.00	0.00	40.00
Kodagu	0.00	0.00	0.00	0.00	0.00	0.00
Shivamogga	100.00	0.00	0.00	0.00	0.00	20.00
High rainfall Total	70.00	0.00	20.00	10.00	0.00	30.00
Chikkamagaluru	100.00	0.00	0.00	0.00	0.00	66.67
Hassan	100.00	0.00	0.00	0.00	0.00	0.00
Kolar	100.00	0.00	0.00	0.00	0.00	72.73
Moderate rainfall Total	100.00	0.00	0.00	0.00	0.00	41.67
Tumakuru	100.00	0.00	0.00	0.00	0.00	0.00
Ballari	50.00	0.00	50.00	0.00	0.00	0.00
Raichur	100.00	0.00	0.00	0.00	0.00	100.00
Low rainfall Total	83.33	0.00	16.67	0.00	0.00	16.67
Grand Total (%)	90.00	0.00	7.50	2.50	0.00	35.00
Total no. of farmers(Nos.)	36	0	3	1	0	14

Source: Primary data collected during Aug-Sep, 2017

According to Table rainfall forecast was the most sought after information for farmers. It was only in Dakshina Kannada & Udupi and Ballari districts where information on wind speed and wind direction had some importance. These two types of information were received by only 10 per cent of the farmers who called Varuna Mitra for purposes other than crop production. Remaining 90 per cent of the farmers were interested in rainfall forecast.

It is of paramount importance to note that 35 per cent of farmers, out of those who called for special purposes, firmly believed the forecast information of Varuna Mitra and acted with due respect to the information they received. There were few instances where the construction work was postponed in Dakshina Kannada & Udupi and Kolar district. Rescheduling of village function was also mentioned by a farmer of Kolar. One farmer of Chikkamagaluru district, based on the information from Varuna Mitra, constructed an additional shelter and thus averted an embarrassment he otherwise would have faced in front of the guests he had invited for a family ceremony. Interaction with farmers revealed that, if not all farmers, many farmers could escape financial losses and could carry-on construction work and social functions due to prior weather information.

6.17. Accuracy levels of forecast called for other purposes

The weather forecast information received by farmers was accurate to the extent of 60 to 90 per cent for as much as 62.50 per cent of the farmers those who called Varuna Mitra for purposes excluding agriculture. However, the per cent of farmers who got the information to this level of accuracy varied from one study district to other as could be seen from Table 6.17.

**Table 6.17: Percentages Distribution of farmers by accuracy levels
(Per cent to those who called for other purposes)**

Region / District	Accurate up to 30 percent	Accurate between 30 to 60 percent	Accurate between 60 to 90 percent	Accurate above 90 percent	Total number of farmers	Farmers who believed and took action accordingly
Dakshina Kannada & Udupi	0.00	60.00	40.00	0.00	5	40.00
Kodagu	0.00	0.00	0.00	0.00	0	0.00
Shivamogga	0.00	20.00	80.00	0.00	5	20.00
High rainfall Total	0.00	40.00	60.00	0.00	10	30.00
Chikkamagaluru	33.33	0.00	66.67	0.00	3	66.67
Hassan	10.00	0.00	90.00	0.00	10	0.00
Kolar	9.09	0.00	63.64	27.27	11	72.73
Moderate rainfall Total	12.50	0.00	75.00	12.50	24	41.67
Tumakuru	100.00	0.00	0.00	0.00	3	0.00
Ballari	50.00	0.00	50.00	0.00	2	0.00
Raichur	0.00	100.00	0.00	0.00	1	100.00
Low rainfall Total	66.67	16.67	16.67	0.00	6	16.67
Grand Total (%)	17.50	12.50	62.50	7.50	-	35.00
Total no. of farmers(Nos.)	7	5	25	3	40	14

Source: Primary data collected during Aug-Sep, 2017

As could be observed from Table, there were instances of farmers in Kolar district who opined that the weather forecast information received by them was above 90 per cent accurate. Around 17.50 per cent of the farmers mentioned that accuracy of information was less than 30 per cent. The accuracy of information ranged from 30 to 60 per cent to 12.50 per cent of the farmers. It was difficult for the farmers to precisely quantify the impact of weather forecast information from Varuna Mitra. However, the farmers had no hesitation in accepting that they could save construction materials, save time and labour on several occasions.

The overall perception of the farmers about Varuna Mitra with respect to weather forecast information is encouraging in terms of type of information provided and its accuracy. With the passage of time, the farmers would accord more faith. However, the farmers would be more than happy to have crop advisory services also.

6.18. Accuracy of forecast for Agriculture

A majority of farmers sought short term rainfall forecast for 1 to 3 days and indicated a wide range of accuracy levels of these predictions. Overwhelming proportion of farmers (65.41%) has indicated the prediction was realised to the extent of above 50 per cent to 100 per cent.

The interesting observation was that there has been an increase in proportion of farmers indicating the percentage realisation. The share of farmers who indicated accuracy levels goes on increasing from less than 10 per cent to 40-50 per cent, Same trend has continued from 50-60 to 70-80 per cent. In the range of 80-90 per cent, there has been a decline and marginal increase in the range of 90-100 per cent realisation of prediction (**Table 6.18**). Among the high rainfall region, the accuracy levels were realised above 50 per cent was found at 77.56 per cent as expected. However the surprising fact is that, the accuracy levels were low in the moderate rainfall (56.89%) than the low rainfall region (61.78%). Among the districts, the proportion of farmers indicated low realisation levels was in Tumakuru (8.67%) and Hassan districts (42%) where the proportion of realisation was less than 50 per cent of the prediction.

The above results show that, the prediction was realised to a greater extent. Implied that, the prediction of rainfall is realized in most of the times. A few farmers indicated that their prediction had gone wrong falling under the category of less than 10 per cent realization of prediction. Overall, a majority of the farmers were of the view that although, the rain had occurred as predicted and they were unable to get exact quantum of rainfall prediction from the Varuna Mitra. In most cases, they got stereo type answers such as drizzling, light and heavy rain. In order to improve the accuracy levels, the isolation distance between Telemetric Rain Gauge Station and Telemetric Weather Gauge station should be reduced to 10 km and 100 kms respectively in wake of erratic rainfall variation across space and time (**Annexure 8.1**). Additionally, information from other institutions should be interlinked as well.

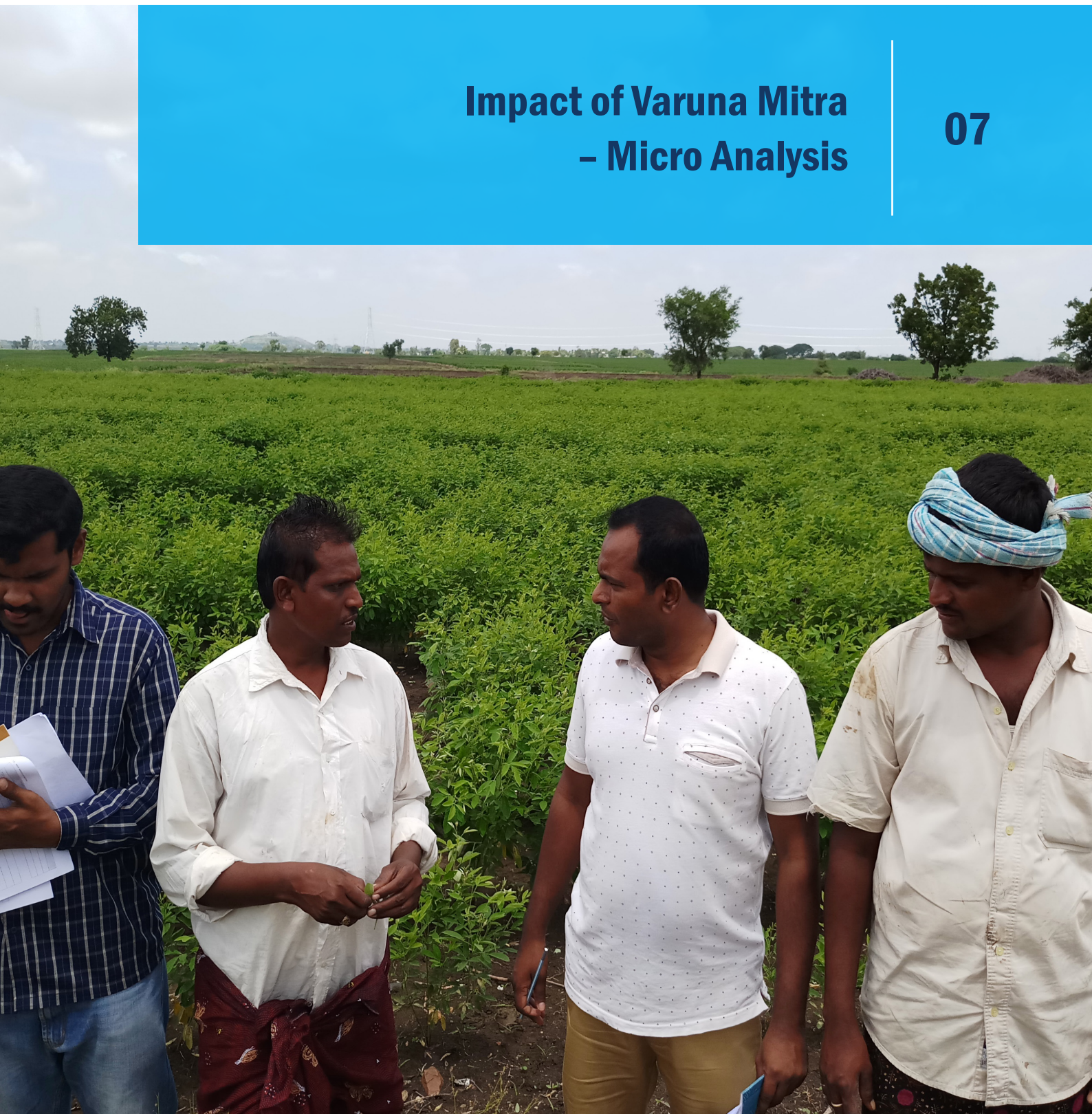
Table 6.18: Percentages Distribution of farmers by accuracy levels of rainfall prediction

Region / District	% to the total no. of farmers										Total no. of farmers
	<10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	
Dakshina Kannada & Udupi	5.33	0.67	4.67	12.00	12.00	23.33	13.33	16.00	7.33	5.33	150
Kodagu	0.00	10.00	0.00	0.00	0.00	17.33	28.67	30.00	10.67	3.33	150
Shivamogga	1.33	2.67	1.33	2.67	14.67	14.00	16.00	34.67	8.00	4.67	150
High rainfall Total	2.22	4.44	2.00	4.89	8.89	18.22	19.33	26.89	8.67	4.44	450
Chikkamagaluru	0.67	4.00	2.00	3.33	23.33	22.67	15.33	21.33	6.00	1.33	150
Hassan	6.00	21.33	13.33	12.67	4.67	12.67	12.67	10.00	6.67	0.00	150
Kolar	0.67	7.33	5.33	3.33	21.33	12.00	18.00	10.00	10.67	11.33	150
Moderate rainfall Total	2.44	10.89	6.89	6.44	16.44	15.78	15.33	13.78	7.78	4.22	450
Tumakuru	0.67	2.67	30.67	42.00	15.33	4.00	2.67	1.33	0.67	0.00	150
Ballari	6.67	2.67	2.00	0.00	0.67	3.33	16.00	11.33	14.67	42.67	150
Raichur	6.67	1.33	1.33	2.00	0.00	2.00	14.00	13.33	25.33	34.00	150
Low rainfall Total	4.67	2.22	11.33	14.67	5.33	3.11	10.89	8.67	13.56	25.56	450
Grand Total (%)	3.11	5.85	6.74	8.67	10.22	12.37	15.19	16.44	10.00	11.41	1350
Total no. of farmers(Nos.)	42	79	91	117	138	167	205	222	135	154	1350

Source: Primary data collected during Aug-Sep, 2017

Impact of Varuna Mitra – Micro Analysis

07



Impact of Varuna Mitra – Micro Analysis

CHAPTER 7

This chapter focuses on the impact of weather based information to the farmers. It includes impact of AgroMet Advisory Services (AAS) specifically weather based using review of literature and impact of the Varuna Mitra Services on cost of cultivation, yield, net income and post-harvest losses using primary data.

7.1. Impact of AgroMet Advisory Services on farmers

An assessment of the impact of weather based information is very essential to know, whether there is any significant change in the farmer's perceptions on cost of cultivation, yield, net income and post-harvest losses before and after the forecast/advice received from AAS.

The Agro advisory Services (AAS) of IMD provides weather and climatic information along with farm management options based on medium range weather forecast. In this case, the impact in terms of reaping higher yield and input saving in terms of water, manpower, electricity and fuel through proper irrigation scheduling are evident (Prasad et al., 2008).

A study of AAS in 14 states across India has demonstrated that it has decreased the cost of cultivation up to 25 per cent for the sample crops. The study also found that there has been increase in cost up to 10 per cent and net returns of up to 83 per cent. The crops that benefited most were paddy, wheat, pearl millet, fruits and vegetables. The economic benefit has been estimated at US \$7.575 billion per year and is extrapolated to rise to US \$32 billion if the entire farming community in the Country were to use AgroMet Advisory Services in their agricultural activities (Rathore & Parvinder Maini (2008).

The National Centre for Medium Range Weather Forecasting (NCMRWF) commissioned a study during 2003-2007 to assess the economic impact of AAS which was carried out by the National Centre for Agriculture Economics and Policy Research (NCAP). The study covered 15 AgroMet Field Units (AMFU) comprising of three kharif (2004, 2005 and 2006) and three rabi seasons (2004-05, 2005-06 and 2006-07). The major crops chosen for the study included food grains, oilseeds, fruits, vegetables and cash crops. The study concluded that farmers could avoid significant losses of farm inputs such as seeds, water, pesticides and increase in yield by the use of AAS. Increase in yield was estimated at 10-15 per cent and reduction in cost to an extent of 2-5 per cent as compared to control farmers (those who have not received AAS). (Malini & Rathore 2011).

In a recent study by National Council of Applied Economic Research (NCAER), carried out in 12 States (Punjab, Uttar Pradesh, Bihar, Uttarakhand, Madhya Pradesh, Rajasthan, Gujarat, Maharashtra, Assam, Andhra Pradesh, West Bengal, Tamil Nadu) and one Union Territory (Puducherry), it has been found that 93 per cent of sample farmers have opined weather predictions were reliable, which helped them to take decisions in farming stages starting from sowing to harvesting (NCEAR 2010).

The study in Western Himalayan found that the medium range forecasts tested for major crops showed an increase in profit due to weather forecasts of AAS to an extent of 2.1 -5.4 per cent in farmers' field and 8.9 - 14.7 per cent in university farm. The cloud cover forecasts saved 44-75 kg fish feed in 100 sq. meter area during South-west monsoon at Palampur. The temperature forecasts were useful in saving

10-20 per cent feed in poultry. The farmers' perceptions have revealed a fairly good use of forecast for various agricultural activities. Proper rainfall forecasts for drainage of maize, vegetables and pulses saved up to Rs.400 per irrigation. Further study found that, the farmers who were provided weather based advisories realized an increase of 1.6-4.6 per cent in net returns as compared to control farmers (non AAS). (Ranbir, et al., 2013).

The study has found that the Agro Advisory Services (AAS) has shown increase in yield by 2-3 qtl/ha in crops like paddy, arecanut, banana and 25 qtl/ha in the case of mango. The net gain in income was also found to be 5.3 - 25 per cent as compared those who have not received the information (Manjappa & Yeledalli, 2013).

Other studies have found substantial increase in yield due to AAS. (Raje Gowda et al., 2008 and Chaudhari et al., 2008). The incremental benefit was 31.4 per cent, 24.7 per cent, 16.2 per cent and 20.6 per cent in finger millet, red gram, field bean and tomato respectively in Eastern Dry Zone of Karnataka. (Raje Gowda et al., 2008). Whereas another study has found an increase by 13.15 qtl/ha in rice, 10 qtl/ha in mango and cashew nut in Konkan region of Maharashtra (Chaudhari et al., 2008)

Similar kind of study in Uttarakhand have found an increase of yield by 3.5 to 6.1 per cent in wheat and an income of 5.5 to 9.5 per cent more as compared to non-AAS during four rabi season between 2004 to 2008 (Kushwaha et al., 2010)

On the similar lines, the study in Hissar also found that the farmers have realized additional benefits in various crops due to better irrigation management an account of agro advisories (Singh et al., 2008).

The Cisco and BT life lines which is voice based information to farmers has impacted an increase of profits from 25 to 150 per cent due to a consistent improvement in crop quality and productivity (Laila Mamdani, 2012).

Climate Change, Agriculture and Food Security (CCAFS) has conducted an in-depth study of AAS in 2012 in association with the India Meteorological Department (IMD) and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in six States namely Punjab, Himachal Pradesh, West Bengal, Andhra Pradesh, Tamil Nadu and Gujarat. The study found that, a total of 67 per cent of farmers had some awareness about the AAS across 6 States. It was rated that the AAS information was most useful. Accuracy of the information was found to be 50-78 per cent across the States (Venkatasubramanian et al., 2014).

7.2. Impact of Varuna Mitra

The impact of Varuna Mitra services on cost of cultivation, yield, net income and post-harvest losses was estimated using following procedure. The impact has been estimated considering two situations, namely, with-information and without-information. The difference between the decision taken with-information and without-information expressed in physical and monetary values, which has been considered as an incremental change, which can be positive and negative depending on the impact indicator. Reduction in cost of cultivation, increase in income (attributed to price and yield), increase in yield and decrease in post-harvest losses with rainfall information is considered as gain, whereas increase in cost of cultivation, decrease in income, decrease in yield and increase in post-harvest losses was considered as losses.

Suppose, the farmer wants to apply PPCs and he wants to know the non-rainy day for application of PPCs. He will call Varuna Mitra help desk for rainfall information. If the farmer has received accurate rainfall information on a particular day as heavy rainfall, then he will postpone his decision for non-rainy

day. By doing so he could save cost, which was supposed to be incurred on PPCs. Otherwise without-information, PPCs applied would have washed away due to heavy rain. The saving in cost is a gain to the farmer.

In the case of sowing stage, rainfall plays a major role. Usually farmers start sowing after a few rainy days. If farmer gets accurate information about the continuous rainfall for few days, he can decide the sowing activity. From this, he could save cost incurred towards supplementary irrigation. This saving in cost is also a gain to the farmer, which also impose positive outcomes on yield and net income. Sowing at accurate time with timely information will increase the germination percentage, which ultimately reflects in the increase in yield and net income.

In a similar manner, impact has been estimated with-information and without-information for taking decision at various stages of farming viz., ploughing, sowing, germination, vegetative growth, flowering, fruit setting, fertilizer application, PPCs application, irrigation, tank-filling, harvesting, post-harvest management and marketing.

Overall impact has been estimated by aggregating the stage-wise impact to arrive at per acre and per farm gain or loss using Varuna Mitra Information. Finally, the impacts are presented in terms of two indicators, (1) Net gain or loss using cost of cultivation, net income and post-harvest losses and (2) Yield.

The impact of Varuna Mitra information specifically on rainfall was presented for major crops viz., paddy, arecanut, coffee, ragi, jowar, mango, redgram/tur, maize, cotton, tomato and chilli. The impact for these crops expressed both in terms of Net gain or loss and Yield. The reason for considering these crops as it accounts for 61 per cent of the cropping area. The remaining crops are grouped and the impact was estimated only in terms of net gain or loss.

Crop-wise impact analysis of Varuna Mitra Services

This section focuses on the rainfall forecast provided to farmers by Varuna Mitra services and assesses its impact on enhancing the economic benefits of the selected stakeholders' viz. farmers. The economic gains originating from the use of rainfall information has been calculated from the percentage increase or decrease indicated by farmers by assigning the market value to the increased production or loss on the total cost and returns during the reference period. In other words, the increase or decrease indicated by different farmers at different stages of the crop cycle was added and the average values used to calculate the benefits accrued per acre.

The field data revealed that 1350 farmers used the rain forecast information for as many as 72 different crops. Among them the major crops that were considered for the study were paddy, areca nut, coffee, ragi, jowar, mango, red gram/tur, maize, cotton, tomato and chilly. These crops account for 53 per cent of the farmers and 60.70 per cent of the operated land area in the study districts. The economic benefits captured by farmers for each of these eleven crops have been systematically presented in the ensuing subsections.

7.2.1. Arecanut

Arecanut is an important plantation crop in Karnataka concentrated in Dakshina Kannada, Shivamogga, Uttara Kannada, and Chikkamagaluru districts that receive fairly heavy rainfall. This crop is also grown in the plains like Tumakuru, Hassan, Chitradurga, and parts of Mandya, Kodagu and Mysuru. The present section attempts to analyse the impact of weather based service on yield, cost and returns of arecanut

growers in sample districts of these regions. Of the total 1350 sample farmers, 18 per cent of the farmers (244) cultivating arecanut in 636.5 acres have indicated an impact that is attributable to the information received from Varuna Mitra Helpdesk Services. The sample farmers were distributed in districts of Dakshina Kannada and Udupi, Shivamogga, Chikkamagaluru, Hassan and Tumakuru. A major share of the area under arecanut was sampled in Dakshina Kannada and Udupi (265 ac), followed by Chikkamagaluru (168.5 ac) and Shivamogga (154 ac). (**Table 7.1**)

The average yield per acre of arecanut was 10.56 quintals and the average yield under irrigation (10.7q) was 69 per cent more than the unirrigated crop (6.33q). The highest cost on cultivation was incurred by farmers of Dakshina Kannada (Rs. 25170/ac) followed by Tumakuru (Rs. 22620/ac) and Shivamogga (Rs. 22420/ac). The net returns in irrigated arecanut was Rs. 244475 per acre whereas in the case of unirrigated it was Rs.136658 per acre (**Table 7.2, Annexure 7.3 and 7.4**). Using these indicators the economic impact of information received from Varuna Mitra weather services have been assessed.

Of the total 362 farmers who have called for various purposes, 39 per cent of the farmers have sought rainfall information during harvesting stage followed by PH operations (29%) (**Table 7.3**). Heavy downpour during harvesting makes picking of nuts a difficult task. With the forecast of heavy rain, farmers may postpone the harvest thus saving labour cost which he would have otherwise incurred. Drying of the arecanut harvested is another important operation in arecanut cultivation. The drying period lasts for about 52 days post harvesting. The occurrence of rain during this period will increase the moisture content and the quality is reduced which affects the price of the produce.

With the forecast information, decrease in cost to an extent of Rs. 2571 per acre was indicated by 87 farmers. Reduction in cost was highest in Dakshina Kannada and Udupi (Rs.3424/ac) followed by Chikkamagaluru (Rs.776 /ac) and Hassan (Rs. 403/ac) (**Table 7.5**). The decrease was mainly indicated at the stages of PPC application and irrigation. The farmers would take up spraying of chemicals to control diseases like foot rot based on the rainfall forecast. With a forecast of rainfall, farmers would cancel irrigating the crop, thereby saving the cost on irrigation. Increase in the cost by Rs. 703 per acre was indicated 11 farmers on their irrigated crop (**Annexure 7.5**). When the forecast predicts no rainfall, the farmers would schedule irrigation which would incur costs. In addition, if it rained contrary to the forecast, the costs incurred would be an additional burden to the farmers.

The average yield realized by the arecanut growing farmers stood at 10.56 quintals per acre. On the whole, 60 farmers indicated to have reaped 4 per cent more than the actual yield by scheduling their operations based on the rainfall forecast. The highest increase in yield was mentioned by farmers of Chikkamagaluru district to an extent of 0.5 quintals per acre. (**Table 7.6 and 7.7**). The farmers attributed the increase to timely rainfall information obtained at different stages of fertilizer application, PPC application, Irrigation, and harvesting stages. With prior information of light rainfall the farmers can schedule the application of plant protection chemicals and fertilizers. When there is forecast of no rain, the farmers can schedule irrigation that aids in increasing yields and managing cost judiciously. A decrease in yield by 0.3 quintals per acre was indicated by one of the farmers in Chikkamagaluru district. The decrease was indicated during the fertilizer application stage.

In terms of income, an increase was disclosed by 106 farmers in irrigated area to an extent of 1.4 per cent. (**Annexure 7.13 and 7.15**) Whereas in unirrigated, six farmers mentioned an increase in their income by 1.37% (**Annexure 7.14 and 7.16**). The incremental increase in income was mainly indicated at the harvesting stage. Scheduling of picking based on the rainfall incidence can save labour cost and increase income. Several farmers in Dakshina Kannada and Shivamogga districts have mentioned a decrease in income. In the case of Dakshina Kannada, this decrease occurred during PPC application.

The cause could be due to failure of forecast and incidence of rain resulting in runoff of PPC that would incur an additional cost on chemicals and labour. While, none of the farmers in unirrigated arecanut have indicated a decrease in income.

On the aspect of post-harvest management, decrease in post-harvest loss was mentioned by farmers in all districts except Hassan. Increase in post-harvest loss was indicated by seven farmers to an extent of 0.27 quintal per acre. However, a decrease post-harvest loss was indicated by 101 farmers (**Table 7.10 and 7.11**). This represents the beneficial impact of an accurate forecast as farmers have scheduled their post-harvest operations like drying based on the rainfall forecast. Incidence of rain during drying can increase the moisture content and decrease quality of the nuts. In Dakshina Kannada and Udupi, under irrigated condition, farmers have mentioned both, an increase and decrease in post-harvest losses. But the number of farmers who indicated a decrease in post-harvest loss exceeds the ones who indicated an increase.

The impact of the forecast information can be assessed from the net gain realized by the farmers by the decrease in costs, increase in income and decrease in post-harvest losses. Though negative impact was indicated by quite a few farmers, the net gain for the farmers who indicated an impact stood at Rs.12728 per acre, a gain which the farmers would not have realized without the forecast information (**Table 7.12**). The net gain was highest in irrigated areca (Rs.12757/ac) whereas in the case of unirrigated arecanut it was Rs. 4400 per acre (**Annexure 7.21 and 7.22**). In the case of yield, the farmers have realized additional yield of 0.4 quintal per acre with the rainfall information. Of all the districts, the highest yield was realized by the farmers of Chikkamagaluru district (0.47q/ac), yield that the farmer would have had to forego in the case of no forecast (**Table 7.13**).

7.2.2. Coffee

Coffee cultivation in Karnataka is concentrated in the hilly regions of Kodagu and Chikkamagaluru districts and account for 71 per cent of the country's production followed by the States of Kerala and Tamil Nadu. Weather parameters are an important stress factor and a major driver of coffee agroecosystem dynamics. Due to the vast area under this plantation crop and its high dependence on monsoon, the crop was chosen to analyse the impact of weather based forecasts on its yield, cost and returns. Of the total farmers surveyed, 15 per cent of the farmers (211) growing coffee concentrated in Kodagu and Chikkamagaluru districts have indicated an impact from receipt of forecast information. These farmers were growing coffee in 1258 acres of land. Among both the districts, only 35 sample farmers in Kodagu district have indicated an impact on unirrigated coffee.

The average cost of cultivating coffee was Rs. 31260 per acre. The cost in the case of unirrigated coffee (Rs. 38609/ac) was 26 per cent higher than irrigated coffee (Rs. 30583/ ac). This is because unirrigated coffee includes a major area under Arabica variety of coffee which is highly susceptible to pest and diseases and needs frequent application of pesticides and chemicals. The average net returns was higher in case of Chikkamagaluru (Rs.35414/ac) followed by Kodagu (Rs.33880 /ac) (**Table 7.2, Annexure 7.3 and 7.4**).

The specific impacts on cost, returns, yield and post-harvest losses are a result of scheduling various farm operations across various stages of crop growth. Of the 432 farmers who called, the highest per cent of farmers had called during the harvesting period (30.56%) followed by fertilizer application stage (17.36%) and flowering stage (15%). These are the most crucial stages in coffee cultivation that impacts the yield (**Table 7.3**).

Net decrease in cost due to forecast information amounted to Rs. 6273 per acre as mentioned by 56 farmers. While an increase in cost by Rs. 3477 per acre was mentioned by 25 farmers (**Table 7.4 and 7.5**). Both the coffee growing districts attributed inaccurate forecasts as the cause for increase in cost. The impact on cost was specifically mentioned at the stages of fertilizer application and irrigation. With a forecast of light rains, coffee farmers would take up application of fertilizers. However, in the event of a heavy downpour contrary to the forecast, would result in leaching of fertilizers applied. As such, farmers would be compelled to reapply fertilizers incurring additional cost. Another important stage that requires rainfall information is flowering period during February-March especially in the *Coffea robusta* where farmers irrigate for blossom. A farmer may schedule irrigation based on the information obtained from the help desk. During the forecast of rain, the farmer would not incur cost on irrigation. However if the forecast was for no rain and then if there is downpour the farmer would have already incurred cost on irrigation which is an additional burden.

The analysis from the survey revealed that the yield of coffee without rainfall information would be 8.39 quintals per acre, whereas with the forecast information the farmers realised an additional yield of 0.77 quintals per acre. The highest incremental increase in yield was indicated by the farmers in Chikkamagaluru (1.71 q/ac). However, 13 farmers mentioned a decrease in yield in Kodagu to an extent of 0.4 quintals per acre particularly attributed to anomalies in rainfall during the harvesting stage (**Table 7.6 and 7.7**). Such incidence of untimely rain during harvesting can cause dropping of berries that would decline the yield. However, in spite of having the rainfall information, taking up any preventive measures to avoid dropping of berries is impractical as the plantations are spread across large areas.

The actual impact of the actions taken post receiving the rainfall information can be assessed by analysing its impact on the income of the farmers. The farmers in both the districts mentioned an increase in the income while, a few farmers indicated a decrease in income. The increase in income by Rs. 3713.5 per acre was mentioned by 42 farmers while the decrease was indicated by 19 farmers that amounted to Rs.3521 per acre (**Table 7.8 and 7.9**). None of the sample farmers in unirrigated coffee plantations witnessed a decrease in income. However, a decrease in income on irrigated coffee areas was mentioned at flowering and harvesting stages. The ideal weather condition post irrigation are light showers or cool weather, however if there is scorching heat during this stage, it would result in premature drying and dropping of flowers that reduces yield and income. However, no immediate preventive measures can be taken against this given the vast extent of the plantation to control the micro-climate.

Post-harvest loss in coffee cultivation is a pressing concern. Accurate rainfall forecast can help the farmers in scheduling farming operations thereby decrease the post-harvest losses to a certain extent. Picked coffee needs to be sun dried for about 15 days. Incidence of rain during this period can reduce the quality of the beans. On the whole, 119 farmers mentioned a decrease in post-harvest losses to an extent of 1.33 q/acre. In the case of both the districts, more than half of the sample farmers indicated a decrease in post-harvest losses. An accurate rainfall forecast heavily influences the scheduling of coffee harvesting as moisture content in the commonly sun dried berries result in loss of quality. Also, in times of a forecast predicting heavy rainfall, farmers could save their crop from dispersion and/or moisture saturation caused by rainwater in the drying yard thereby preserving the quality of the beans as well. However 25 farmers mentioned an increase in post-harvest losses to an extent of 1.21 quintals per acre (**Table 7.10 and 7.11**).

The incremental net returns realised from the rainfall information was Rs. 11118 per acre. The net gain in unirrigated coffee (Rs. 13534/ac) was 26 per cent higher than the irrigated (Rs. 10661/ac) (**Table 7.12, Annexure 7.21 and 7.22**). In the case of yield, the incremental yield realised in irrigated coffee was 0.92 q/ac whereas in unirrigated coffee it was 0.26 q/ac (**Annexure 7.23 and 7.24**).

Therefore, with increasing incidences of anomalies in weather parameters, forecasts and timely dissemination of information on weather would help coffee farmers mitigate losses and be in a position to adopt mitigation measures at different stages of their production cycle.

7.2.3. Cotton

Cotton is an important fiber and cash crop and plays a dominant role in the industrial and agricultural economy in India. Karnataka is one of the major long staple cotton producers in the South and the ninth major cotton growing state in the country. The state is known for growing hybrids and high yielding varieties in districts like Raichur, Bagalkot, Bijapur, Ballari, Dharwad and Belagavi under irrigated conditions. While, rainfed cotton (with assured rainfall) is predominantly grown in Dharwad, Belagavi, Shivamogga, Mysore and Karwar.

As rainfed cotton yields are closely related to prevailing weather conditions especially the onset of the monsoons and length, any anomalies in these parameters result in an adverse impact on returns

The impact of weather forecast on yield and income levels of cotton was indicated by 158 farmers who were cultivating cotton on 1065 acres (Table 7.1). The average yield of cotton was 12.51 qtl/ac with the highest yield realized in Ballari (14.40 q/ acre). The average cost of cultivation was Rs.26366.58 per acre whereas the net return was Rs.25358 per acre (Table 7.2). Of the 166 farmers who called, highest per cent of the farmers obtained rainfall information during PPC application stage (47.12%), to protect the crop from pest and diseases (Table 7.3).

With regard to costs, decrease in cost to an extent of Rs.1,237.43 per acre was indicated by 104 farmers. A majority of the farmers (83) in Raichur district indicated a decrease in cost to the extent of 7.18 per cent per acre (Table 7.4 and 7.5). The decrease in cost was indicated at the stage of PPC application. The decrease of cost at PPC application stage was indicated by 30 and 14 farmers from Raichur and Ballari districts respectively. Cotton crop is pest intensive and periodic application of pesticides (5-6 times of crop period) is essential to control the pest and reap a good harvest. When farmers receive rainfall forecast, they postpone the application of pesticides and thereby no additional costs from disuse or reapplication is incurred. But the incidence of rain within 3-4 hours of application of PPCs can increase the cost as the farmer is compelled to reapply the chemicals. Further, the increase in cost at germination and irrigation stage was indicated by around six farmers in each of these stages. Under the rainfed conditions, the farmers realized good germination (100%) within 4-5 days of sowing when the forecast of rainfall given by the Varuna Mitra was accurate. However, there were instances when the germination was only up to the extent of 80 per cent as the actual rainfall did not match the forecast. In order to maintain a good density of plants in the field, farmers have replanted the cotton plants wherever the germination was scanty or poor. This has resulted in farmers incurring additional cost on labour and seeds.

Under irrigated conditions, farmers enquired about the probability of rain before taking a decision to irrigate the crop by borewell and canal. However, during instances of no rainfall prediction, farmers have irrigated their crop and prevented flower dropping. . On the other hand, if they had irrigated and there was a spell of rain subsequently on the same day, the moisture in the soil would increase and would have led to flower dropping and also development of small pods. To mitigate this, farmer has to reapply fertilizers and chemical spray which increases cost of cultivation.

Farmers (102) in both the districts mentioned an increase in yield by 0.46 quintals per acre. While, a decrease in yield by 0.57 q/ ac was indicated by 16 farmers (Table 7.6 and 7.7). The increase in yield was

indicated at the stages of sowing, germination, fertilizer application, PPC application and irrigation. The cotton growers need to apply pesticides post 45-50 days of sowing. Prior to its application, many farmers called Varuna Mitra enquiring about the probability of rain and accordingly they applied pesticides. The increase in yield at irrigation stage was indicated by nine farmers from Raichur. This increase has been attributed to timely mobilization of irrigation based on the probability of occurrence of rainfall.

In terms of income, an increase in income by Rs.1581 per acre was indicated by 87 farmers (55%). This increase was indicated at the stages of sowing, germination, fertilizer application, PPC application, irrigation and harvesting. A decrease in income by Rs.1056.4 per acre was indicated by 13 farmers (8.22%) (**Table 7.8** and **7.9**). Prior to applying pesticides many farmers called the Varuna Mitra enquiring about the probability of rainfall during the period set by them for application. Accordingly, they had scheduled the application of pesticides. This has helped the farmers increase their income from stable yields.

In terms of post-harvest management, post-harvest decrease in loss was indicated by 22 farmers of both the districts to an extent of 0.73 quintals per acre (**Table 7.10** and **7.11**). In the case of irrigated cotton, decrease in post-harvest loss was reported by eight farmers and in unirrigated cotton 14 farmers mentioned the same (**Annexure 7.17** and **7.18**). Post-harvest increase in loss was indicated by only two of the farmers of both the districts to an extent of 2.25 quintals per acre (**Table 7.11**). Unexpected rain during harvest results in a heavy loss in terms of perishability of the crop as well as a fall in the quality of the produce. In order to accurately schedule harvesting of the crop, farmers call Varuna Mitra to enquire about the probability of rainfall in the period considered by them to harvest. If the forecast information provided predicts no rain, farmers go ahead with the harvest. Preponement of the harvesting time due to forecast of heavy rains as well as securing crops in the drying yard from moisture saturation on account of the probability of rain/ cloudy weather has led to decrease in post-harvest losses.

The average net returns realised from the rainfall information was Rs.4126.03/- per acre (**Table 7.12**). The net gain in irrigated cotton (Rs. 4257/- per acre) was more than that of unirrigated cotton (Rs.2189 per acre) (**Annexure 7.21** and **7.22**). In the case of yield, the incremental yield realized in irrigated cotton was 0.37 q/ac whereas in unirrigated cotton it was 0.26 q/ac (**Annexure 7.23** and **7.24**).

7.2.4. Paddy

Paddy is one of the major cereals cultivated in Karnataka and predominantly grown in kharif season. The present study tries to assess the impact of weather forecast information on cost, yield, income and post-harvest losses of paddy in the districts of Dakshina Kannada & Udupi, Shivamogga, Chikkamagaluru, Kolar, Tumakuru, Ballari and Kodagu. The average yield in these districts stood at 15.66 quintals per acre with cost of cultivation amounting to Rs. 17193 per acre and a net return of Rs. 15265 per acre. The highest yield realized was in the low rainfall region with a yield of 22.55 quintals per acre (**Table 7.2**). This is due to the sufficient canal water availability in the districts of Ballari and Raichur. A total of 323 farmers indicated the impact of Varuna Mitra help desk services on cost, yield, net returns and post-harvest losses in terms of percentage increase and decrease and these indicators have been chronicled in the following paragraphs.

A large number of farmers (44%) have sought forecast information during harvesting stage of the crop cycle. Incidence of rainfall during harvesting can deteriorate the quality of grains and therefore scheduling of harvesting based on rainfall and proper post-harvest care based on the forecast can aid the farmers in realizing better returns.

In terms of the cost of cultivation, the highest average decrease in cost was indicated by farmers growing irrigated paddy (Rs. 996 per acre) whereas, the decrease considering both irrigated and unirrigated paddy was Rs. 949 per acre as stated by 84 farmers. Highest decrease in cost was witnessed in Ballari (Rs.795/ac) while the least was witnessed in Chikkamagaluru (Rs.448/ac) (**Table 7.4, 7.5 and Annexure 7.7 and 7.8**). Accurate forecast of rainfall at sowing stage can reduce cost. The farmers can take up sowing based on the incidence of rain. During forecast of high temperature, the farmers can postpone sowing and germination. Heavy downpour during PPC application stage can result in leaching of the chemicals sprayed; hence the farmer is compelled to spray again which is an additional cost. Timely irrigation is crucial in paddy cultivation. Based on the forecast information, farmers would irrigate the crop. However, if the forecast is inaccurate and it does rain, irrigation charges incurred results in an additional burden on the farmers.

Scheduling of operations based on the rainfall information obtained has led to a yield increase of 0.39 quintals per acre as indicated by 55 farmers. However, reduction in yield was mentioned by one of the farmers in Ballari district. The farmer attributed the reduction in yield during spraying of plant protection chemicals. The Farmer might have taken up spraying based on anticipation of light rains, however, increase in the intensity of rain negates the effects of spraying and results in additional cost to the farmer and consequently affects the yield. The highest increase in yield was observed in high (0.49q/ac) followed by moderate rainfall regions (0.35q/ac) and low rainfall region (0.26q/ac) (**Table 7.6 and 7.7**).

The average income has increased by Rs.473 per acre as indicated by 127 farmers. Highest increase in income was observed in irrigated paddy (Rs.541/acre) followed by unirrigated (Rs.192/ac). The increase was mostly mentioned by the farmers in Ballari (81.12%), Kodagu (56.25%), and Shivamogga (53.72%). While, a decrease in income was mentioned by 30 farmers to an extent of Rs.350 per acre (**Table 7.8 and 7.9, Annexure 7.15 and 7.16**). The increase in income is a result of scheduling of various operations based on the forecast of rain incidence. This would have saved the labour cost, increased the yield levels thereby increasing the income.

In the case of post-harvest losses, none of the farmers have mentioned an increase in post-harvest losses. On the contrary, there has been a decrease in PH losses to an extent of 0.63 q/ac that was reported 74 farmers with 44 of them from Shivamogga (**Table 7.10 and 7.11**). With the help of rainfall forecast, farmers could schedule their harvesting operation and safeguard the crop from post-harvest losses. Some of the timely practices during this stage of harvesting would be protecting the crop in the drying yard, postponement of harvesting operation in the case of heavy rain forecast. Incidence of rain during post-harvest operations like threshing can lead to loss of crop and reduce the quality of grains.

Net gain realized from the cultivation of paddy was Rs.2549 per acre. Net gain in the case of irrigated paddy was Rs. 2869 per acre, while unirrigated paddy gains were lesser by 32 per cent. The highest net gain was realized in Ballari district (Rs.3084/ac) followed by Shivamogga (Rs.2324/ac) and Raichur (Rs.2302/ac) (**Table 7.12, Annexure 7.21 and 7.22**). Among the various rainfall regions, the analysis revealed only marginal differences in the income realized. In the case of yield the highest net yield was realized by Kodagu (0.61q/ac) followed by Kolar (0.56q/ac) and Dakshina Kannada (0.49q/ac) (**Table 7.13**).

7.2.5. Maize

Maize is an important cereal crop in Karnataka and is grown through all seasons both under rain fed and irrigation conditions. In terms of production, Karnataka stands second in the country next to Andhra

Pradesh. In recent years, the area, production and yield of the crop has been increasing owing to a variety of interventions and given that maize is extremely sensitive to any water deficiency, information on rainfall forecasts have significantly contributed to this growth. In the present study, 6.5 per cent of the total sample farmers (1350) growing maize in 493 acres of land have sought information on rain forecast (**Table 1**).

Out of 88 maize growing farmers, majority of them have received the rainfall information during sowing stage (50%) since adequate moisture is essential for germination which further leads to good crop stand and yield. Failure of rain after sowing compels the farmer for re sowing which would be an additional cost (**Table 7.3**).

The weather based information from time to time has had both positive and negative impact on yield, income, cost and post-harvest losses. With regard to cost, 8 farmers indicated decrease in cost to an extent of Rs. 608.33 per acre (**Table 7.5 and 7.4**). With prior information about dry spells, the farmer may plan irrigation leading to better germination. In the case of low germination, the farmers compelled to re sow which leads to increase in cost. Similarly during application of PPC, incidence of rain can cause washing away of chemicals which is an additional cost to the farmer.

With access to forecasts, timely expected rains or irrigation in times of low probability of rainfall during sowing can impact yields. In the event of an incidence of rain post irrigation, excess water in the crop fields can lead to stagnation that can affect the crop in its early stages. This also results in additional costs that could have been avoided if there was a high probability of rainfall. On the other hand, accurate forecast of rain would help the farmer avoid scheduled irrigation and save on costs.

Increase in yield was mentioned by 53 farmers to an extent of 0.85 quintals per acre. Adequate moisture during fertilizer application is crucial. Farmer can schedule the irrigation based on the rainfall forecast during application of fertilizer. Without the forecast information, the farmer would have taken up irrigation which would turn out be an additional cost. Decrease in yield was indicated by 26 farmers to an extent of 0.41q per acre (**Table 7.6 and 7.7**). Low moisture during cob formation will result in decreased yield.

In case of income, 22 farmers have mentioned decrease in income of Rs.220/acre and in Ballari district 15 farmers have indicated increase in income of Rs.756/acre. The highest increase in income was observed in high rainfall region (Rs.942/acre) followed by Low rainfall region (Rs.725/acre) (**Table 7.8 and 7.9**).

With the forecast information, three farmers indicated a decrease in post-harvest loss by 0.35q/acre. Incidence of rain while drying the cobs can reduce the quality of the crop. Among the districts, 4.78 per cent of the decrease in the post-harvest loss was observed in Shivamogga district which influenced the yield positively by 0.6q/acre (**Table 7.10 and 7.11**).

The net gain realized by the maize farmers is assessed from the decrease in cost, increase in income and decrease in post-harvest losses. The maize farmers indicated both a positive and negative impact but the net gain per acre stood at Rs.1070. The net gain was highest for unirrigated maize (Rs.1271 per acre) compared to irrigated (Rs.767/acre) (**Table 7.12, Annexure 7.21 and 7.22**). In case of yield, the farmers realized an additional yield of 0.44q/acre with the rainfall information. Among the districts, the highest yield was realized by the farmers of Shivamogga district (1.17q/ac) (**Table 7.13**).

7.2.6. Ragi

Karnataka has the largest area under finger millet and is the biggest producer of ragi in India. Ragi is the main staple food consumed by the majority of the population in South Karnataka. It is grown as rainfed as well as irrigated crop, but majority cultivated in rainfed condition as a mono crop as well as intercrop. Ragi is mainly grown in Tumakuru, Ramanagara, Kolar, Mandya, Bengaluru Rural, Hassan, Chikkaballapura, Kolar, Ballari, Mysuru, Bengaluru Urban Chitradurga, Chikkamagaluru Chamarajanagar and Davanagere districts. In Ragi, rainfall forecast information plays a very important role in scheduling of various agricultural operations. This crop is intolerant to heavy rainfall and requires a dry spell at the time of grain ripening. Of the sample farmers, 320 farmers indicated an impact of rainfall information on ragi in the districts of Ballari, Chikkamagaluru, Hassan, Kolar and Tumakuru with a total land of 590 acres (Table 7.1).

Average cost of cultivation of Ragi indicated by farmers was Rs.6362 per acre. The cost in the case of irrigated Ragi (Rs.8379/acre) was 37.27 per cent higher than unirrigated Ragi (Rs.6104.2/acre). This was because irrigated ragi included additional labour at the time of irrigation and more fertilizer dosage compared to unirrigated ragi. The average yield of Ragi was more in irrigated condition (11.16 q/acre) than unirrigated condition (8.44 q/acre) and the average net returns was also higher in case of irrigated ragi (Rs.16107/acre) than unirrigated ragi (Rs.6944.53/acre) (Table 7.2, Annexure 7.3 and 7.4).

The specific impacts on cost, returns, yield and post-harvest losses were a result of timely scheduling various farm operations across eleven stages of crop growth. Of the 452 farmers, the highest number of farmers had called during the harvesting period (39.16%) followed by sowing stage (34.29%) and post-harvest management (10.84%). These are the most crucial stages in Ragi cultivation that impact the yield and as well as quality of the produce.

A total of 48 farmers mentioned a net decrease in cost due to forecast information amounting to Rs.985 per acre (Table 7.4 and 7.5). The decrease in cost can be attributed to accurate forecast at the time of harvest and sowing season which avoids excess labour cost. Majority of farmers (24%) mentioned that there is a yield enhancement due to accurate information provided by Varuna Mitra at the rate of 0.77 quintal per acre. The farmers in Hassan mentioned yield increase by 0.73 quintal per acre whereas Tumakuru farmers indicated an increase of 0.57 quintal per acre. Some farmers also mentioned there is a decrease in yield due to decisions based on inaccurate forecast at the time of sowing and PPC application. A total of 18 farmers (5.6%) from Hassan mentioned yield decrease at the rate of 0.41 quintal per acre followed by Tumakuru (4 farmers) at the rate of 0.62 quintal per acre, the decrease in yield is mainly due to poor germination rate resulted due to wrong decision at the time of sowing (Table 7.6 and 7.7).

A total of 77 farmers (24%) opined that there was an increase in income at the rate of 6.02 per cent per acre. Only a few farmers (3%) mentioned a decrease in income (Rs.357/- acre) due to untimely incidence of rain at the time of harvesting (Table 7.8 and 7.9).

Weather forecast plays crucial role in decisions related post-harvest management in Ragi. Incidence of rain during harvesting can reduce the yield and quality is also affected. As per analysis 112 farmers (35%) opined about having benefited from Varuna Mitra forecast information by reducing post-harvest loss at the rate of 0.41 quintals per acre. In Hassan, 32 farmers opined that they were able to save the yield up to 12.54 per cent by avoiding post-harvest loss (Table 7.10 and 7.11). Occurrence of rain during threshing stage can deteriorate the quality of grain. A total of 14 farmers from Hassan mentioned an increase in post-harvest loss due to inaccurate forecast by Varuna Mitra at the rate of 1.37 per cent acre.

The average net returns realised from the rainfall information was Rs.3056.78/- per acre. The net gain from unirrigated ragi was Rs. 3073.09/- per acre which was higher than irrigated Ragi Rs.2927.40/- per acre (**Table 7.12, Annexure 7.21 and 7.22**) In the case of yield, the incremental yield realised from irrigated ragi was 0.71 q/ac whereas in unirrigated ragi it was 0.45 q/ac (**Annexure 7.23 and 7.24**) .

7.2.7. Tur

Tur or Pigeon pea or red gram grown mostly in rain fed conditions is one of the major pulses grown in Karnataka. The north Karnataka districts viz., Gulbarga, Vijayapura, Bidar, Raichur and Ballari are the leading producers of this crop. A total of 38 farmers in three districts (Kolar, Ballari and Raichur) grew tur in an area of 261.82 acres (**Table 7.1**). A major proportion of the irrigated area was in Raichur followed by Ballari.

The average yield of Tur was 7.74 qtl/ac with the highest yield realized in Ballari (8.23 q/ acre). While, the average cost of cultivation was Rs.8976.26 per acre whereas the net return was Rs.16127.46/- per acre (**Table 7.3**). Among all the stages, highest per cent of the farmers obtained rainfall information during PPC application stage, to protect the crop from pest and diseases.

The highest proportion of farmers called Varuna Mitra during application of PPC (34.21%) followed by sowing (26.32%) (**Table 7.2**). The least number of calls were made during the flowering and ploughing stages. A higher proportion of farmers called during the application of PPC which implied that the yield levels of pigeon pea mainly depended upon the management of pests as the crop is sensitive to pests during the flowering stage.

The cost per acre has decreased by Rs.585.42/-per acre, the decline per acre cost of cultivation in the case irrigated area (Rs. 583.33/-) and the unirrigated operated area (Rs. 587.50/-) was almost similar (**Table 7.5, Annexure 7.7 and 7.8**). Rainfall during PPC application can increase cost as the farmer is compelled to re spray.

Accurate rainfall information has further resulted in increased yield as indicated by 10 farmers to an extent of 0.33q/ac which the farmer would have otherwise forgone. Increase in yield was particularly attributed to the PPC application stage (**Table 7.6 and 7.7**).

Another distinct fact is that there has been both, a positive and negative impact on income. As many as 16 farmers indicated an increase in income (Rs.1559.35/- per acre) because farmers applied PPC which controls the disease and enhances the yield. While, 16 farmers indicated a decrease in income (Rs.340.29 /-) due to incidences of rainfall during PPC application (**Table 7.8 and 7.9**).

It was established from the survey that the timely use of rainfall information to alter the harvesting operations for tur prevented post-harvest losses of the crop. This resulted in an increase in the yield by 0.28 quintals per acre which pushed the increase in yield from 7.46 to 7.74 quintals per acre (**Table 7.11**).

The average net returns realised from the rainfall information was Rs.1385.71/- per acre. The net gain in unirrigated tur was Rs.1119.79/- per acre which was higher than irrigated tur Rs.750.81/- per acre (**Table 7.12, Annexure 7.21 and 7.22**).

7.2.8. Chilli

Chilli is an essential vegetable and condiments crop with an immense commercial value. Due to variation in the agro climatic conditions of different chilli growing areas pests have had varying trends in their incidence as well as in the nature and extent of damage to this crop. Therefore, the onset, frequency and density of rainfall during this crop cycle plays a key role in obtaining a profitable harvest. In this study, the cultivation of chilli was reported in Ballari and Raichur districts and the impact of weather forecast on yield and income levels of chilli was indicated by 55 farmers who were cultivating chilli in land of 278.30 acres. The average yield of chilli in these districts was 8.25 q/ac with the highest yield being realised in Raichur (8.89 q/acre). The average cost of cultivation was Rs.33828 per acre and the net returns was Rs.31202 per acre (**Table 7.1 and 7.2**).

Of the 100 farmers who called for forecast information, a majority of the farmers called during harvesting (17.86%), vegetative growth and flowering (13.1%) (**Table 7.3**). Incidence of heavy rain for chilli crop can affect the yield thereby increasing the cost borne by the farmer.

With regard to costs, decrease in cost to an extent of Rs.1218 per acre was indicated by 21 farmers, while two farmers in Raichur district mentioned an increase in cost by Rs.1790 per acre (**Table 7.4 and 7.5**). The increase in cost was indicated at the stage of PPC application. On forecast of cloudy weather which is congenial for the multiplication of disease causing agents, the farmers had taken up PPC application in order to save the crop. As against a forecast of sunny weather, the pesticides application was an additional cost on the farmers. Thus increasing the cost incurred per acre. However, this was mentioned by less than 18 per cent of the total 44 farmers in Ballari district.

Nearly 30 per cent of the farmers in both the districts mentioned an increase in yield by 0.37 quintals per acre. Decrease in yield by 0.35 q/ ac was indicated by 6 farmers from Ballari district (**Table 7.6 and 7.7**). The decrease was indicated at the stages of flowering, fertilizer application, PPC application and irrigation. Decrease in yield at the flowering stage was indicated by one of the farmers as excess rain during flowering leads to dropping of flowers thus affecting the yield. However, they are beyond the control of the farmers. The decrease of yield at irrigation stage was indicated by two farmers. On forecast of no rainfall, these farmers had taken up irrigation. However, post irrigation there was incidence of heavy rainfall. This led to water logging in the crop field which is not congenial for the plant growth. At the maturity stage, heavy rainfall would lead to dropping of fruits that would cause decrease in yield.

Increase in income by Rs.1626 per acre was indicated by 20 farmers (**Table 7.8 and 7.9**). This increase was indicated at stages of ploughing, vegetative growth, flowering, fruit setting, fertilizer application, PPC application, irrigation and PHM. A decrease in income was indicated by 5 farmers. As mentioned earlier, heavy rain can cause flower dropping and can affect the yield. Decrease in income was also mentioned at fertilizer application stage. Leaching of fertilizers due to heavy rain is an additional cost on the farmer and could also affect the yield.

Post-harvest decrease in loss was indicated by the farmers of both the districts to an extent of 0.62 quintals per acre (**Table 7.10 and 7.11**). In the case of unirrigated chilli, decrease in post-harvest loss was mentioned by 80 per cent of the farmers. Preponement of the harvesting due to forecast of heavy rain and protecting the crops in the drying yard has led to a decrease in post-harvest losses. Net gain in the case of chilli crop was Rs.6817 per acre whereas in the case of irrigated was Rs.7260 per acre and in unirrigated it was Rs.4820 per acre. In the case of yield, the net gain was 0.18 quintals per acre (**Table 7.13**).

7.2.9. Mango

Mango occupies a prominent place amongst the fruits grown in India because of its great utility, and is acknowledged as the king of fruits. Karnataka is one of the major states cultivating this crop. Within the state, Kolar district is famous for the mango cultivation, particularly in Srinivasapura taluk. A failure of rain would lead to dropping of tender fruits that might result in 15 per cent decline in yield.

The farmers have contacted Varuna Mitra at four different stages of crop cultivation. Of the 12 farmers who sought information at various stages, 50 per cent of the farmers have contacted during harvesting stage as incidence of rain during harvesting can deteriorate the quality of fruits. Hence the farmer may prepone the harvesting in case of probability of rainfall. 33.33 per cent farmers have also called during PPC application stage (**Table 7.3**). As fruit setting is a crucial stage in mango, timely spraying of chemicals and any incidence of rain at this stage can both reduce yield.

With regard to cost component, five farmers have mentioned a decrease in cost by Rs.1268/acre with prior rainfall information, application of pesticides during flowering and fruit setting stage has marginally reduced the cost which contrarily the farmer would have incurred in case it rained (**Table 7.4 and 7.5**). Mango needs about 15 days for full bloom of the flowers. This stage is susceptible to pests. Application of pesticide at this stage is crucial. Incidence of rain during PPC application can increase the cost.

A single farmer indicated an increase in yield of 1.2q/acre that contributed 3.43 per cent to the total yield of the farmer (**Table 7.6 and 7.7**). Spraying of chemicals at the time of fruit setting, can lead to increased yield. In terms of income, only one farmer has expressed an increase in income by Rs.1125/acre (**Table 7.8 and 7.9**).

In case of post-harvest management, decrease in post-harvest loss of 2.4 per cent was mentioned by five farmers in Kolar district that influenced an increase in yield of 0.84q/acre (**Table 7.10 and 7.11**). Incidence of rain at the time of harvest can deteriorate the quality of fruits thus fetching a lower price.

None of the mango growing farmers reported a negative impact from Varuna Mitra help desk services. The net gain realized by the mango farmers was Rs.3619/acre from Kolar district of Moderate rainfall region. In case of yield, mango growing farmers realized an additional yield of 1.2q/acre (**Table 7.12**).

7.2.10. Jowar

Jowar (Sorghum) is one of the most important crops cultivated after rice in Karnataka. It is largely grown under rainfed conditions and Karnataka is the second largest sorghum producer in India, after Maharashtra. Jowar is not a water intensive crop and has drought adaptation capability in comparison to paddy and sugarcane. Commonly, the crop's response to rainfall is mediated by interactions between the timing of rainfall, the soil water balance and crop development. Therefore, the study of yield indicated the impact of rainfall across the crops' phenological phases. The most sensitive period being the reproductive phase from panicle initiation through flowering for sorghum.

A total of 23 farmers with 97.98 acres of land sought information from the Varuna Mitra (**Table 7.1**). The sample farmers were concentrated in Ballari, Raichur and Tumakuru districts and have availed rainfall information from Varuna Mitra. In terms of the cost, the average cost of cultivation incurred by the Jowar growing farmers was Rs.10359.16 per acre (**Table 7.2**). Some farmers indicated a decline of Rs.500 per acre resulting in a net decline in cost of cultivation of Rs.9859.16. A marked reduction in cost of cultivation was observed in Tumakuru and Raichur districts.

Of the 23 farmers who have called for various stages of the crop cycle. A majority of them availed information on rainfall forecasts for sowing stage (63.16%) followed by harvesting (31.58%) and PHM (5.26%) (Table 7.3). As jowar is grown under unirrigated condition, rainfall is most important during sowing stage for better germination of the crop. In case of drought, it may lead to the crop failure.

On the whole, three farmers mentioned a decrease in cost of Rs.500 with 2 farmers from Tumakuru and 1 farmer from Raichur (Table 7.4 and 7.5). None of the farmers indicated an increase in cost. The forecast information could have altered their sowing operation and reduced the cost.

In case of yield, five farmers have mentioned increase in yield by 1.67q/acre to the total yield of the farmers and six farmers have indicated decrease in yield of 0.67q/acre (Table 7.6 and 7.7). Among the districts, the decline was prominent in the case of Raichur district to the extent of 0.67q/acre. The decline in yield per acre has led to a decline in income per acre of Rs.260 per acre. Increase in income was mentioned by nine farmers of Rs.445.98 per acre and a single farmer mentioned a decrease in income of Rs.260 per acre (Table 7.8 and 7.9). With regard to post-harvest losses, two farmers mentioned an increase in post-harvest loss of 0.56q/acre which reduced to the extent of 5.42 per cent of the total yield in Raichur district. While, five farmers indicated a decrease in post-harvest loss of 0.49 q/acre that influence around 5.51 per cent of the total yield among the districts (Table 7.10 and 7.11).

The net gain of jowar was realized by a decrease in cost, increase in income and decrease in Post-harvest loss. The net gain for the farmers who indicated an impact was Rs.860 per acre (Table 7.12). Highest net gain was observed in Ballari district (Rs.4042) under irrigated condition. In case of yield, the farmers realized an additional yield of 1.28q/acre (Table 7.13 and Annexure 7.21).

7.2.11. Tomato

Tomato is the world's largest vegetable crop after potato and sweet potato and tops the list of canned vegetables. Tomato is a warm season crop and long dry spells and heavy rainfall, both, have a detrimental effect on growth and fruiting. The plant cannot withstand frost and high humidity. The major tomato producing states in India are Tamil Nadu, Karnataka, Andhra Pradesh, Telangana, Orissa etc.

In the analysis, tomato was cultivated only in Kolar district. The impact of weather forecast on Tomato was indicated by 91 farmers growing tomato in an area of 274 acres (Table 7.1). The average yield of Tomato was 104.77 q/acre and the average cost of cultivation was Rs.75839 per acre with an average net return was Rs.60372 per acre (Table 7.2).

A total of 111 farmers sought information at various stages. Among all the stages, the highest per cent of the farmers requested rainfall information particularly during PPC application stage of 62.16 per cent of farmers to protect the crop from pest and diseases, followed by sowing stage (13.51 %) to alter the sowing operation for better germination of the crop (Table 7.3).

The increase in cost was indicated at the stages of sowing and PPC application. On a forecast communicating cloudy weather which is congenial for the multiplication of disease causing agents, the farmers had taken up PPC application in order to protect the crop. All the tomato growing farmers revealed that there was a reduction in the cost of cultivation as they had not scheduled application of pesticides and fertilizer if rains were predicted prior to their decision to apply. The weather based information from time to time has a both positive and negative impact with respect to cost, income and yield. With regard to cost, 11 farmers of the Kolar district mentioned an increase in cost of Rs.2687.97 per acre. While a decrease in cost to an extent of Rs.2217.71 per acre was indicated by 32 farmers (Table 7.4 and 7.5).

Nearly, 26 farmers of Kolar district mentioned an increase in yield by 2.36 q/acre, while a decrease in yield by 3.41 q/acre was indicated by 4 farmers (**Table 7.6** and **7.7**). The decrease was indicated at stages of sowing and PPC application. The decrease in yield at the sowing stage was indicated by one of the farmers as heavy rain can cause seed loss and affect the yield. The leaching of plant protection chemicals due to heavy rain was an additional cost on the farmer and could also affect the yield.

In terms of income, an increase in income by Rs.3375/acre was indicated by 3 farmers (**Table 7.8** and **7.9**). This increase in income was indicated at the stage of harvesting. Assuredly, none of the farmers indicated a decrease in income. The preponement of the schedule for harvest due to forecast of heavy rains has helped protect the crop and consequently an increase in income.

The net gain was obtained by decrease in cost and increase in income. Though negative impact was indicated by several farmers, the net gain for the farmers who indicated an impact was Rs.4338/acre whereas in case of yield, the farmers realised an additional yield of 1.59 q/acre post sourcing information from Varuna Mitra (**Table 7.12** and **7.13**).

7.2.12. Other crops

Apart from the major crops for which the impact was indicated, farmers have also sought information for 32 other crops distributed across the districts. This section attempts at analyzing the impact of weather forecast information on cost and returns of other crops. The impact of this information on yield has not been considered as the unit of yield varies across the crops included in the category - Others.

The other crops were cultivated on 1405.53 acres of land by 483 farmers (**Table 7.1**). The crops included in this category were cereals, pulses, flowers, plantation, oilseeds & cash crops and Spices. Of the area under other crops, 61 per cent of the land was under irrigation and the average costs of cultivation of these crops were Rs.37691.64 per acre, with a net gain of Rs.34104.33 per acre (**Table 7.2**).

Among districts, the highest net returns per acre was realized in Dakshina Kannada & Udupi district under irrigated condition (Rs.97500) (**Annexure 7.3**). This increase in income was from the cultivation of pepper and Banana crops. Similarly, a return of Rs.93560 per acre was reported by farmers in Tumakuru from the cultivation of Pomegranate under irrigation. In unirrigated regions, the highest income was realized by the farmers of Shivamogga (Rs.63032/ac) from the cultivation of ginger. Kolar farmers realized income of Rs.38226.90 per acre (**Annexure 7.4**). The major crops cultivated in this district were cabbage, capsicum and other vegetables.

A majority of the farmers sought rainfall information during sowing stage (24.84%), followed by harvesting (20.29%), fertilizer application (19.25%) and PPC application (12.63%) (**Table 7.3**). Under irrigated condition, decrease in the cost to an extent of Rs.622 per acre was indicated by 118 farmers whereas; an increase in cost was mentioned by 11 (**Annexure 7.5** and **7.7**). Whereas, in the case of unirrigated condition, 98 farmers mentioned a decrease in cost and 22 farmers indicated an increase in cost (**Annexure 7.6**).

Inaccurate forecast at the stages of irrigation, sowing, fertilizer application can lead to an increase in the cost of cultivation. However, this was indicated by a minimal number of the farmers. The overall statistic revealed that 216 farmers reported a decrease in costs and 33 farmers indicated an increase in costs to an extent of Rs.589 and Rs.451 respectively (**Table 7.4** and **7.5**).

In terms of income, an increase in income was indicated by 211 farmers whereas a decrease in income was mentioned by 50. The Increase in the income was to an extent of Rs. 579 per acre and the decrease

amounted to Rs.430 per acre (Table 7.8 and 7.9). The incidence of rain during harvesting, fertilizer application, and PPCs application can lead to a decrease in income. Therefore, having access to rainfall information can help farmers plan and schedule their operation effectively thereby achieving cost efficiency across their crop production cycle.

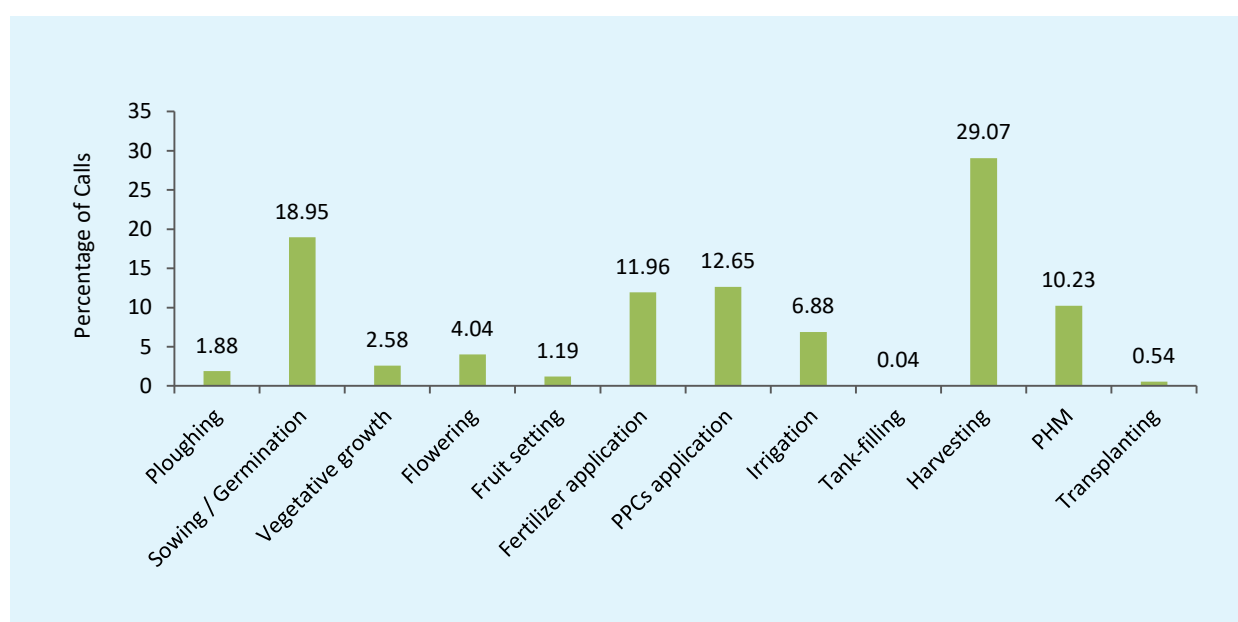
The net gain from the cultivation of other crops was Rs.4132 per acre. Net gain in irrigated and unirrigated conditions was Rs.4886 and Rs.3499 respectively (Table 7.12, Annexure 7.21 and 7.22).

7.2.13. Overall impact - Micro analysis

This section attempts to compare the overall impact of Varuna Mitra helpdesk services by encapsulating impacts on costs, yield, PH loss and income and finally net gains across all crops.

Of the 2601 farmers who called seeking information, 29 per cent of the farmers had contacted Varuna Mitra during harvesting followed by sowing (17.58%), PPC application (12.65%). Whereas the least number of farmers had contacted the Help Desk during tank filling (0.04%) and transplanting (0.54%) (Table 7.3, Figure 7.1). This implied that harvesting as the most important stage that requires accurate rainfall forecast to effectively schedule the operation.

Figure 7.1: Stage-wise calls made by farmers



Percentage of farmers who perceived a change in Cost, Yield, Income and Post-Harvest losses

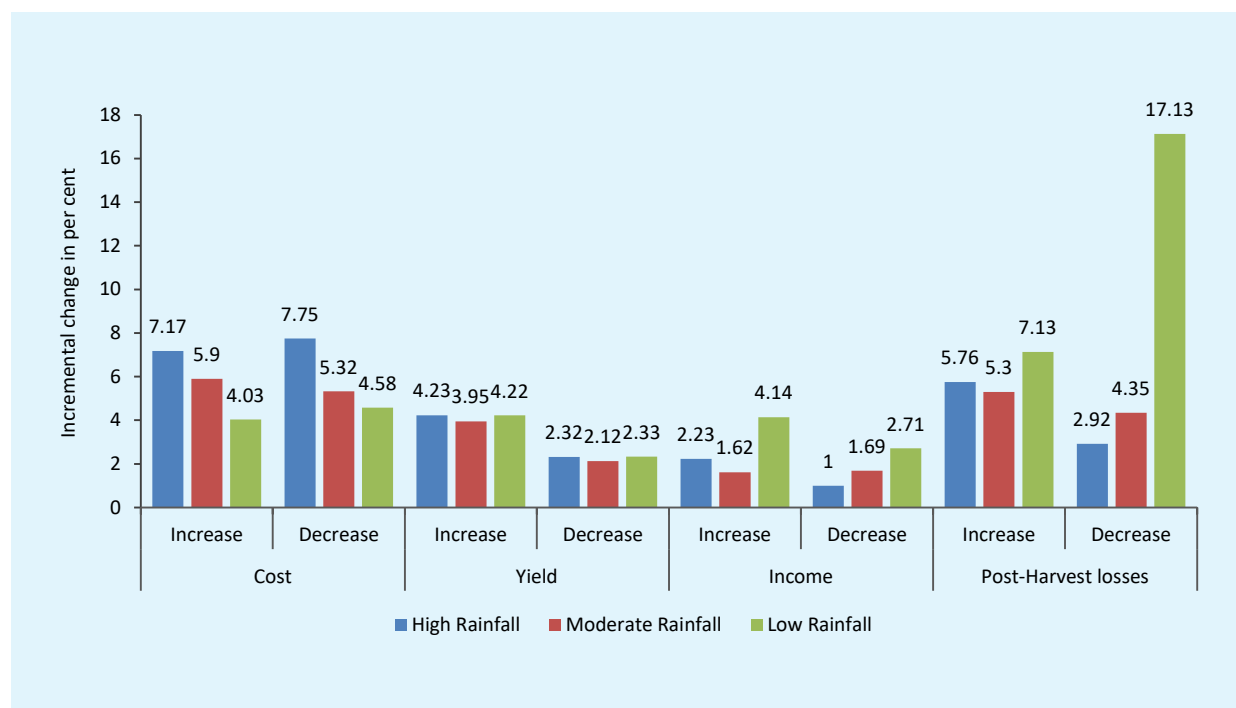
A significant per cent of farmers have indicated decrease in cost, increase in income, increase in yield and decrease in post-harvest losses. On the whole decrease in cost has been indicated by 666 farmers (49%), increase in incremental yield by 671 farmers (49.70%), increase in incremental income by 720 farmers (53%) and decrease in post-harvest losses by 752 farmers (55.70%).

Percentage incremental change in cost, yield, income, and post-harvest losses

An overall decrease in cost by 6.71 per cent, increase in income by 1.86 per was observed by the farmers. Across regions, the highest decrease in cost was seen in high rainfall region (7.75%), followed by moderate rainfall region (5.32%). In the case of post-harvest losses, decrease in post-harvest losses

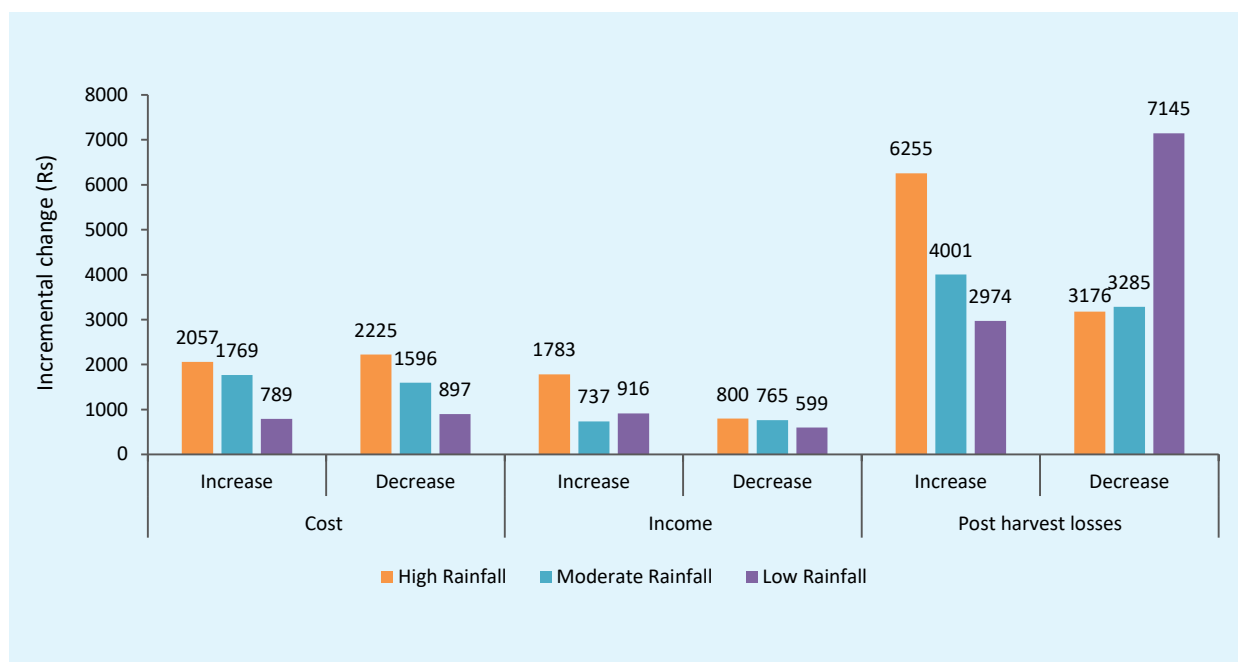
by 17.13 per cent was mentioned by 236 farmers in low rainfall region. In the case of moderate and high rainfall regions decrease in post-harvest losses was 4.36 per cent and 2.93 per cent respectively. In the case of percentage change in yield, highest incremental increase was seen in jowar (16.17%) followed by ragi (8.83%) and coffee (8.36%) (Figure 7.2)

Figure 7.2: Incremental change in cost, yield, income, and post-harvest losses



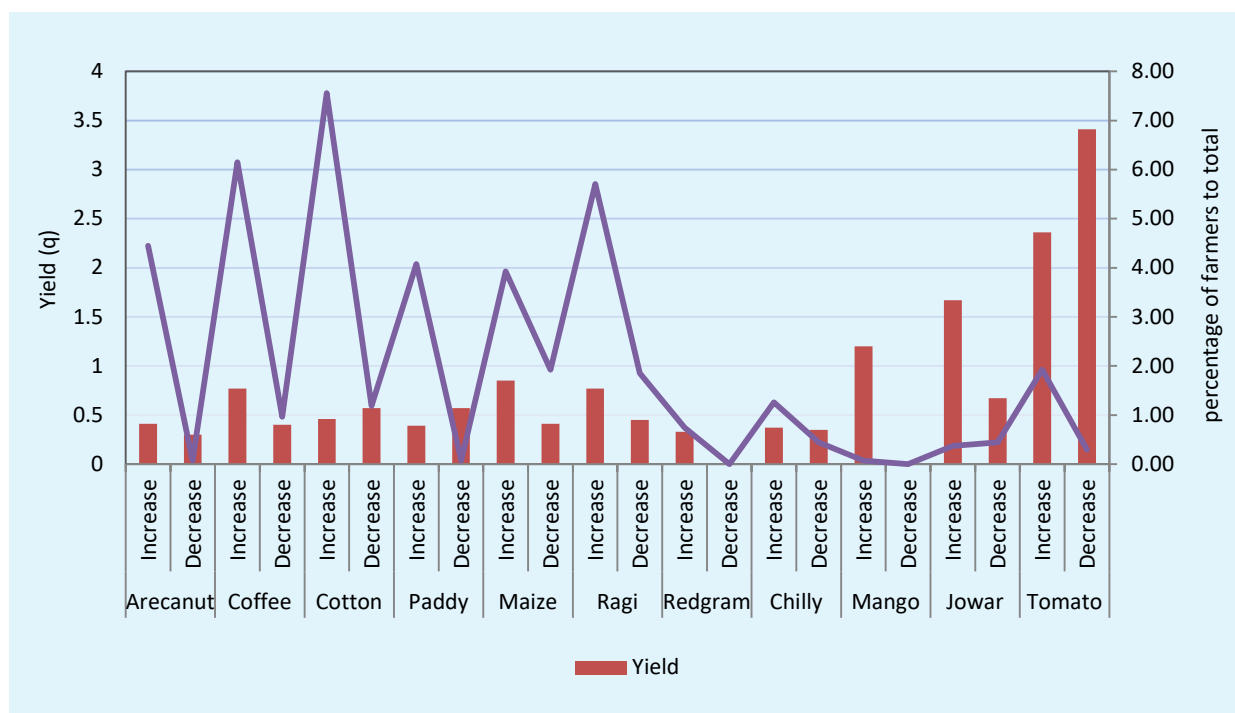
Incremental change in cost, Income and Post-Harvest losses

Most of the farmers from all the three rainfall regions indicated a decrease in costs, increase in income and decrease in post-harvest loss. Though the amount of decrease and increase appear to be the same, there is significant difference in the number of farmers who indicated it. Decrease in cost was mentioned by 666 farmers (49%), whereas increase in cost by as less as 100 farmers (7%). Similarly, with regard to income, increase in income was opined by 720 farmers (53%) and decrease in income was indicated by 172 farmers (13%). The highest decrease in cost to an extent of Rs.6273/ac with the rainfall information was witnessed among 56 coffee farmers (4%) who indicated the decrease at stages of irrigation and fertilizer application. With the forecast of rain for couple of days, the farmers could save the irrigation cost which otherwise would have been incurred. The usefulness of rainfall information was found to be higher in ground water irrigated area as compared to surface water. Other crops that followed coffee in terms of decrease in cost were arecanut (Rs.2571/ac), tomato (Rs.2218/ac) and mango (Rs.1268/ac). In terms of income, the highest increase in income was indicated by 42 farmers (3%) in coffee (Rs.3713/ac), 112 farmers (8%) growing arecanut (Rs.3355/ac), 20 farmers (1%) growing chilli (Rs.1626/ac) and 16 redgram farmers (1%) (Rs.1559/ac). There were instances of farmers indicating decrease in income as well. Decrease in income was also indicated for the same crops for which increase was mentioned. In the case of coffee, it was Rs.3521/ac, followed by arecanut (Rs.2658/ac) and chilli (Rs.1721/ac). However, this was mentioned by a fewer farmers. Similarly, in the case of post-harvest losses, increase in the post-harvest loss was Rs.4001 per acre in the moderate rainfall region, whereas the decrease was Rs.3285 per acre. But the decrease was attributed by 185 farmers whereas increase was indicated by 52 farmers (2%) (Figure 7.3).

Figure 7.3: Incremental change in cost of cultivation, income and post-harvest losses

Incremental change in yield across crops

The highest incremental increase in yield was seen in tomato (2.36 qtl/ac), followed by jowar (1.67 qtl/ac), mango (1.2 qtl/ac), maize (0.85 qtl/ac) coffee (0.77 qtl/ac) and ragi (0.77 qtl/ac). The increase in yield was attributed to appropriate time of sowing, fertilizer application, and irrigation operations based on the rain forecast received. Decrease in yield was observed to be 3.41 qtl/ac in the case of tomato which exceeds the average incremental increase in yield. However, this was indicated by only 4 farmers, whereas increase in yield was mentioned by 26 farmers (**Figure 7.4**).

Figure 7.4: Incremental change in yield across crops

Incremental change in per acre- net returns and yield and per household net returns

It was seen from the results of incremental net gain across crops (**Figure 7.5**) that arecanut had realized the highest incremental gain of Rs.12728 per acre followed by coffee (Rs.11118/ac), Chilli (Rs.6818/ac) and tomato (Rs.4338/acre). The highest net gain in the case of arecanut is due to the high market price of the crop, additional yield realised and the post-harvest losses saved with the rainfall forecast information. Similarly saving of costs incurred on irrigation, reduction of post-harvest losses and timely application of fertilizers with the rainfall information in advance has led to increased net gain in coffee. The least incremental net gain was in maize (Rs.1071/ac), and jowar (Rs.860/ac). With respect to yield, the highest incremental yield realized was in tomato (1.59 qtl/ac), jowar (1.28 qtl/ac) and mango (1.20 qtl/ac) (**Figure 7.6**).

Figure 7.5: Crop-wise per acre incremental change in net gain per acre

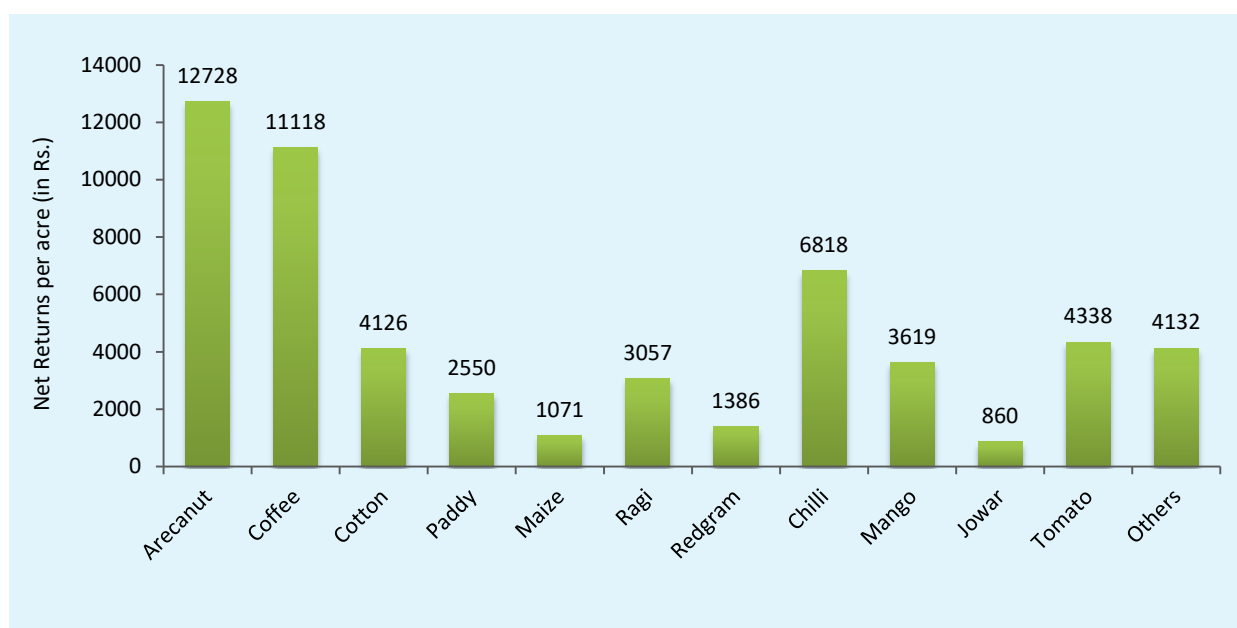
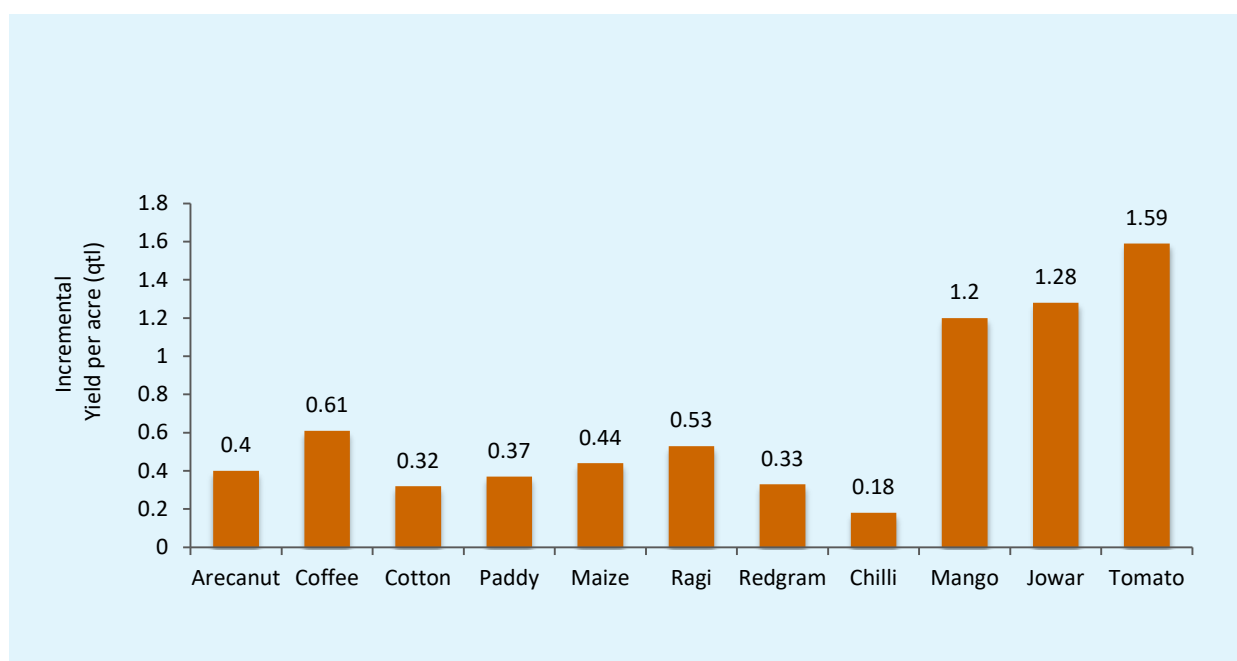
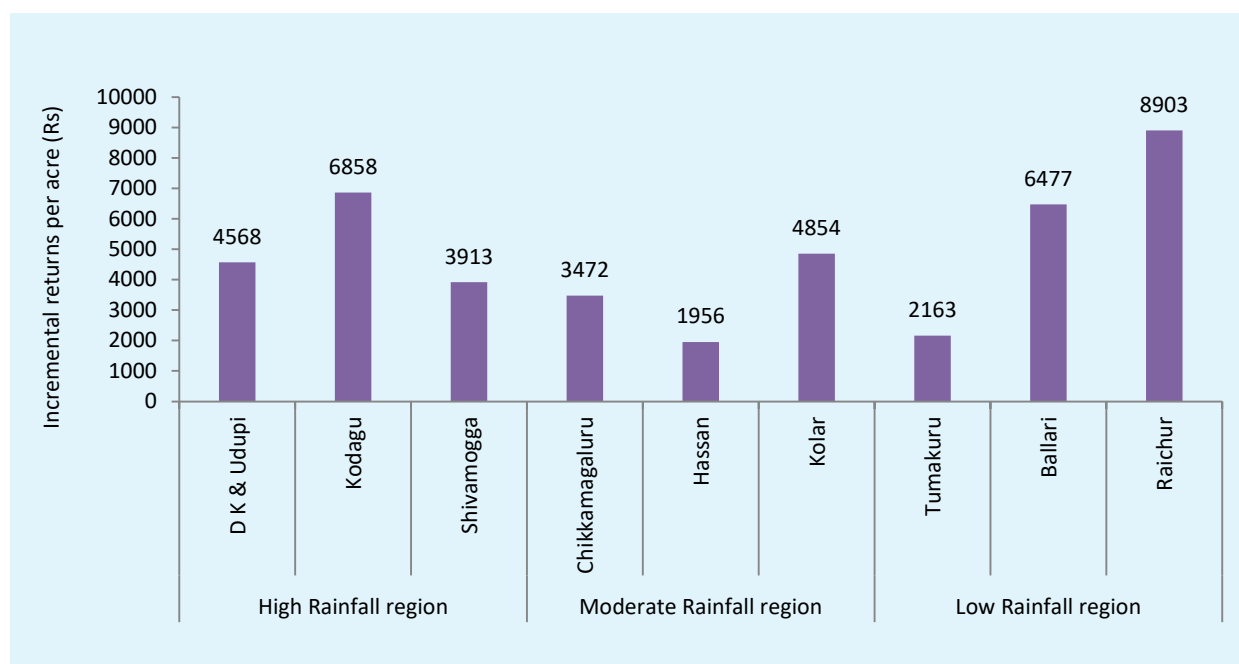


Figure 7.6: Incremental yield per acre



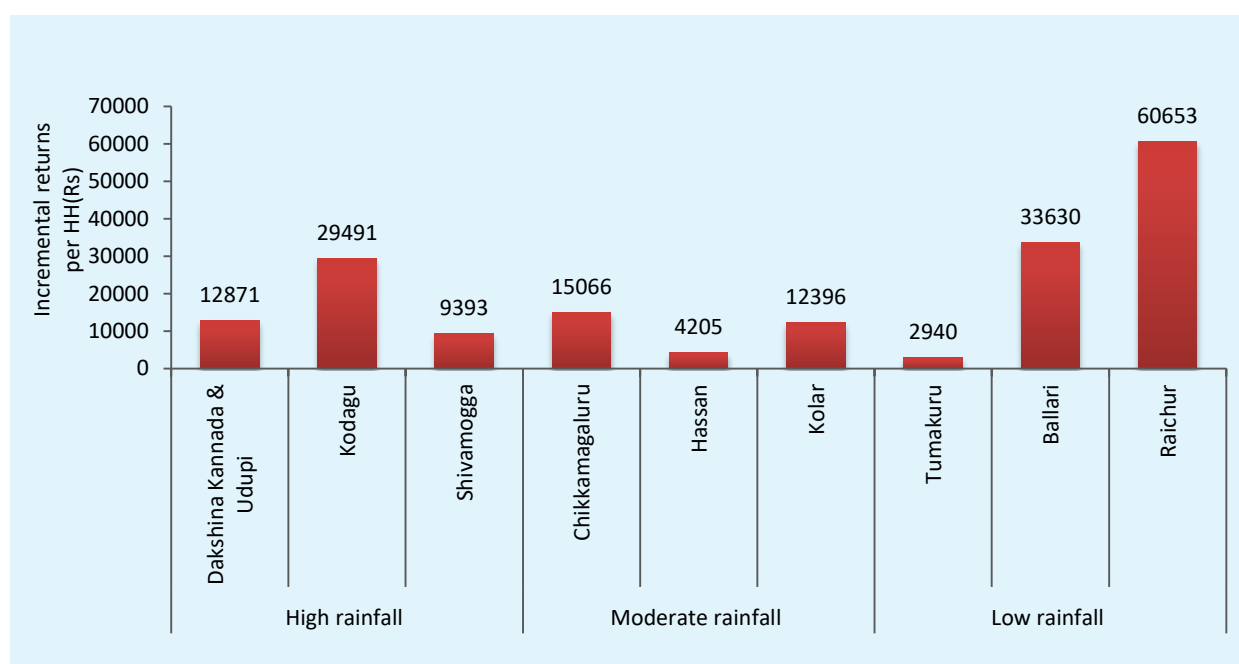
Highest net gain per acre was observed in Raichur (Rs.8903) with cotton, redgram and paddy as prominent crops followed by Kodagu (Rs.6858/ac), and Ballari (Rs.6477/ac) (**Figure 7.7**). The incremental gain is the result of decrease in cost, increase in income and decrease in post-harvest losses.

Figure 7.7: Incremental gain per acre



The net gain per farmer was highest in Raichur (Rs.60653) followed by Ballari (Rs.33629), the districts mainly cultivating cotton, paddy and redgram, both districts are in low rainfall region (**Figure 7.8**). The highest per household net gain in Raichur is due to the high operational land holding with 6.81 acres per farmer. This is 92 per cent higher than the average holding of the entire sample farmers (3.53 acres). Among the high rainfall regions, households in Kodagu earned relatively higher net returns (Rs.29490) and in moderate rainfall regions, Chikkamagaluru (Rs. 15066) realised relatively higher net return.

Figure 7.8: Incremental gain per farmer



7.3 Macro level projections derived using micro level results

The impact estimated from the primary data was considered as a base for projecting the impact of Varuna Mitra help desk services at the State level. The per farmer net returns realized across 10 districts was considered to arrive at the gains realized for the entire state. The state is divided into 10 agro climatic zones and it is assumed that the cropping pattern within the districts of a particular agro-climatic zone remains more or less similar. Hence the average incremental net gain of the sample districts in a particular agro-climatic zone was considered as the net gain realized in the non-sample district of the same zone. In the case of single sample district in a zone, the net gain of the same district was assumed to be the gain of remaining non-sample districts. For instance, Gulbarga, Yadgir and Raichur are the districts that fall under North Eastern Dry zone. However, among these districts, only Raichur was the sample district. Thus, the per farmer incremental gain of Raichur district (Rs.60,653) was considered as the incremental income of Gulbarga and Yadgir too. Thus, with this procedure, highest per farmer incremental gain was observed in Bidar, Gulbarga, Yadgir and Raichur (Rs.60,653), whereas least incremental gain was seen in Chitradurga, Davanagere, and Tumakuru (Rs.2939). In the case of two or more sample districts with in a particular zone, the average net gain per farmer was considered for the remaining non-sample districts. By following this procedure, the per farmer incremental gain for the 30 districts was derived. These values were then multiplied with the number of beneficiaries from the respective districts who called Varuna Mitra during 2016-17 seeking rainfall information and the total number of beneficiaries were 1,75,833. A total of all the estimates thus obtained was considered as the projection for the state which was Rs.495.3 Crore. However, the study revealed that the farmers have further disseminated the forecast information to 7 farmers and help desk numbers to 5 farmers, the impact of which was not considered. Hence the total incremental income for the state the may be several times higher than the projected estimate of Rs.495.3 Crore. In the similar manner, the per acre net incremental gain realized across districts was also estimated. Thus, per farmer and per acre net gain realized with derivations for the entire state would be Rs.28168 and Rs.5979, respectively (**Table 7.15**). This is 56 per cent and 17 per cent higher than the per farmer (Rs.18005) and per acre (Rs.5107) results of 10 sample districts (**Table 7.16**). However, the validity and accuracy of the estimates are subject to the following limitations:

- Though the indicated procedure assumes similar cropping pattern within agro- climatic zones, in practicality there exists wide variation in weather, soil type, irrigation status, cropping pattern within district and zone. Hence assuming the similar net gain within a zone may not be highly accurate.
- Impact of variation in weather is specific to each crop. Different types of crops may be seen to be cultivated in a given area. Hence generalizing of the results for the entire area would not be precise.
- In estimating per acre net gain across districts, the data on total area was used, as the total operational area was not available. This may reduce the accuracy of the results as we are unaware about the actual area for which the farmer had taken decisions based on the forecast information.
- The estimates consider the total number of farmers who obtained information from Varuna Mitra as 1.76 lakh. But the primary data reveals that a farmer would in turn pass on the information to 7 other farmers and help desk numbers to 5 farmers, totalling to 12. The information on decisions taken by these farmers are unavailable.

Table 7.1: Details of number of farmers who availed VM service and land per beneficiary

Region / District	Arecanut		Coffee		Cotton		Paddy		Maize		Ragi		Redgram	
	No. of Beneficiary	Land per beneficiary	No. of Beneficiary	Land per beneficiary	No. of Beneficiary	Land per beneficiary	No. of Beneficiary	Land per beneficiary	No. of Beneficiary	Land per beneficiary	No. of Beneficiary	Land per beneficiary	No. of Beneficiary	Land per beneficiary
Dakshina Kannada & Udupi	74.00	3.58	-	-	-	-	64.00	2.08	-	-	-	-	-	-
Kodagu	-	-	140.00	4.54	-	-	16.00	1.56	-	-	-	-	-	-
Shivamogga	64.00	2.41	-	-	-	-	121.00	2.39	10.00	2.64	-	-	-	-
High rainfall Total	138.00	3.04	140.00	4.54	-	-	201.00	2.22	10.00	2.64	-	-	-	-
Chikkamagaluru	61.00	2.76	71.00	8.77	-	-	61.00	2.34	6.00	2.83	6.00	1.83	-	-
Hassan	8.00	2.13	-	-	-	-	0.00	-	1.00	2.00	101.00	1.80	-	-
Kolar	-	-	-	-	-	-	2.00	1.50	0.00	-	68.00	2.34	-	-
Moderate rainfall Total	69.00	2.69	71.00	8.77	-	-	63.00	2.31	7.00	2.71	176.00	2.01	-	-
Tumakuru	37.00	0.86	-	-	-	-	17.00	1.06	1.00	1.00	133.00	1.56	-	-
Ballari	-	-	-	-	35.00	4.09	22.00	3.91	66.00	6.52	11.00	2.64	1.00	4.00
Raichur	-	-	-	-	123.00	7.57	20.00	5.50	4.00	4.00	-	-	37.00	6.97
Low rainfall Total	37.00	0.86	-	-	158.00	6.74	59.00	3.63	71.00	6.30	144.00	1.64	38.00	6.89
Grand Total (%)	244.00	2.61	211.00	5.96	158.00	6.74	323.00	2.50	88.00	5.60	320.00	1.84	38.00	6.89

Region / District	Chilli		Mango		Jowar		Tomato		Others		Total	
	No. of Beneficiary	Land per beneficiary	No. of Beneficiary	Land per beneficiary	No. of Beneficiary	Land per beneficiary	No. of Beneficiary	Land per beneficiary	No. of Beneficiary	Land per beneficiary	No. of Beneficiary	Land per beneficiary
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	16.00	2.24	154.00	2.82
Kodagu	-	-	-	-	-	-	-	-	34.00	4.62	190.00	4.30
Shivamogga	-	-	-	-	-	-	-	-	62.00	2.38	257.00	2.40
High rainfall Total	-	-	-	-	-	-	-	-	112.00	3.04	601.00	3.11
Chikkamagaluru	-	-	-	-	-	-	-	-	73.00	3.35	278.00	4.34
Hassan	-	-	-	-	-	-	-	-	72.00	2.64	182.00	2.15
Kolar	-	-	12.00	4.85	-	-	91.00	3.02	90.00	1.96	263.00	2.55
Moderate rainfall Total	-	-	12.00	4.85	-	-	91.00	3.02	235.00	2.60	724.00	3.14
Tumakuru	-	-	-	-	10.00	1.35	-	-	71.00	1.32	269.00	1.36
Ballari	44.00	4.51	-	-	7.00	8.64	-	-	28.00	5.70	214.00	5.19
Raichur	11.00	7.27	-	-	6.00	4.00	-	-	37.00	5.47	238.00	6.81
Low rainfall Total	55.00	5.06	-	-	23.00	4.26	-	-	136.00	3.35	721.00	4.28
Grand Total (%)	55.00	5.06	12.00	4.85	23.00	4.26	91.00	3.02	483.00	2.91	2046.00	3.53

Source: Primary data collected during Aug-Sep, 2017

Table 7.2: Cost of cultivation, yield and net returns of the sample who availed VM Service during the Year 2016-17

Region / District		Arecanut			Coffee			Cotton			Paddy			Maize			Ragi		
		COC	Yield	N.Return	COC	Yield	N.Return	COC	Yield	N.Return	COC	Yield	N.Return	COC	Yield	N.Return	COC	Yield	N.Return
Season: Kharif, Rabi and Summer (COC in Rupees per acre; Yield, in Qtls and Net Return in Rupees per acre)																			
Dakshina Kannada & Udupi		25169.88	11.00	250002.50	-	-	-	-	-	-	14142.01	13.25	10302.40	-	-	-	-	-	-
Kodagu		-	-	-	31415.85	9.29	33879.60	-	-	-	12362.00	10.50	10256.00	-	-	-	-	-	-
Shivamogga		22420.52	10.80	267852.47	-	-	-	-	-	-	14170.98	14.05	12774.30	11369.44	12.56	27059.25	-	-	-
High rainfall Total		24204.63	10.94	258887.20	31415.85	9.29	33879.60	-	-	-	14061.19	13.61	11897.99	11369.44	12.56	27059.25	-	-	-
Chikkamagaluru		21291.44	10.27	220816.75	31100.71	9.02	35414.83	-	-	-	12265.60	11.77	10721.46	10309.32	11.94	7787.94	4318.18	7.36	7454.55
Hassan		20156.00	8.36	188844.00	-	-	-	-	-	-	-	-	-	11500.00	11.29	7500.00	5241.76	8.69	6967.03
Kolar		-	-	-	-	-	-	-	-	-	16453.00	15.00	14265.00	-	-	-	7895.36	9.03	10131.45
Moderate rainfall Total		21187.38	10.09	217886.63	31100.71	9.02	35414.83	-	-	-	12351.87	11.83	10794.47	10434.66	11.87	7757.63	6412.59	8.80	8412.87
Tumakuru		22619.72	8.25	166993.72	-	-	-	-	-	-	15000.00	16.28	14952.00	9756.00	11.36	15000.00	6163.68	8.80	7332.63
Ballari		-	-	-	-	-	-	26958.90	14.40	28939.44	26452.00	23.00	25995.00	11965.71	14.59	13692.06	7172.41	7.56	7793.10
Raichur		-	-	-	-	-	-	26238.99	12.22	24796.03	29453.00	23.22	26532.00	15000.00	12.50	15000.00	-	-	-
Low rainfall Total		22619.72	8.25	166993.72	-	-	-	26336.58	12.51	25357.71	27031.32	22.55	25342.18	12069.24	14.51	13741.73	6287.64	8.67	7344.57
Grand Total (%)		23245.24	10.56	241002.94	31259.81	9.16	34639.74	26336.58	12.51	25357.71	17193.60	15.66	15265.53	11908.24	14.31	14224.26	6362.46	8.75	7984.28

Region / District		Redgram			Chilli			Mango			Jowar			Tomato			Others			Average	
		Cost.C	Yield	N.Return	Cost.C	Yield	N.Return	Cost.C	Yield	N.Return	Cost.C	Yield	N.Return	Cost.C	Yield	N.Return	Cost.C	Yield	N.Return	Cost.C	N.Return
Dakshina Kannada & Udupi		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30114.98	37814.95	22198.74	158973.12	32205.38
Kodagu		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32652.00	28929.00	31070.35	32205.38	86919.02
Shivamogga		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72709.04	54004.54	30106.58	79801.28	56610.08
High rainfall Total		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	49759.46	40750.48	28704.51	39919.41	45416.59
Chikkamagaluru		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	38940.94	29803.70	28555.68	29977.96	34490.36
Hassan		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14494.10	17765.16	10420.74	20123.18	25488.55
Kolar		-	-	-	-	-	-	13665.00	35.00	45000.00	-	-	-	75839.08	104.77	60372.03	40696.48	35317.91	44195.14	39919.41	45416.59
Moderate rainfall Total		-	-	-	-	-	-	13665.00	35.00	45000.00	-	-	-	75839.08	104.77	60372.03	31858.84	27668.65	29977.96	34490.36	24703.91
Tumakuru		-	-	-	-	-	-	-	-	-	5333.00	10.00	14750.00	-	-	-	48211.49	56338.33	18781.29	25488.55	17873.91
Ballari		9186.00	8.23	12391.00	33939.54	7.61	33387.40	-	-	-	11760.04	11.13	9118.19	-	-	-	58998.48	48700.59	16237.49	17873.91	22116.50
Raichur		8973.01	7.73	16185.39	33625.00	8.89	27837.50	-	-	-	9655.00	8.50	12021.00	-	-	-	13346.78	20498.07	37756.38	19573.59	44364.53
Low rainfall Total		8976.26	7.74	16127.46	31602.54	7.77	29583.19	-	-	-	10359.16	10.33	10604.89	-	-	-	36508.00	37756.38	19573.59	22116.50	44364.53
Grand Total (%)		8976.26	7.74	16127.46	33828.75	8.25	31202.58	13665.00	35.00	45000.00	10359.16	10.33	10517.51	75839.08	104.77	60372.03	37691.64	34104.33	25263.49	44364.53	44364.53

Source: Primary data collected during Aug-Sep, 2017

Table 7.3: Stage-wise distribution of farmers

Crops	% to the total no. of farmers													Total no. of farmers
	Ploughing	Sowing	Germination	Vegetative growth	Flowering	Fruit setting	Fertilizer application	PPCs application	Irrigation	Tank-filling	Harvesting	PHM	Transplanting	
Arecanut	-	1.66	-	-	-	-	6.91	17.4	6.08	-	38.95	29.01	-	362(100)
Coffee	-	-	-	-	15.05	-	17.36	8.33	14.58	-	30.56	14.12	-	432(100)
Cotton	-	13.46	1.92	2.88	-	-	14.42	47.12	13.46	-	6.73	-	-	166(100)
Paddy	2.71	21.69	1.2	-	-	-	12.95	4.82	8.73	-	43.67	-	4.22	332(100)
Maize	6.82	50	4.55	2.27	-	1.14	12.5	3.41	7.95	-	6.82	4.55	-	88(100)
Ragi	2.43	34.29	-	3.1	1.99	-	7.3	-	0.66	0.22	39.16	10.84	-	452(100)
Redgram	2.63	26.32	-	10.53	2.63	5.26	5.26	34.21	5.26	-	7.89	-	-	38(100)
Chilli	-	4.76	-	13.1	13.1	10.71	7.74	8.93	11.9	-	17.86	11.9	-	100(100)
Mango	-	8.33	-	-	-	8.33	-	33.33	-	-	50	-	-	12(100)
Jowar	-	63.16	-	-	-	-	-	-	-	-	31.58	5.26	-	23(100)
Tomato	5.41	13.51	0.9	5.41	4.5	1.8	0.9	62.16	-	-	4.5	0.9	-	111(100)
Others	3.31	24.84	5.18	3.31	0.62	1.45	19.25	12.63	3.93	-	20.29	5.18	-	483(100)
Total	1.89	17.58	1.39	2.59	4.05	1.19	11.97	12.65	6.88	0.04	29.07	10.23	0.54	2601(100)

Source: Primary data collected during Aug-Sep, 2017

Table 7.4: Distribution of farmers based on cost component

Region / District	Arecanut (%)		Coffee (%)		Cotton (%)		Paddy (%)		Maize (%)		Ragi (%)		Redgram (%)	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	-	48.28	-	-	-	-	100.00	17.86	-	-	-	-	-	-
Kodagu	-	-	48.00	69.64	-	-	-	-	-	-	-	-	-	-
Shivamogga	27.27	31.03	-	-	-	-	-	48.81	-	12.50	-	-	-	-
High Rainfall total	27.27	79.31	48.00	69.64	-	-	100.00	66.67	-	12.50	-	-	-	-
Chikkamagaluru	72.73	12.64	52.00	30.36	-	-	-	7.14	-	-	-	-	-	-
Hassan	-	2.30	-	-	-	-	-	-	-	-	-	-	-	-
Kolar	-	-	-	-	-	-	-	-	-	-	-	47.92	-	-
Moderate Rainfall total	72.73	14.94	52.00	30.36	-	-	-	7.14	-	-	-	47.92	-	-
Tumakuru	-	5.75	-	-	-	-	-	7.14	-	-	-	52.08	-	-
Ballari	-	-	-	-	5.88	20.19	-	5.95	-	87.50	-	-	-	-
Raichur	-	-	-	-	94.12	79.81	-	13.10	-	-	-	-	-	100.00
Low rainfall total	-	5.75	-	-	100.00	100.00	-	26.19	-	87.50	-	52.08	-	100.00
Grand Total (Nos.)	11	87	25	56	17	104	1	84	-	8	-	48	-	2

Region / District	Chilli (%)		Mango (%)		Jowar (%)		Tomato (%)		Others (%)		Total (%)	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	3.24	3.03	2.00	9.61
Kodagu	-	-	-	-	-	-	-	-	11.57	12.12	16.00	9.61
Shivamogga	-	-	-	-	-	-	-	-	15.28	-	3.00	15.32
High Rainfall total	-	-	-	-	-	-	-	-	30.09	15.15	21.00	34.53
Chikkamagaluru	-	-	-	-	-	-	-	-	15.74	-	21.00	10.21
Hassan	-	-	-	-	-	-	-	-	8.80	42.42	14.00	3.15
Kolar	-	-	-	100.00	-	-	100.00	100.00	18.98	18.18	17.00	15.17
Moderate Rainfall total	-	-	-	100.00	-	-	100.00	100.00	43.52	60.61	52.00	28.53
Tumakuru	-	-	-	-	-	-	-	-	10.19	6.06	2.00	9.01
Ballari	-	71.43	-	-	-	-	-	-	6.48	15.15	6.00	9.31
Raichur	100.00	28.57	-	-	-	-	-	-	9.72	3.03	19.00	18.62
Low rainfall total	100.00	100.00	-	-	-	-	-	-	26.39	24.24	27.00	36.94
Grand Total (Nos.)	2	21	-	5	-	-	11	32	216	33	100	666

Source: Primary data collected during Aug-Sep, 2017

Table 7.5: Impact of Varuna Mitra Helpdesk Services on cost component (Rs. per acre)

Region / District	Arecanut		Coffee		Cotton		Paddy		Maize		Ragi		Redgram	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	-	3424.62 (13.61)	-	-	-	-	558 (3.95)	674.33 (4.77)	-	-	-	-	-	-
Kodagu	-	-	3290 (10.47)	7046 (22.43)	-	-	-	-	-	-	-	-	-	-
Shivamogga	449.84 (2.01)	568.44 (2.54)	-	-	-	-	-	682.47 (4.82)	-	480 (4.22)	-	-	-	-
High Rainfall total	449.84 (1.86)	2306.98 (9.53)	3290 (10.47)	7046 (22.43)	-	-	558 (3.97)	680.29 (4.84)	-	480 (4.22)	-	-	-	-
Chikkamagaluru	581 (2.73)	776.36 (3.65)	3650 (11.74)	4500 (14.47)	-	-	-	448.33 (3.66)	-	-	-	-	-	-
Hassan	-	403	-	-	-	-	-	-	-	-	-	-	-	-
Kolar	-	-	-	-	-	-	-	-	-	-	747.60 (9.47)	-	-	-
Moderate Rainfall total	581 (2.74)	718.92 (3.39)	3650 (11.74)	4500 (14.47)	-	-	-	448.33 (3.63)	-	-	747.60 (11.66)	-	-	-
Tumakuru	-	391.26 (1.73)	-	-	-	-	-	575 (3.83)	-	-	512.96 (8.32)	-	-	-
Ballari	-	-	-	-	1253.61 (4.73)	1585.71 (5.99)	-	795 (3.01)	-	626.66 (5.24)	-	-	-	-
Raichur	-	-	-	-	857.81 (5.36)	1149.31 (7.18)	-	743 (2.52)	-	-	-	-	585.42 (6.52)	-
Low rainfall total	-	391.26 (1.73)	-	-	881.09 (5.05)	1237.43 (7.21)	-	709 (2.62)	-	626.66 (5.19)	512.96 (8.16)	-	585.42 (6.52)	-
Grand Total	703.68 (3.03)	2571.08 (11.06)	3477.2 (11.12)	6273.11 (20.07)	881.09 (5.05)	1237.43 (7.21)	558 (3.25)	948.78 (5.52)	-	608.33 (5.11)	985.49 (15.49)	-	585.42 (6.52)	-

Region / District	Chilli		Mango		Jowar		Tomato		Others		Total	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	379.57 (1.26)	529 (2.38)	2446.97 (11.02)	-
Kodagu	-	-	-	-	-	-	-	-	427.12 (1.31)	2549.13 (8.2)	4460.5 (14.36)	-
Shivamogga	-	-	-	-	-	-	-	-	781.3 (1.07)	449.84 (1.49)	682.27 (2.27)	-
High Rainfall total	-	-	-	-	-	-	-	-	601.81 (1.21)	2056.84 (7.17)	2224.65 (7.75)	-
Chikkamagaluru	-	-	-	-	-	-	-	-	441.32 (1.13)	2480.86 (8.69)	1510.81 (5.29)	-
Hassan	-	-	-	-	-	-	-	-	789 (5.44)	433.27 (4.16)	752.24 (7.22)	-
Kolar	-	-	-	-	-	-	2687.97 (3.54)	2217.71 (2.92)	686.55 (1.69)	1990.95 (4.5)	1828.07 (4.14)	-
Moderate Rainfall total	-	-	-	-	-	-	2687.97 (3.54)	2217.71 (2.92)	618.56 (1.94)	1769.42 (5.9)	1595.62 (5.32)	-
Tumakuru	-	-	-	-	-	500 (9.40)	-	-	549.53 (1.14)	45 (0.24)	522 (2.78)	-
Ballari	-	1225.51 (3.61)	-	-	-	-	-	-	874.67 (1.48)	622.14 (2.44)	1165.96 (4.57)	-
Raichur	1790 (5.66)	1200 (3.57)	-	-	-	500 (5.18)	-	-	266.33 (2)	919.68 (5.66)	951.85 (5.86)	-
Low rainfall total	1790 (5.29)	1218.22 (3.85)	-	-	-	500 (6.43)	-	-	525.05 (1.44)	788.77 (4.03)	897.31 (4.58)	-
Grand Total	1790 (5.29)	1218.22 (3.6)	-	1268.39 (9.28)	-	500 (6.43)	2687.97 (3.54)	2217.71 (2.92)	588.84 (1.56)	1582.43 (6.26)	1695.76 (6.71)	-

Note: Figures in parenthesis indicates the percentage of increase and decrease in cost
Source: Primary data collected during Aug-Sep, 2017

Table 7.6: Distribution of farmers based on yield component

Region / District	Arecanut (%)		Coffee (%)		Cotton (%)		Paddy (%)		Maize (%)		Ragi (%)		Redgram (%)	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	10.00	-	-	-	-	-	21.82	-	-	-	-	-	-	-
Kodagu	-	-	81.93	100.00	-	-	12.73	-	-	-	-	-	-	-
Shivamogga	-	-	-	-	-	-	18.18	-	15.09	7.69	-	-	-	-
High Rainfall total	10.00	-	81.93	100.00	-	-	52.73	-	15.09	7.69	-	-	-	-
Chikkamagaluru	70.00	100.00	18.07	-	-	-	10.91	-	24.53	11.54	1.30	-	-	-
Hassan	6.67	-	-	-	-	-	-	-	-	3.85	38.96	72.00	-	-
Kolar	-	-	-	-	-	-	1.82	-	-	-	24.68	8.00	-	-
Moderate Rainfall total	76.67	100.00	18.07	-	-	-	12.73	-	24.53	15.38	64.94	80.00	-	-
Tumakuru	13.33	-	-	-	-	-	12.73	-	-	-	33.77	16.00	-	-
Ballari	-	-	-	-	9.80	12.50	10.91	100.00	60.38	76.92	1.30	4.00	-	-
Raichur	-	-	-	-	90.20	87.50	10.91	-	-	-	-	-	100.00	-
Low rainfall total	13.33	-	-	-	100.00	100.00	34.55	100.00	60.38	76.92	35.06	20.00	100.00	-
Grand Total	60	1	83	13	102	16	55	1	53	26	77	25	10	-

Region / District	Chilli (%)		Mango (%)		Jowar (%)		Tomato (%)		Others (%)		Total (%)	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	3.3	0	3.58	0
Kodagu	-	-	-	-	-	-	-	-	1.1	0	11.48	9.49
Shivamogga	-	-	-	-	-	-	-	-	17.58	5.13	7.45	2.92
High Rainfall total	-	-	-	-	-	-	-	-	21.98	5.13	22.5	12.41
Chikkamagaluru	-	-	-	-	-	-	-	-	18.13	7.69	16.39	5.11
Hassan	-	-	-	-	-	-	-	-	12.09	30.77	8.35	22.63
Kolar	-	-	-	-	-	-	-	-	14.29	10.26	10.88	7.3
Moderate Rainfall total	-	-	-	-	-	-	-	-	44.51	48.72	35.62	35.04
Tumakuru	-	-	-	-	-	-	-	-	13.19	10.26	9.69	5.84
Ballari	82.35	100	-	-	20	33.33	-	-	4.4	15.38	10.73	27.74
Raichur	17.65	-	-	-	80	66.67	-	-	15.93	20.51	21.46	18.98
Low rainfall total	100	100	-	-	100	100	-	-	33.52	46.15	41.88	52.55
Grand Total	17	6	1	-	5	6	26	4	182	39	671	137

Source: Primary data collected during Aug-Sep, 2017

Table 7.7: Impact of Varuna Mitra Helpdesk Services on Yield (Qtl. per acre)

Region / District	Arecanut		Coffee		Cotton		Paddy		Maize		Ragi	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	0.3 (2.73)	-	-	-	-	-	0.49 (3.7)	-	-	-	-	-
Kodagu	-	-	0.56 (6)	0.4 (4.31)	-	-	0.61 (5.81)	-	-	-	-	-
Shivamogga	-	-	-	-	-	-	0.39 (2.78)	-	1.47 (11.7)	0.43 (3.42)	-	-
High Rainfall total	0.3 (2.74)	-	0.56 (6)	0.4 (4.31)	-	-	0.49 (3.6)	-	1.47 (11.7)	0.43 (3.42)	-	-
Chikkamagaluru	0.5 (4.87)	0.3 (2.92)	1.71 (18.96)	-	-	-	0.32 (2.72)	-	0.85 (7.12)	0.41 (3.43)	0.57 (7.74)	-
Hassan	0.16 (1.91)	-	-	-	-	-	-	-	-	0.49 (4.34)	0.73 (8.4)	0.41 (4.72)
Kolar	-	-	-	-	-	-	0.56 (3.73)	-	-	-	0.83 (9.24)	0.53 (5.87)
Moderate Rainfall total	0.47 (4.66)	0.3 (2.97)	1.71 (18.96)	-	-	-	0.35 (2.96)	-	0.85 (7.16)	0.43 (3.62)	0.77 (8.71)	0.42 (4.79)
Tumakuru	0.15 (1.82)	-	-	-	-	-	0.24 (1.47)	-	-	-	0.79 (9)	0.62 (7.05)
Ballari	-	-	-	-	0.59 (4.09)	1.01 (7.01)	0.28 (1.22)	0.57 (2.48)	0.69 (4.73)	0.41 (2.81)	0.56 (7.41)	0.4 (5.29)
Raichur	-	-	-	-	0.45 (3.68)	0.5 (4.09)	0.25 (1.08)	-	-	-	-	-
Low rainfall total	0.15 (1.82)	-	-	-	0.46 (3.67)	0.57 (4.55)	0.26 (1.15)	0.57 (2.53)	0.69 (4.75)	0.41 (2.83)	0.78 (9.03)	0.58 (6.66)
Grand Total	0.41 (3.89)	0.3 (2.84)	0.77 (8.36)	0.4 (4.37)	0.46 (3.67)	0.57 (4.55)	0.39 (2.49)	0.57 (3.64)	0.85 (5.94)	0.41 (2.87)	0.77 (8.83)	0.45 (5.18)

Region / District	Redgram		Chilly		Mango		Jowar		Tomato	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	-	-
Kodagu	-	-	-	-	-	-	-	-	-	-
Shivamogga	-	-	-	-	-	-	-	-	-	-
High Rainfall total	-	-	-	-	-	-	-	-	-	-
Chikkamagaluru	-	-	-	-	-	-	-	-	-	-
Hassan	-	-	-	-	-	-	-	-	-	-
Kolar	-	-	-	-	1.2 (3.43)	-	-	-	2.36 (2.25)	3.41 (3.25)
Moderate Rainfall total	-	-	-	-	1.2 (3.43)	-	-	-	2.36 (2.25)	3.41 (3.25)
Tumakuru	-	-	-	-	-	-	-	-	-	-
Ballari	-	-	0.38 (4.99)	0.35 (4.6)	-	-	0.77 (6.92)	0.67 (6.02)	-	-
Raichur	0.33 (4.27)	-	0.3 (3.38)	-	-	-	0.38 (4.47)	-	-	-
Low rainfall total	0.33 (4.26)	-	0.37 (4.71)	0.35 (4.5)	-	-	1.67 (16.18)	0.67 (6.49)	-	-
Grand Total	0.33 (4.26)	-	0.37 (4.44)	0.35 (4.24)	1.2 (3.43)	-	1.67 (16.17)	0.67 (6.49)	2.36 (2.25)	3.41 (3.25)

Note: Figures in parenthesis indicates the per cent of increase or decrease in yield

Source: Primary data collected during Aug-Sep, 2017

Table 7.8: Distribution of farmers based on income component

Region / District	Arecanut (%)		Coffee (%)		Cotton (%)		Paddy (%)		Maize (%)		Ragi (%)		Redgram (%)	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	18.75	50.00	-	-	-	-	9.45	100.00	-	-	-	-	-	-
Kodagu	-	-	80.95	63.16	-	-	7.09	-	-	-	-	-	-	-
Shivamogga	52.68	50.00	-	-	-	-	51.18	-	13.33	-	-	-	-	-
High Rainfall total	71.43	100.00	80.95	63.16	-	-	67.72	100.00	13.33	-	-	-	-	-
Chikkamagaluru	21.43	-	19.05	36.84	-	-	11.02	-	-	-	1.30	-	-	-
Hassan	-	-	-	-	-	-	-	-	-	-	22.08	80.00	-	-
Kolar	-	-	-	-	-	-	-	-	-	-	36.36	20.00	-	-
Moderate Rainfall total	21.43	-	19.05	36.84	-	-	11.02	-	-	-	59.74	100.00	-	-
Tumakuru	7.14	-	-	-	-	-	2.36	-	-	-	36.36	-	-	-
Ballari	-	-	-	-	9.20	15.38	14.17	-	86.67	100.00	3.90	-	-	-
Raichur	-	-	-	-	90.80	84.62	4.72	-	-	-	-	-	100.00	100.00
Low rainfall total	7.14	-	-	-	100.00	100.00	21.26	-	86.67	100.00	40.26	-	100.00	100.00
Grand Total	112	6	42	19	87	13	127	30	15	22	77	10	16	16

Region / District	Chilli (%)		Mango (%)		Jowar (%)		Tomato (%)		Others (%)		Total (%)	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	2.37	-	5.28	19.19
Kodagu	-	-	-	-	-	-	-	-	11.85	14.00	9.44	11.05
Shivamogga	-	-	-	-	-	-	-	-	18.96	-	23.06	1.74
High Rainfall total	-	-	-	-	-	-	-	-	33.18	14.00	37.78	31.98
Chikkamagaluru	-	-	-	-	-	-	-	-	28.44	6.00	15.00	5.81
Hassan	-	-	-	-	-	-	-	-	15.64	42.00	6.94	16.86
Kolar	-	-	100.00	-	-	-	100.00	-	4.27	2.00	5.69	1.74
Moderate Rainfall total	-	-	100.00	-	-	-	100.00	-	43.60	70.00	26.25	30.23
Tumakuru	-	-	-	-	22.22	-	-	-	14.22	16.00	9.86	4.65
Ballari	85.00	100.00	-	-	55.56	-	-	-	3.32	-	9.72	16.86
Raichur	15.00	-	-	-	22.22	100.00	-	-	25.12	20.00	22.08	22.09
Low rainfall total	100.00	100.00	-	-	100.00	100.00	-	-	42.65	36.00	41.67	43.60
Grand Total	20	5	1	-	9	1	3	-	211	50	720	172

Source: Primary data collected during Aug-Sep, 2017

Table 7.9: Impact of Varuna Mitra Helpdesk Services on income component (Rs. per acre)

Region / District	Arecanut		Coffee		Cotton		Paddy		Maize		Ragi		Redgram	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
D. Kannada & Udupi	688.14 (0.28)	777 (0.31)	-	-	-	-	467.5 (4.54)	350 (3.4)	-	-	-	-	-	-
Kodagu	-	-	3473.15 (10.25)	2950 (8.71)	-	-	406.23 (3.96)	-	-	-	-	-	-	-
Shivamogga	4464.2 (1.67)	4540.61 (1.7)	-	-	-	-	414.23 (3.24)	-	942.5 (3.48)	-	-	-	-	-
High Rainfall total	3472.99 (1.35)	2658.81 (1.04)	3473.15 (10.25)	2950 (8.71)	-	-	420.83 (3.54)	350 (2.94)	942.5 (3.48)	-	-	-	-	-
Chikkamagaluru	3089 (1.39)	-	4735 (13.37)	4500 (12.71)	-	-	502.14 (4.68)	-	-	-	-	-	-	-
Hassan	-	-	-	-	-	-	-	-	-	-	405.19 (5.82)	350 (5.02)	-	-
Kolar	-	-	-	-	-	-	-	-	-	-	623.99 (6.16)	385 (3.8)	-	-
Moderate Rainfall total	3089 (1.41)	-	4735 (13.37)	4500 (12.71)	-	-	502.14 (4.65)	-	-	-	536.52 (6.38)	357 (4.24)	-	-
Tumakuru	21.62 (0.01)	-	-	-	-	-	533 (3.56)	-	-	-	396.09 (5.4)	-	-	-
Ballari	-	-	-	-	1962.77 (6.78)	1856 (6.41)	673 (2.59)	-	725.57 (5.3)	340.39 (2.49)	419.44 (5.38)	-	-	-
Raichur	-	-	-	-	1542.34 (6.22)	911.02 (3.67)	526 (1.98)	-	-	-	-	-	1559.35 (9.63)	340.29 (2.1)
Low rainfall total	21.62 (0.01)	-	-	-	1581 (6.23)	1056.4 (4.16)	624.78 (2.47)	-	725.57 (5.28)	340.39 (2.48)	398.35 (5.42)	-	1559.35 (9.67)	340.29 (2.11)
Grand Total	3355.35 (1.39)	2658.81 (1.1)	3713.5 (10.72)	3521.05 (10.16)	1581 (6.23)	1056.4 (4.16)	473.15 (3.1)	350 (2.29)	756.12 (5.32)	220.25 (1.55)	480.89 (6.02)	357 (4.47)	1559.35 (9.67)	340.29 (2.11)

Region / District	Chilli		Mango		Jowar		Tomato		Others		Total	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	380.01 (1)	-	577.92 (0.36)	318.55 (0.2)
Kodagu	-	-	-	-	-	-	-	-	684.29 (2.37)	521.42 (1.8)	2041.92 (6.34)	2055.26 (6.38)
Shivamogga	-	-	-	-	-	-	-	-	799.22 (1.48)	-	1952.81 (2.25)	1.41 (0)
High Rainfall total	-	-	-	-	-	-	-	-	728.23 (1.79)	521.42 (1.28)	1783.01 (2.23)	799.61 (1)
Chikkamagaluru	-	-	-	-	-	-	-	-	632.43 (2.12)	545 (1.83)	785.83 (1.39)	2209 (3.9)
Hassan	-	-	-	-	-	-	-	-	459.78 (2.59)	226.26 (1.27)	441.22 (2.19)	260.4 (1.29)
Kolar	-	-	1125 (2.5)	-	-	-	3375.03 (5.59)	-	533.47 (1.51)	204.7 (0.58)	790.4 (1.98)	324.9 (0.81)
Moderate Rainfall total	-	-	1125 (2.5)	-	-	-	3375.03 (5.59)	-	629.56 (2.28)	244.32 (0.88)	736.65 (1.62)	765.29 (1.69)
Tumakuru	-	-	-	-	435 (2.95)	-	-	-	342.5 (0.61)	308.35 (0.55)	338.13 (0.98)	308.35 (0.89)
Ballari	1637.95 (4.91)	1720.99 (5.15)	-	-	495.56 (5.43)	-	-	-	334.42 (0.69)	-	1006.36 (4.07)	682.95 (2.76)
Raichur	1563 (5.61)	-	-	-	333 (2.77)	260 (2.16)	-	-	569.53 (2.78)	554.65 (2.71)	1145.8 (6.41)	559.8 (3.13)
Low rainfall total	1626.71 (5.5)	1720.99 (5.82)	-	-	445.98 (4.21)	260 (2.45)	-	-	475.57 (1.26)	520.68 (1.38)	915.99 (4.14)	598.71 (2.71)
Grand Total	1626.71 (5.21)	1720.99 (5.52)	1125 (2.5)	-	445.98 (4.24)	260 (2.47)	3375.03 (5.59)	-	578.98 (1.7)	430.46 (1.26)	826.46 (1.86)	750.21 (1.69)

Note: Figures in parenthesis indicates the per cent of increase or decrease in income

Source: Primary data collected during Aug-Sep, 2017

Table 7.10: Distribution of farmers based on Post-Harvest component

Region / District	Areca nut (%)		Coffee (%)		Cotton (%)		Paddy (%)		Maize (%)		Ragi (%)	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	42.86	14.85	-	-	-	-	-	10.81	-	-	-	-
Kodagu	-	-	32.00	66.39	-	-	-	-	-	-	-	-
Shivamogga	57.14	55.45	-	-	-	-	-	59.46	-	33.33	-	-
High Rainfall total	100.00	70.30	32.00	66.39	-	-	-	70.27	-	33.33	-	-
Chikkamagaluru	-	7.92	68.00	33.61	-	-	-	6.76	-	-	-	-
Hassan	-	-	-	-	-	-	-	-	-	-	100.00	28.50
Kolar	-	-	-	-	-	-	-	-	-	-	-	5.35
Moderate Rainfall total	-	7.92	68.00	33.61	-	-	-	6.76	-	-	100.00	33.92
Tumakuru	-	21.78	-	-	-	-	-	4.05	-	33.33	-	62.50
Ballari	-	-	-	-	50.00	40.91	-	14.86	100.00	33.33	-	3.57
Raichur	-	-	-	-	50.00	59.09	-	4.05	-	-	-	-
Low rainfall total	-	21.78	-	-	100.00	100.00	-	22.97	100.00	66.67	-	66.07
Grand Total	7	101	25	119	2	22	-	74	2	3	14	112

Region / District	Redgram (%)		Chilli (%)		Mango (%)		Jowar (%)		Tomato (%)		Others		Total	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	-	-	-	-	3.30	3.06
Kodagu	-	-	-	-	-	-	-	-	-	-	-	7.50	8.79	12.50
Shivamogga	-	-	-	-	-	-	-	-	-	-	12.20	13.50	9.89	17.02
High Rainfall total	-	-	-	-	-	-	-	-	-	-	12.20	21	21.98	32.58
Chikkamagaluru	-	-	-	-	-	-	-	-	-	-	26.83	14	30.77	10.77
Hassan	-	-	-	-	-	-	-	-	-	-	24.39	14	26.37	7.98
Kolar	-	-	-	-	-	100.00	-	-	-	-	-	16.50	-	5.85
Moderate Rainfall total	-	-	-	-	-	100.00	-	-	-	-	51.22	44.50	57.14	24.60
Tumakuru	-	-	-	-	-	-	-	-	-	-	-	10.50	-	15.56
Ballari	-	-	-	81.25	-	-	-	60.00	-	-	14.63	11	7.69	8.38
Raichur	-	100.0	-	18.75	-	-	100.00	40.00	-	-	21.95	13	13.19	19.68
Low rainfall total	-	100.0	-	100.00	-	-	100.00	100.00	-	-	36.59	34.50	20.88	42.82
Grand Total	-	9.	-	16	-	5	2	5	-	-	41	200	91	752

Source: Primary data collected during Aug-Sep, 2017

Table 7.11: Impact of Varuna Mitra Helpdesk Services on post-harvest component (Qtl. per acre)

Region / District	Arecanut		Coffee		Cotton		Paddy		Maize		Ragi	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	0.29 (2.64)	0.4 (3.64)	-	-	-	-	-	0.52 (3.93)	-	-	-	-
Kodagu	-	-	1.2 (12.92)	1.09 (11.73)	-	-	-	-	-	-	-	-
Shivamogga	0.25 (2.32)	0.33 (3.04)	-	-	-	-	-	0.64 (4.56)	-	-	-	-
High Rainfall total	0.27 (2.44)	0.34 (3.12)	1.2 (12.92)	1.09 (11.73)	-	-	-	0.62 (4.56)	-	-	-	-
Chikkamagaluru	-	0.23 (2.24)	1.21 (13.41)	1.8 (19.96)	-	-	-	0.68 (5.78)	-	-	-	-
Hassan	-	-	-	-	-	-	-	-	-	-	0.12 (1.37)	1.09 (12.54)
Kolar	-	-	-	-	-	-	-	-	-	-	-	0.29 (3.21)
Moderate Rainfall total	-	0.23 (2.28)	1.21 (13.41)	1.8 (19.96)	-	-	-	0.68 (5.75)	-	-	0.12 (1.37)	0.97 (11.73)
Tumakuru	-	0.38 (4.61)	-	-	-	-	-	0.46 (2.83)	-	-	-	0.12 (1.36)
Ballari	-	-	-	-	3.3 (22.91)	0.68 (4.72)	-	0.73 (3.17)	-	-	-	0.25 (3.31)
Raichur	-	-	-	-	1.2 (9.82)	0.76 (6.22)	-	0.48 (2.07)	-	-	-	-
Low rainfall total	-	0.38 (4.61)	-	-	2.25 (17.98)	0.73 (5.83)	-	0.64 (2.84)	-	-	-	0.12 (1.38)
Grand Total	0.27 (2.53)	0.34 (3.23)	1.21 (13.18)	1.33 (14.51)	2.25 (17.98)	0.73 (5.83)	-	0.63 (4.01)	-	-	0.12 (1.37)	0.41 (4.82)

Region / District	Redgram		Chilli		Mango		Jowar		Tomato	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	-	-
Kodagu	-	-	-	-	-	-	-	-	-	-
Shivamogga	-	-	-	-	-	-	-	-	-	-
High Rainfall total	-	-	-	-	-	-	-	-	-	-
Chikkamagaluru	-	-	-	-	-	-	-	-	-	-
Hassan	-	-	-	-	-	-	-	-	-	-
Kolar	-	-	-	-	0.84 (2.4)	-	-	-	-	-
Moderate Rainfall total	-	-	-	-	0.84 (2.4)	-	-	-	-	-
Tumakuru	-	-	-	-	-	-	-	-	-	-
Ballari	-	-	-	0.54 (7.05)	-	-	-	0.67 (6.02)	-	-
Raichur	-	0.28 (3.62)	-	0.99 (11.14)	-	-	0.56 (6.59)	0.56 (6.59)	-	-
Low rainfall total	-	0.28 (3.62)	-	0.62 (8)	-	-	0.56 (5.42)	0.63 (6.13)	-	-
Grand Total	-	0.28 (3.62)	-	0.62 (7.54)	-	-	0.56 (5.42)	0.49 (5.51)	-	-

Note: Figures in parenthesis indicates the per cent of increase or decrease in income
Source: Primary data collected during Aug-Sep, 2017

Table 7.12: Net gain realised across crops (Rs. per acre)

Region / District	Areanut	Coffee	Cotton	Paddy	Maize	Ragi	Redgram	Chilli	Mango	Jowar	Tomato	Others	Overall
Dakshina Kannada & Udupi	10485.19	-	-	1615.53	-	-	-	-	-	-	-	649.63	4568.12
Kodagu	-	12591.97	-	406.23	-	-	-	-	-	-	-	10968.72	6858.36
Shivamogga	12199.57	-	-	2324.39	2524.60	-	-	-	-	-	-	4317.35	3912.94
High Rainfall total	12468.21	12591.97	-	2167.51	2524.60	-	-	-	-	-	-	2792.94	4926.11
Chikkamagaluru	8717.78	9002.49	-	1776.82	-	-	-	-	-	-	-	3394.69	3471.95
Hassan	403.00	-	-	-	-	2733.90	-	-	-	-	-	3871.80	1956.32
Kolar	-	-	-	-	-	1550.90	-	-	3618.95	-	4337.80	5933.29	4854.04
Moderate Rainfall total	8761.41	8047.29	-	2311.49	-	3986.89	-	-	3618.95	-	4337.80	3704.95	3308.36
Tumakuru	12035.18	-	-	1947.31	523.01	793.11	-	-	-	935.00	-	5548.51	2163.49
Ballari	-	-	3746.92	3084.40	785.56	614.33	-	6848.95	-	2189.56	-	9787.10	6477.13
Raichur	-	-	4559.15	2302.40	-	-	1385.71	8861.96	-	635.33	-	3419.98	8903.11
Low rainfall total	12035.18	-	4126.04	2820.35	862.59	800.04	1385.71	6809.00	-	1394.49	-	8100.06	7501.55
Grand Total	12727.72	11117.92	4126.04	2549.87	1070.58	3056.79	1385.71	6817.65	3618.95	860.38	4337.80	4132.10	5106.58

Source: Primary data collected during Aug-Sep, 2017

Table 7.13: Net yield realised across crops (Qtl. per acre)

Region / District	Areanut	Coffee	Cotton	Paddy	Maize	Ragi	Redgram	Chilli	Mango	Jowar	Tomato
Dakshina Kannada & Udupi	0.30	-	-	0.49	-	-	-	-	-	-	-
Kodagu	-	0.41	-	0.61	-	-	-	-	-	-	-
Shivamogga	-	-	-	0.39	1.17	-	-	-	-	-	-
High Rainfall total	0.30	0.41	-	0.49	1.17	-	-	-	-	-	-
Chikkamagaluru	0.47	1.71	-	0.32	0.69	0.57	-	-	-	-	-
Hassan	0.16	-	-	-	-	0.30	-	-	-	-	-
Kolar	-	-	-	0.56	-	0.70	-	-	1.20	-	1.59
Moderate Rainfall total	0.45	1.71	-	0.35	0.69	0.51	-	-	1.20	-	1.59
Tumakuru	-	-	-	0.24	-	0.60	-	-	-	-	-
Ballari	0.15	-	0.32	0.16	0.26	0.08	0.33	0.16	-	0.05	-
Raichur	-	-	0.32	0.25	-	-	0.33	0.30	-	0.38	-
Low rainfall total	0.15	-	0.32	0.22	0.26	0.57	0.33	0.18	-	1.28	-
Grand Total	0.40	0.61	0.32	0.37	0.44	0.53	0.33	0.18	1.20	1.28	1.59

Source: Primary data collected during Aug-Sep, 2017

Table 7.14: Net gain realised per farmer

Region / District	Net Gain per farmer (Rs)
Dakshina Kannada & Udupi	12870.82
Kodagu	29490.96
Shivamogga	9392.74
High Rainfall total	15308.41
Chikkamagaluru	15066.41
Hassan	4205.45
Kolar	12396.44
Moderate Rainfall total	10376.61
Tumakuru	2939.61
Ballari	33629.64
Raichur	60653.37
Low rainfall total	32136.20
Grand Total	18005.37

Source: Primary data collected during Aug-Sep, 2017

Table 7.15: Distribution of Farmers who have indicated Constraints and Offered Suggestions

Agro Climatic Zones	Districts	Number of beneficiaries	Total area	Net incremental gain per acre (Rs.)	Incremental gain across districts (entire acre in Rs)	Incremental gain Per farmer (Rs)	Incremental gain across districts (entire farmers in Rs)
1. North Eastern Transition Zone	Bidar	5581	21040	8903	187318140	60653	338506458
2. North Eastern Dry Zone	Kalaburagi	11856	57696	8903	513678197	60653	719106355
	Yadgir	4870	19200	8903	170942650	60653	295381912
	Raichur	14839	56105	8903	499507740	60653	900035357
3. Northern Dry Zone	Koppal	6839	21926	6477	142019431	33630	229993108
	Gadag	2862	11916	6477	77181352	33630	96248030
	Belgaum	9037	28823	6477	186692650	33630	303911057
	Bijapur	11425	43826	6477	283868513	33630	384218637
	Bagalkot	6213	21893	6477	141801864	33630	208940953
	Bellary	20887	69369	6477	449313650	33630	702422291
4. Central Dry Zone	Chitradurga	10051	28912	2163	62551667	2940	29546020
	Davanagere	6809	19415	2163	42004634	2940	20015804
	Tumakuru	14078	34405	2163	74435285	2940	41383830
5. Eastern Dry Zone	Bangalore Rural	2149	4368	4854	21203320	12396	26639950
	Ramanagara	580	1221	4854	5926492	12396	7189935
	Bangalore Urban	414	827	4854	4013175	12396	5132126
	Kolar	6356	14682	4854	71267064	12396	78791773
	Chikkaballapura	9070	20364	4854	98848641	12396	112435711

Contd....

Agro Climatic Zones	Districts	Number of beneficiaries	Total area	Net incremental gain per acre (Rs.)	Incremental gain across districts (entire acre in Rs)	Incremental gain Per farmer (Rs)	Incremental gain across districts (entire farmers in Rs)
6. Southern Dry Zone	Mysore	1918	4113	1956	8046794	4205	8066053
	Chamarajanagar	3667	8707	1956	17034109	4205	15421385
	Madya	2203	4456	1956	8716560	4205	9264606
7. Southern Transition Zone	Hassan	5936	15401	1956	30129558	4205	24963551
8. Northern Transition Zone	Dharwad	3557	13355	6477	86504986	33630	119620630
	Haveri	2871	8753	6477	56691404	33630	96550696
9. Hilly Zone	Uttara Kannada	176	503	4887	2460162	17983	3164990
	Shimoga	2444	6198	3913	24253067	9393	22955857
	Chikkamagaluru	7817	22001	3472	76385504	15066	117774127
	Kodagu	1093	3750	6858	25720427	29491	32233619
10. Coastal Zone	Udupi	135	297	4568	1355041	12871	1737561
	Dakshina Kannada	100	231	4568	1055601	12871	1287082
Total		175833	563753	5979	3370927678	28168	4952939464

Source: KSNDMC data base 2016-17; Primary data collected during Aug-Sep, 2017

Table 7.16: Net gains at micro and macro level

Sl. No.	Net gain realised	Micro	Macro	Percentage change (Macro as compared to micro)
		Sample Districts (10)	State (30)	
1	Net gain per acre (Rs)	5107	5979	17 %
2	Net gain per farmer (Rs)	18005	28168	56%
3	Overall Net gain (Rs)	2.43 Cr	495.3 Cr	-

Source: Primary data collected during Aug-Sep, 2017

7.4. Constraints Given by the Sample Farmers

During the course of availing the services of Varuna Mitra, the farmers have come across various constraints. Of the total sample 1350 as many as 897 farmers account for 66.4 per cent have indicated constraints, the rest have either neutral or not given any constraints (**Table 7.17**). From this, it is clear that a larger segment of the farmers have faced problem across the districts and regions. In almost all the districts and regions, the proportion of farmers indicated the constrains were higher with more than 61 per cent except in the case of Kodagu district (50 %) in high rainfall region and Ballari district (54%) in the low rainfall region.

Table 7.17: Distribution of Farmers who have indicated Constraints and Offered Suggestions

Region / District	Constraints			Suggestions		
	Indicated	Not Indicated	Total	Provided	Not provided	Total
Dakshina Kannada & Udupi	91 (60.67)	59 (39.33)	150	147 (98.00)	3 (2.00)	150
Kodagu	75 (50.00)	75 (50.00)	150	79 (52.67)	71 (47.33)	150
Shivamogga	119 (79.33)	31 (20.67)	150	116 (77.33)	34 (22.67)	150
High Rainfall total	285 (63.33)	165 (36.67)	450	342 (76.00)	108 (24.00)	450
Chikkamagaluru	114 (76)	36 (24.00)	150	114 (76.00)	36 (24.00)	150
Hassan	115 (76.67)	35 (23.33)	150	142 (94.67)	8 (5.33)	150
Kolar	107 (71.33)	43 (28.67)	150	143 (95.33)	7 (4.67)	150
Moderate Rainfall total	336 (74.67)	114 (25.33)	450	399 (88.67)	51 (11.33)	450
Tumakuru	91 (60.67)	59 (39.33)	150	79 (52.67)	71 (47.33)	150
Ballari	81 (54.00)	69 (46.00)	150	89 (59.33)	61 (40.67)	150
Raichur	104 (69.33)	46 (30.67)	150	113 (75.33)	37 (24.67)	150
Low rainfall total	276 (61.33)	174 (38.67)	450	281 (62.44)	169 (37.56)	450
Grand Total	897 (66.44)	453 (33.56)	1350	1022 (75.70)	328 (24.30)	1350

Note: Figures in the parenthesis are percentages to total

Source: Primary data collected during Aug-Sep, 2017

7.5. Types of Constraints

Many farmers have indicated that they experienced as many as 13 constraints while availing the Rainfall information from the Varuna Mitra (**Table 7.18**). Among these, a larger proportion of farmers have indicated that the forecast information provided by Varuna Mitra was not always found to be accurate. This has hampered their agricultural operations. As the calls are not free, many farmers are spending a significant amount on the calls that they made to Varuna Mitra. They are expressing this cost is a burden to them as such they call it as a constraint (16.37%). This was followed by irregular messages (10.32%). The farmers are no doubt getting SMS messages from Varuna Mitra but irregularly. They are attributing this as a constraint. The poor quality of calls, network problem and call waiting time were attributed as other constraints of Varuna Mitra. Across the rainfall category districts, similar constraints were seen except in the case of low rainfall region where the proportion of farmers who indicated the call waiting was constraint (9.20%). Across the districts, similar observation we can see, except in the case of a few districts. In Shivamogga, the proportion of farmers indicated that, sometime information is not accurate was lowest with 17.29 per cent and the farmers indicating line busy was highest in Dakshina Kannada and Udupi and Kolar (**Table 7.18**). Similarly, the proportion of farmers indicated more problem of poor quality of calls was found in Tumakuru district (18.52%) and network problem in Ballari (12.0%).

7.6. Suggestions Offered by Farmers

Of the 1350 sample farmers, 96.59 per cent provided 23 suggestions (**Table 7.19**). The proportion of farmers who suggested the improvement in accuracy of forecast stood at 29.51 per cent followed by

Table 7.18: District-wise distribution of constraints reported by farmers

Constraints	Dakshina Kannada & Udupi	Kodagu	Shivamogga	High Rainfall Area	Chikka- magalur	Hassan	Kolar	Medium rainfall Area	Tumakuru	Ballari	Raichur	Low Rainfall Area	Grand Total
Sometimes information on forecast is not accurate	57 (50.89)	48 (57.83)	23 (17.29)	128 (39.02)	32 (26.89)	83 (70.94)	48 (40.68)	163 (46.05)	58 (53.7)	43 (43.00)	57 (48.31)	158 (48.47)	449 (44.54)
Messages are sent irregularly	11 (9.82)	15 (18.07)	27 (20.3)	53 (16.16)	21 (17.65)	3 (2.56)	16 (13.56)	40 (11.30)	8 (7.41)	2 (2)	1 (0.85)	11 (3.37)	104 (10.32)
SMS sent in local language is not readable in certain mobiles	1 (0.89)	2 (2.41)	-	3 (0.91)	-	-	2 (1.69)	2 (0.56)	1 (0.93)	-	-	1 (0.31)	6 (0.6)
Response to calls by tele- advisors is poor	6 (5.36)	1 (1.2)	1 (0.75)	8 (2.44)	2 (1.68)	-	3 (2.54)	5 (1.41)	-	-	3 (2.54)	3 (0.92)	16 (1.59)
Telephone lines are busy	22 (19.64)	-	15 (11.28)	37 (11.28)	13 (10.92)	6 (5.13)	22 (18.64)	41 (11.58)	-	3 (3)	5 (4.24)	8 (2.45)	86 (8.53)
Cost incurred on calls to VM is more	14 (12.5)	7 (8.43)	45 (33.83)	66 (20.12)	21 (17.65)	11 (9.4)	13 (11.02)	45 (12.71)	19 (17.59)	21 (21)	14 (11.86)	54 (16.56)	165 (16.37)
Clarity in calls is lacking	-	5 (6.02)	2 (1.5)	7 (2.13)	5 (4.2)	3 (2.56)	2 (1.69)	10 (2.82)	20 (18.52)	2 (2)	1 (0.85)	23 (7.06)	40 (3.97)
More calls were dropped	-	-	-	-	1 (0.84)	-	8 (6.78)	9 (2.54)	-	3 (3)	7 (5.93)	10 (3.07)	19 (1.88)
Network problem	-	-	-	-	1 (0.84)	3 (2.56)	4 (3.39)	8 (2.26)	-	12 (12)	12 (10.17)	24 (7.36)	32 (3.17)
Call waiting Time is more	-	-	4 (3.01)	4 (1.22)	3 (2.52)	1 (0.85)	-	4 (1.13)	-	13 (13)	17 (14.41)	30 (9.20)	38 (3.77)
Only three days information Provided than long Term	1 (0.89)	-	8 (6.02)	9 (2.74)	9 (7.56)	1 (0.85)	-	10 (2.82)	-	-	1 (0.85)	1 (0.31)	20 (1.98)
No Agro advisory related information	-	5 (6.02)	2 (1.5)	7 (2.13)	1 (0.84)	6 (5.13)	-	7 (1.92)	2 (1.85)	1 (1)	-	3 (0.92)	17 (1.69)
Not aware of other services provided by Varuna Mitra than rainfall	-	-	6 (4.51)	6 (1.83)	10 (8.4)	-	-	10 (2.82)	-	-	-	-	16 (1.59)
Total	112 (100)	83 (100)	133 (100)	328 (100)	119 (100)	117 (100)	118 (100)	354 (100)	108 (100)	100 (100)	118 (100)	326 (100)	1008 (100)

Note: Figures in the parenthesis are percentages to total
Source: Primary data collected during Aug-Sep, 2017

Table 7.19: District-wise distribution of suggestions offered by farmers

Suggestions	Dakshina Kannada & Udupi	Kodagu	Shivamogga	High Rainfall Area	Chikka- magaluru	Hassan	Kolar	Medium rainfall Area	Tumakuru	Ballari	Raichur	Low Rainfall Area	Grand Total
More accuracy of forecast	65 (25.29)	36 (41.86)	24 (18.05)	125 (26.26)	32 (26.67)	58 (40.28)	60 (25.64)	150 (30.12)	44 (48.89)	27 (25)	39 (29.55)	110 (33.33)	385 (29.51)
Long term forecast	2 (0.78)	6 (6.98)	9 (6.77)	17 (3.57)	11 (9.17)	6 (4.17)	0 (0)	17 (3.410)	2 (2.22)	-	1 (0.76)	3 (0.91)	37 (2.84)
Regular SMS Facility	45 (17.51)	8 (9.3)	27 (20.3)	80 (16.81)	22 (18.33)	1 (0.69)	66 (28.21)	89 (17.87)	-	15 (13.89)	10 (7.58)	25 (7.58)	194 (14.88)
More rainfall related messages at the time of sowing period	3 (1.17)	-	-	3 (0.63)	-	-	-	-	-	-	-	-	3 (0.23)
Call should be made Toll Free	68 (26.46)	2 (2.33)	47 (35.34)	117 (24.58)	23 (19.17)	11 (7.64)	64 (27.35)	98 (19.68)	7 (7.78)	22 (20.37)	22 (16.67)	51 (15.45)	266 (20.4)
Improve call clarity	-	4 (4.65)	2 (1.5)	6 (1.26)	7 (5.83)	-	-	7 (1.41)	13 (14.44)	-	-	13 (3.94)	26 (1.99)
Need Improvement in call handling	-	-	-	-	-	-	1 (0.43)	1 (0.20)	-	-	-	-	1 (0.08)
Quick Response from Varuna Mitra	-	-	4 (3.01)	4 (0.84)	2 (1.67)	-	-	2 (0.40)	-	-	-	-	6 (0.46)
Call back service for people whose call was dropped while conversation	-	-	10 (7.52)	10 (2.10)	11 (9.17)	-	-	11 (2.21)	-	-	-	-	21 (1.61)
Need Agro Advisory Services	24 (9.34)	18 (20.93)	5 (3.76)	47 (9.87)	3 (2.5)	49 (34.03)	8 (3.42)	60 (12.05)	20 (22.22)	24 (22.22)	45 (34.09)	89 (26.97)	196 (15.03)
Need Market Related Information	3 (1.17)	7 (8.14)	-	10 (2.10)	-	19 (13.19)	9 (3.85)	28 (5.62)	2 (2.22)	1 (0.93)	5 (3.79)	8 (2.42)	46 (3.53)
Technical guidance for applying of Insurance and Government subsidy schemes	-	2 (2.33)	-	2 (0.42)	-	-	-	-	-	5 (4.63)	1 (0.76)	6 (1.82)	8 (0.61)
Increase in Number of Tele Lines	21 (8.17)	-	1 (0.75)	22 (4.62)	1 (0.83)	-	14 (5.98)	15 (3.01)	-	-	-	-	37 (2.84)
Need text Messages in English Language	1 (0.39)	-	-	1 (0.21)	-	-	-	-	-	-	-	-	1 (0.08)
Need information of other Weather Parameters through SMS	10 (3.89)	-	-	10 (2.10)	-	-	-	-	-	1 (0.93)	-	1 (0.30)	11 (0.84)
Need Voice messages	-	3 (3.49)	-	3 (0.63)	-	-	10 (4.27)	10 (2.01)	2 (2.22)	-	2 (1.52)	4 (1.21)	17 (1.3)
Pre informative messages regarding Cyclones	1 (0.39)	-	-	1 (0.21)	-	-	-	-	-	-	-	-	1 (0.08)
Interactive Voice Response facility	-	-	-	-	-	-	-	-	-	-	1 (0.76)	1 (0.30)	1 (0.08)
Need village wise Agro Advisory Service Centers	2 (0.78)	-	-	2 (0.42)	-	-	-	-	-	1 (0.93)	1 (0.76)	2 (0.61)	4 (0.31)
Need training camps on Disaster Management	-	-	-	-	-	-	-	-	-	6 (5.56)	3 (2.27)	9 (2.73)	9 (0.69)
Need health Advisory Services for Farming Community	-	-	-	-	-	-	-	-	-	5 (4.63)	1 (0.76)	6 (1.82)	6 (0.46)
Skill Development Programmes for farmers	-	-	-	-	-	-	1 (0.43)	1 (0.20)	-	1 (0.93)	1 (0.76)	2 (0.61)	3 (0.23)
Awareness Programmes on Varuna Mitra	12 (4.67)	-	4 (3.01)	16 (3.36)	8 (6.67)	-	1 (0.43)	9 (1.81)	-	-	-	-	25 (1.92)
Total	257 (100)	86 (100)	133 (100)	476 (100)	120 (100)	144 (100)	234 (100)	498 (100)	90 (100)	108 (100)	132 (100)	330 (100)	1304 (100)

Note: Figures in the parenthesis are percentages to total;

Source: Primary data collected during Aug-Sep, 2017

calls should be made free (20.4%), expecting agro advisory services (15.03%) and expecting regular SMS messages (14.88%). The rest of the farmers have suggested the increase of number of lines to cope with the demand. They also suggested that the forecast information should be for longer period. Among the districts, the proportion of farmers indicated that the need of accurate information was the highest with 48.39 in the case of Tumakuru followed by Kodagu (41.86%), and Hassan (40.28%). In Shivamogga, a larger proportion of farmers expected the call should be made free (35.34%). The need of the agro advisory service was sought by farmers in Shivamogga was the lowest with 3.76 per cent and also lowest in Chikkamagaluru (2.5%) and Kolar (3.42%) districts. In the case of Raichur district, the proportion of farmers suggested that, they need more agro advisory services with 34.09 per cent which is two times more than the average of all sample districts.

7.7. Reason for Not Taking the Decision Based on the Information

Out of 1350 sample farmers, only 65 (4.81%) have not taken any decision based on rainfall forecast provided by Varuna Mitra due to various reasons. Among these, 78.46 per cent have not taken decision on forecast information as they felt that the information provided was not accurate. The remaining have not taken any decision due to the crop was severely damaged by the pests and diseases (4.62%), the farmers was out of village due to other works (1.54%). Some have not considered the forecast due to the fact that the sowing season was over (3.08%) and other have expressed finance problem and labour problems (10.77%) (Table 7.20). Across the districts, we do find that majority have not taken decision on account of inaccurate rainfall forecast.

Table 7.20: Distribution of Beneficiaries who have not taken any decision on Forecast

Districts	% to the total						Total Nos.
	Information was Not Accurate	Severe Pest Attack	Out of Station	Sowing Season was Over	Not considered Seriously	Other Reasons	
Shivamogga	100.00	0	0	0	0	0	4
Hassan	100.00	0	0	0	0	0	12
Kolar	60.00	40.00	0.00	0.00	0.00	0.00	5
Tumakuru	100.00	0.00	0.00	0.00	0.00	0.00	21
Ballari	33.33	11.11	0.00	11.11	0.00	44.44	9
Raichur	57.14	0.00	7.14	7.14	7.14	21.43	14
Total (%)	78.46	4.62	1.54	3.08	1.54	10.77	65
Total (Nos.)	51	3	1	2	1	7	-

Source: Primary data collected during Aug-Sep, 2017



Collecting Data from a sample farmer in Raichur district



Collecting Data from a sample farmer in Raichur district



Collecting Data from a Coconut farmer in Tumkur district



Collecting Data from a sample farmer in Kolar district



Pepper plot of sample farmer in Udupi district



Collecting Data from a Coffee farmer in Kodagu district

Findings and Recommendations

08



Findings and Recommendations

CHAPTER 8

Finding and Recommendations are drawn based on the analysis of primary and secondary data. These findings and recommendations are presented separately as under:

8.1. Findings

8.1.1. Impact of Varuna Mitra - Macro Analysis

- Secondary data results have shown that the performance of the Programme has been impressive. This is evident from the increase in number of calls since its inception from a meagre 6,565 in 2011 to 10.42 lakh in 2016, which is increasing at a Compound Annual Growth Rate (CAGR) of 61.55 per cent considering all 30 districts in Karnataka while the growth rate between 2013 and 2017 is increasing at 51.46 per cent. The growth rate across districts ranged between 92.58 per cent in Kodagu district to 13.92 per cent in Dakshina Kannada. Lowest growth rate was observed in Uttara Kannada (37.94%), Dharwad (32.92%), Gadag (29.08%), and Bengaluru urban (18.83%), whereas highest growth rate was seen in Kodagu (92.58%), Mysuru (92.25%), Kolar (90.63%), Koppal (89.15%) and Chikkaballapura (83.91%). In terms of the pattern of calls during the drought years, it was found that the number of calls increased with the increase in number of districts that experienced drought. Particularly, the frequency of calls has been highest in 2016-17 as the year experienced the lowest rainfall in the past 46 years. If the calls continue to increase at the same growth rate, calls are projected at 63.57 lakhs by 2020. This shows that the programme is advantageous to farmers and other stakeholders, which also substantiates its popularity in the State.
- During 2016-17, there were a total of 1.76 lakh callers who made 10.42 lakhs calls. It works out to 5,876 beneficiaries per district with an average of 34,724 calls per district and an average of 2,854 calls was made by beneficiaries per day in the State. Among the districts, the highest number of calls was received from Ballari which accounted for 11.08 per cent followed by Tumakuru (8.72%), Raichur (7.24%), Chikkaballapura (7.08%) and Kalaburagi (6.42%). As these districts receive less rainfall and are frequently prone to droughts, farmers in these areas are in dire need of rainfall forecast. Another interesting fact was that urbanized districts have also extensively utilized the Varuna Mitra services. This may be attributed to the general public attempting to take preventive measures during heavy spells of rain that had caused inundation due to poor drainage systems.
- Among the beneficiaries who called during 2016-17, 99.53 per cent of queries were with regard to rainfall which is very crucial input for agricultural operations and crop survival. The farmer mostly enquired about current day forecasts (63.02%). The kharif season (July-October) received 52.11 per cent of the total calls. Of the various purposes for which the calls were made, majority of the farmers sought information for agriculture (90.39%), followed by horticulture (8.65%), animal husbandry (0.39%) and sericulture (0.57%). The total of 1.76 lakh farmers owned 56.38 lakh hectares of land, of which irrigated land accounted 64.54 per cent.

- The farmers sought information on rainfall for about 73 crops. Among these crops, 56.95 per cent of the calls pertained to only ten crops. They include- cotton, chilli, onion, ground nut, maize, jowar, ragi, paddy, tur and sugarcane. Among them maize accounted for highest share, both under irrigated and dry land with 14.41 per cent of the area, 10.71 per cent of the farmers and 13.80 per cent of the calls. This is followed by tur which accounted for 14.64, 7.99 and 11.05 per cent of area, number of farmers and calls, respectively. Of the calls reported, a majority of the calls were made during the germination stage of all the crops (37.35%) followed by harvesting (22.40%), sowing (12.45%) and vegetative phase (10.38%). The least number of calls were made at the transplantation stage (0.81%). Particularly, jowar crop growers made the maximum number of calls during sowing stage followed by cotton and tur, calls from growers of sugarcane, tur and ragi were more during germination stage. In vegetative stage, chilly, cotton and sugarcane accounted for a major share of the calls and a higher number of calls were registered from paddy, ragi, sugar cane and ground nut growers during harvesting stage.

8.1.2. Impact of Varuna Mitra - A Micro Analysis

Socio economic characteristics and cropping pattern of the sample farmers

- Of the respondents who sought rainfall information from VARUNA MITRA for agricultural operations, 99.48 per cent were males. Sample respondents in all the districts were male except for Dakshina Kannada & Udupi (2.67%), Shivamogga (0.67%) and Chikkamagaluru (1.33%) where the respondents were female.
- A higher proportion of them (56.74 %) were found in the age group of 36-60 years, followed by 39.26 per cent in the age group of 18-35 years. The minimum age was 18 years and 4 per cent of the farmers were above 60 years. Ballari had the highest number of farmers in the age group of 18 to 35 years and the lowest in this age group were from Shivamogga (30%). The farmers between the age group of 36 to 60 years were highest in Dakshina Kannada & Udupi (63.33%) and the lowest was in Ballari (48%). The farmers above 60 years were highest in Dakshina Kannada & Udupi (10.67%) and a few farmers in this district were also over 80 years.
- The literacy levels among the respondent farmers who contacted VARUNA MITRA were high at 97 per cent. Nearly 78 per cent of the farmers were educated up to secondary school, 14 per cent were graduates, 4 per cent of the farmers had education up to primary school, and 2 per cent of the farmers were post graduates. About 3 per cent of the farmers were illiterates, which was highest in low rainfall region (4%). This proportion was relatively higher in the case of High rainfall districts particularly coastal and malnad region as compared to low rainfall and moderate rainfall regions. These results show that literacy levels were relatively higher among the farmers and therefore they were aware of VARUNA MITRA and contacted it for forecast which would facilitate to alter the agricultural operations.
- The total operational land of sample farmers was 9588 acres which works out to be 7.11 acres per farmers which is closer to 7.93 acre as per KSNDMC data for the reference year, 2016-17. The proportion of irrigation was higher which stood at 55 per cent of the operational land, which is lesser than the 64.54 per cent land as per KSNDMC data. Among the districts, land per farmer was found at 10 acres in Ballari and 14 acres in Raichur. This is quite higher as compared to KSNDMC data, 8

and 9 acres, respectively. On the basis of irrigated land, the highest irrigated area per farmer was in Chikkamagaluru (7.86 acres) and lowest irrigated area per farmer was in Tumakuru (1.12 acres).

- Most of the irrigated farmers have adapted micro irrigation. This is clear from the higher proportion of area under micro irrigation (51.52%). More proportion of micro irrigation was found in high rainfall and moderate rainfall regions. It is quite surprising to note that normally one would expect high proportion of micro irrigation in low rainfall region. Percentage of drip/ sprinkler to the total irrigated area across districts indicates that, Kodagu has the highest drip/sprinkler area (97%), followed by Hassan (87%), Chikkamagaluru (83%) and Kolar (78%). It is strange to note that, highest area under micro irrigation has been reported in Moderate rainfall region (82%) followed by High rainfall region (71%) and Low rainfall region (2%). Relatively lower area under micro irrigation has been reported in low rainfall region specifically Raichur and Ballari, which had access to surface water.
- Nearly, 48 per cent of the area was irrigated through ground water (bore wells), 43 per cent by surface water and 9 per cent by both surface and ground water (Conjunctive use) at aggregate level.
- Most of the area was irrigated using ground water in Hassan (100%), Tumakuru (100%), Kolar (98%), Dakshina Kannada & Udupi (86%) and Shivamogga (83%). In the remaining districts it was dominated by either surface water or both ground water and surface water (Conjunctive use). Out of the irrigated area in sample districts, 47 per cent was through ground water, 43 per cent using surface water and 9 per cent using both surface and ground water (Conjunctive use).
- The number of marginal farmers were highest in Dakshina Kannada & Udupi (47%), followed by Hassan (40%), and Tumakuru (29%), while small farmers were highest in Tumakuru (55%) followed by Kodagu (51%), Shivamogga (46%) and Hassan (45%). The percentage of medium farmers was highest in Chikkamagaluru (52%), followed by Kodagu (46%) and Raichur (41%), while large farmers were found to be highest in Ballari (35%) followed by Raichur (32%) and Chikkamagaluru (26%).
- At the aggregate level, 4.66 per cent of the area operated by 19 per cent of the marginal farmers, 20 per cent by 37 per cent of the small farmers, 31 per cent by 30 per cent of the medium farmers and 44 per cent by 15 per cent of the large farmers. Thus, indicating in-equity in distribution of operational land among marginal, small, medium and large farmers.
- The classification of farmers by size of land holding shows that more number of farmers were marginal and small farmers account for 55.56 per cent by holding 25.04 per cent of the land. The proportion of this category and land owned was lower as compared to agricultural census 2010-11 in the State, but also lower as compared to the secondary data provided by KSNDMC. According to this, the proportion of marginal and small farmers was 47.62 per cent and 10.87 per cent land.
- The net income from Agriculture, Allied activities, and non-agriculture sources for the period from July, 2016 to June, 2017 worked out to approximately Rs.3.52 lakhs per farmer. Agriculture constituted around 89 per cent of the total income. Allied activities like dairy, poultry and fishery formed only 2.5 per cent of the total income of farmers. The contribution of poultry and fishery to net income was negligible in all the districts, thus indicating lack of enterprise diversification. Average net income per farmer was highest at Rs.8.87 farmer in Chikkamagaluru, whereas it was lowest in Tumakuru (Rs.1.32 Lakh).

- The sample farmers in study area had grown about 72 crops in an area of 9848.78 acres (Gross Sown Area). These crops were classified into eight groups. They are cereals, pulses, oil seeds and cash crops, fruits, vegetables, flowers and plantation crops. The proportion of CGA area under cereals was 30 per cent considering both irrigated and unirrigated followed by plantation (28%), cash crops (14%), vegetables (10%) and pulses (9%). Cereals, cash crops and pulses are the major crops grown in low rainfall region; plantation, vegetables, cereals and fruits in moderate rainfall region; plantation and cereals in high rainfall region. If we look at the specific crops across the districts, it was found that arecanut was found in Chikkamagaluru, Udupi, Tumakuru, Udupi & Dakshina Kannada districts. The cereal crops were grown in all the districts. The coffee was grown in Kodagu. The horticultural crops were grown mainly in Kolar. Among un-irrigated crops, cereals, pulses and oil seeds & cash crops accounted for around three-fourth of gross un-irrigated area.
- At the aggregate level with respect to irrigated area, plantation crops (43%) occupied the highest area followed by cereals (19%), cash crops (16%) and vegetables (15%). Cash crops (39%) accounted for the highest share, followed by cereals (34%) and vegetables (15%) in the low rainfall region, while plantation crops (76%) occupied highest area, followed by cereals (15%) and others (7%) in the high rainfall region. Plantation crops (55%) occupied highest share in the cropping area followed by vegetables (26%) and cereals (7%) in the moderate rainfall region.
- In un-irrigated area at the state level, cereals (44%) has covered highest area followed by pulses (20%), cash crops (12%), plantation crops (7%) and others (8%). It is interesting to note that cereals (64%) occupied highest area to the total area in high rainfall region.
- It is expected more number of farmers would have benefited from various crop insurance schemes. Among the sample farmers, as less as 31 per cent of the farmers had availed crop insurance. Shivamogga (29.33%) has the highest number of farmers who have availed crop insurance followed by Kolar (19%), Raichur (12%), and Ballari (11.23%).

Opinions and Perceptions of sample farmers regarding Varuna Mitra

- Various sources played an important role in dissemination of VARUNA MITRA services among the farmers. The prominent among them was the friends from whom an overwhelming majority of farmers received information about VARUNA MITRA (63.19%) followed by RSK (16.08%) and Relatives (12.02%). These results are in conformity of VARUNA MITRA data of KSNDMC for the reference year, 2016-17. The rest of sources account for less than 5 per cent. The gram panchayats expected to play a major role that has not happened. Among the regions and districts, more or less similar pattern prevailed.
- Having known about the services of Varuna Mitra, 95 per cent of the farmers sought information regarding rainfall forecast followed by temperature (4.08%), relative humidity (2%), wind speed (0.82%) and wind direction (0.38%).
- Considering number of calls made to VARUNA MITRA over time indicated tremendous increase in growth rate of calls. This increase was also visible among the farmers considering starting year of contact by beneficiaries. In the beginning years i.e. 2011 and 2012 there were fewer calls to Varuna Mitra help-desk (2.83%). Thereafter there has been a tremendous increase. This shows the popularity and usefulness of forecast information for farmers for taking up agricultural operations.

- A large proportion of farmers preferred direct interaction method (mobile) with the VARUNA MITRA (88.67%) followed by text message (11%), both voice and text message (8%) and voice message (4%). The direct interaction would facilitate to clarify doubts and gives some kind of satisfaction and have more confidence in the information. With regard to language, most of the farmers preferred Kannada (88%), followed by Kannada and English (10%), only English (1.34%) and other language (1%).
- A large number of farmers contacted Varuna Mitra individually by using their mobiles (84%) and a small proportion (21.78%) contacted Varuna Mitra collectively. All the farmers in Kodagu, Hassan, Tumakuru had contacted individually.
- The farmers who availed information from VARUNA MITRA for their benefit, has further shared the information to other farmers either by informing them directly or providing the VARUNA MITRA help desk information. On an average, farmer who contacts Varuna Mitra help desk Services has conveyed the information to 6.7 farmers and provided contact number of VARUNA MITRA to 5.3 persons. Altogether, each farmer has dissimilated information to 12 persons. Region-wise comparison also indicate that each farmer has disseminated rainfall information to about 12 farmers.
- The farmers normally contact the VARUNA MITRA when there were clouds in the sky or by noticing the withering away of the crop in the field to make sure whether rain would occur or not for taking decisions on agriculture. The finding shows that more than half of the farmers (58.75%) have called help desk based on the cloud cover and the others in the sample (49.26%) have called help-desk by observing their crop in the field. This means both are the decisive factors for the farmers to make him to contact VARUNA MITRA to get information in time and make informed decisions in agricultural operations.
- During the crop cycle, farmers made frequent calls to VARUNA MITRA. The average calls made by them were 17. These are on higher side as compared to the 6 call per year as per secondary data. The number may be due to recalling problem of farmers or may be calls made by him since he started calling VARUNA MITRA. Although the average calls were at 17, as many as 11 calls were ignored without taking any activity on the probability of rains. As expected the average calls made in high rainfall regions were less as compared to moderate and low rainfall. However, the surprising fact is the moderate rainfall should be lower than low rainfall but the calls were more.
- The duration of conversation between the VARUNA MITRA and farmer would determine the usefulness and effectiveness. The finding shows that the duration of each call was 61-120 seconds (16.60 per cent) followed by 9.78 per cent in the range of 121-180 seconds i.e. 2 to 3 minutes. This means only short duration calls may not be so useful except telling rain or no rain without any advice. As the call duration was very less, the cost incurred by the farmers was also low. Over 30 per cent of the farmers incurred below Rs.2 per call. Surprisingly a larger proportion of farmers (more than 60%) did not indicate duration and cost of calls. The probable reason may be the offering of free services by some of the mobile companies as such they were not bothered to indicate.
- Most of farmers across seasons opined that the quality of calls were good (83.64%) and only a small number of farmers stated that the quality of the calls were poor (1.25%). Few farmers opined neutral (15.11%) view with respect to quality of calls. It is noticeable that over 90 per cent of the farmers from the high rainfall region were most satisfied with the quality of the call as compared to farmers from the moderate rainfall region (85%) and low rainfall region (75%). With regard to SMS, 990 farmers (73.34%) have reported that they have not received any messages from Varuna Mitra. Among the rainfall regions, farmers from low rainfall region have received more SMS messages than other regions.

- One of the basic objectives of providing weather information to farmers is reduce the risks of farmers. This was realized as 57 per cent of the farmers opined the advance information has helped to overcome risks in agriculture. But the surprising fact is that the proportion of farmers indicated risk aversion was 84 per cent of farmers in high rainfall districts, 49.11 per cent in moderate rainfall districts which are higher than 38.67 per cent in low rainfall districts.
- Other than agricultural purposes, a small proportion of farmers (40 farmers) availed rainfall information before taking up socio-cultural activities, fishing, sericulture, transportation of produce and construction activities. The advance information on rainfall to finalize the non-rainy day for social function, venturing for fishing due in non-rainy day and keeping chandrike for drying purpose in the case of sericulture. The realization of prediction as per these stakeholders was as high as 62.50 per cent in the range of 60-90 per cent.
- In agricultural sector, 65.41 per cent of the farmers have indicated that the prediction was realized to the extent of above 50 per cent to 100 per cent. Among the high rainfall region, the accuracy levels realized was above 50 per cent found at 77.56 per cent as expected. However the surprising fact is that the accuracy levels were low in the moderate rainfall (56.89%) than the low rainfall region (61.78%). Among the districts, the proportion of farmers indicated low realization levels was in Tumakuru (8.67%) and Hassan districts (42%) where the proportion of realization was less than 50 per cent of the prediction. The above results show that the prediction was realized to a greater extent, implying that the prediction of rainfall is realized in most of the times.

Opinions and Perceptions of stakeholders regarding Varuna Mitra

- The Department of Agriculture, public and media have mostly availed services of Varuna Mitra. Out of these, 50 sample covered in 21 districts comprising both agriculture and non-agriculture stakeholders were interviewed to ascertain the utility of the services of Varuna Mitra as well as to seek their feedback. The agriculture stakeholders comprise of Departments of Agriculture and Forest. Non-agriculturist stakeholders comprise of media and industrialists. The Agriculture Department availed the information on Varuna Mitra to take the decision on agriculture operation on their farm, plan programmes and to disseminate information to the farmers in their jurisdiction. Most of the stakeholders were media people (32%), followed by agricultural officers (28%), traders (10%) and remaining were the other government officials and public.
- The non-agricultural stakeholders availed the services of Varuna Mitra for transporting goods and burning of bricks, whereas, the media people availed the information for publishing weather bulletins in regional newspapers.
- Most of the stakeholders (46%) mentioned friends as a source of information followed by government mandate (14%), Internet (12%), Newspapers (6%), RSK'S (6%), electronic and print media (4%) and others (8%).
- A total of 36 stakeholders (72%) sought information regarding rainfall forecast, whereas 8 stakeholders (16%) obtained information on rainfall and temperature. The remaining has sought information on more than 2 weather related parameters.
- On the whole 1787 phone calls were made by stakeholders, of which as less as 16 per cent of the calls were utilized for decision making. A larger proportion of the calls (19.72%) made by agriculture department stakeholders were utilized for sowing-related operations.

- An overwhelming majority of stakeholders (80%) indicated that the quality of the calls were good. Nearly 16 per cent were of neutral view. Only a negligible per cent (4%) of the callers were unsatisfied with the quality of calls.
- About 52 per cent of the stakeholders indicated accuracy level of 90-100 per cent, 70-80 per cent and 50-60 per cent by 22% of the stakeholders each.
- On the whole, 94 per cent of the stakeholders indicated the forecasts information was useful and helped them in taking decisions, resulted in positive outcomes.

8.1.3. Economic Impact of Varuna Mitra on cost of cultivation, yield, net income and post-harvest losses

- Farmers have called Varuna Mitra at various stages with respect to different crops. There are several instances of farmers growing similar crops who have called at various stages. Thus, for this reason the stage-wise percentages has been worked out for 2601 sample farmers instead of actual sample size, 1350. Nearly 29 per cent of the total farmers (2601) contacted Varuna Mitra help desk during harvesting followed by sowing (19%), PPC application (12.65%). Whereas the least number of farmers had contacted during tank filling (0.04%) and transplanting (0.54%).
- About 49 per cent of the total farmers (1350) had indicated a decrease in cost of cultivation to an extent of Rs. 1696 per acre, whereas increase in cost was mentioned by only 7.4 per cent of the farmers to an extent of Rs.1582 per acre. The highest decrease in cost was observed to an extent of Rs. 6273 per acre was witnessed among 56 coffee farmers (4%) who indicated the decrease at stages of irrigation and fertilizer application. With the forecast of rain for couple of days, the farmers could save the irrigation cost which otherwise would have been incurred. Other major crops that followed coffee in terms of decrease in cost were arecanut (Rs.2571/ac), tomato (Rs.2218/ac) and mango (Rs.1268/ac).
- Increase in yield was indicated by 671 farmers (49.70%). Across major crops, highest incremental increase in yield was mentioned by 5 farmers (0.37%) in jowar (1.67 qtl/ac @ 16.17%) followed by 77 farmers (5.7%) in ragi (0.77 qtl/ac @ 8.83%), 83 farmers in coffee (6.1%) (0.77 qtl/ac @ 8.36%;). The incremental increase in yield was also indicated by 26 farmers (1.92%) in tomato (2.36 qtl/ac @ 2.25%), 1 farmer in (3.9%) in mango (1.2 qtl/ac @ 3.43%) and 53 farmers (3.9%) in maize (0.85 qtl/ac @ 5.94%). The increase in yield was attributed to appropriate time of sowing, fertilizer application and irrigation operations based on the rain forecast received. Highest decrease in incremental yield was observed in tomato (3.41 qtl/ac @ 3.25%) by 4 farmers (0.29%), followed by 16 farmers (1.1%) in cotton (0.57 qtl/ac @ 4.55%), and 1 farmer in paddy (0.57 qtl @ 3.64%).
- With regard to change in income, a total of 720 farmers (53.33%) indicated incremental increase in income by Rs.826 per acre, whereas 172 farmers (12.74%) mentioned a decrease in income to an extent of Rs.750 per acre. Highest incremental increase was indicated by 42 farmers (3%) in coffee (Rs.3713/ac @ 10.72%), 112 farmers (8%) in arecanut (Rs.3355/ac @ 1.39%), 20 farmers (1%) in chilli (Rs.1626/ac @ 5.21%) and 16 farmers in redgram (1%) (Rs.1559/ac @ 9.67%). There were instances of farmers indicating decrease in income as well. Decrease in income was indicated for the same crops for which increase was mentioned. In the case of coffee, it was Rs.3521/ac (10.16%), followed by arecanut (Rs.2658/ac @ 1.1%) and chilli (Rs.1627/ac @ 5.52%). However, this was mentioned by 19, 6 and 5 farmers, respectively.

- With respect to post harvest losses, a total of 752 farmers (55.70%) indicated a decrease in post-harvest loss to an extent of Rs.4402 (@ 6.3%) per acre whereas 91 farmers (6.7%) indicated an increase in post-harvest losses by Rs. 4562 per acre (@ 6.55%). The highest decrease in post-harvest losses was indicated in coffee (Rs. 9562/ac @ 14.5%) by 119 farmers (8.8%), arecanut (Rs.8534/ac @ 3.22%) by 101 farmers (7.48%) and chilli (Rs.4903/ac @ 7.5%) by 16 farmers (1.18%). The highest incremental increase in post-harvest losses was observed in cotton (Rs. 9022/ac @ 17.45%) by 2 farmers, coffee (Rs. 6686/ac @ 10.14%) by 25 farmers (1.8%), arecanut (Rs.6686/ac @ 2.5%) by 7 farmers (0.51%), and ragi (Rs. 1295/ac @ 9.02%) by 14 farmers (1%).
- Per acre results across crops has indicated that arecanut had realized the highest incremental gain of Rs.12728 per acre followed by coffee (Rs.11118/ac), Chilli (Rs.6818/ac) and tomato (Rs.4338/ac). The highest net gain in the case of arecanut is due to the relatively higher market price of the crop, additional yield realized and the post-harvest losses saved with the rainfall forecast information. Similarly saving of costs incurred on irrigation, reduction of post-harvest losses and timely application of fertilizers with the rainfall information in advance has led to increased net gain in coffee. The least incremental net gain was in maize (Rs.1071/ac), and jowar (Rs. 860/ac).
- The overall net gain per acre irrespective of the crop and district was Rs.5107. The highest incremental net gain per acre was observed in Raichur (Rs.8903) with cotton, redgram and paddy as prominent crops followed by Kodagu (Rs.6858/ac), and Ballari (Rs.6477/ac).
- The net gain per farmer was highest in Raichur (Rs.60653) followed by Ballari (Rs.33629), the districts mainly cultivating cotton, paddy and redgram, both districts are in low rainfall region. The highest net gain per farmer in Raichur is due to the high operational land holding with 6.81 acres per farmer. This is 92 per cent higher than the average holding of the entire sample farmers (3.53 acres). Among the high rainfall regions, farmers in Kodagu earned relatively higher net gain (Rs.29490) and in moderate rainfall regions, Chikkamagaluru (Rs.15066) realized relatively higher net gain. At aggregate level, the net gain was Rs.18005 per farmer.
- The projections made at the macro level with micro level results as base indicate an overall income realized at the state level as Rs. 495.3 Crore during 2016-17, which is a result of timely operations based on the weather information obtained from Varuna Mitra. With the estimation for the state, the per farmer and per acre incremental net gain was Rs.28168 and Rs.5979 respectively. This is 56 per cent and 17 per cent higher than the per farmer (Rs.18005)and per acre (Rs.5107) results of 10 sample districts.

8.2. Recommendations

- Currently, the average command area under the Telemetric Weather Station (TWS) is 210 sq.km at the State level. In the case of Sujala - III watershed programme, one telemetric weather station has been installed for every 5 sq.km. In Western countries, weather observation stations installed for every 100 sq.km. Keeping this in mind, the command area of the telemetric weather station should be reduced to at least 100 sq.km to ensure more accuracy by installing more telemetric stations in the districts where the command area of the device is more than 100 sq.km.
- In addition, KSNDMC, IMD, ISRO, Agriculture Universities and Water Resources Department has installed telemetric weather stations at various locations in the State. In order to further increase the accuracy level, special efforts needed by KSNDMC to use information from all these sources for increasing accuracy levels as isolation distance significantly reduces through this effort.

- Out of 1350 farmers interviewed, only 17 per cent (224) of farmers have access market and AgriMet advisories other than Varuna Mitra. Nearly 57 per cent of the sample farmers have indicated the need for AgriMet and market advisories. Most of the farmers have opined that they require agri-advisories from sowing to marketing stage in addition to weather-based information. In this regard, Agriculture and Horticulture Universities should identify a nodal help desk (i.e. KVKs) in each district for providing Agri-advisories to farmers. In this regard, KSNDMC can forward such calls to these nodal centers for attending to the farmer queries quickly. Further, Department of Marketing and Inspection's Agmarknet may be interfaced with Varuna Mitra for providing market information. Through such integration, farmers can be richly benefitted.
- It is to note that only less than 0.5 per cent of the sample farmers are utilising forecast related to wind speed and direction, temperature and relative humidity. Farmers opined the contact number of Varuna Mitra to be made toll free. This may also increase the number of cultivators reaching Varuna Mitra. Special extension efforts needed from the concerned institutions for disseminating the information provided by Varuna Mitra.
- It was opined by the sample respondents that Varuna Mitra should make an attempt to provide the forecast of the lightening to save lives and crops as lightening during the rainy season has affected crops and deaths have been reported in the state.
- Call dropping, irregularity in sending SMSs, busy line and poor voice clarity are the problems encountered by few sample farmers. This could be addressed by increasing the telephone lines and employing additional staff as number of calls is increasing at a CAGR of 51.46 per cent between 2013 and 2017.
- The name of the villages was not collected, which needs to be collected as it is quite difficult to locate the beneficiaries with the existing information. In addition, there should be mechanism to regularly update the mobile numbers as the beneficiaries would have changed mobile numbers overtime.
- A significant number of respondents are not aware about the forecast of other parameters such wind speed, wind direction, temperature and relative humidity. The tele-advisors may provide awareness in this regard.
- A small per cent (2.62%) of the cultivators in the state are aware of Varuna Mitra services. In view of this, special efforts needed from concerned institutions such as Panchayats, Agriculture and Horticulture departments and universities to create awareness. Charts and posters about Varuna Mitra services have to be displayed in all these places and mass media (TV, Radio and Newspaper) may be effectively used as well.
- Most of the stakeholders opined that the information provided was accurate and useful in taking decisions. However, in order to improve the effectiveness and expansion of Varuna Mitra, Dissemination of AgroMet advisories, Toll Free Calls and increase in number of Tele Lines was mainly suggested by stakeholders.

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CHAPTER 9

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Vegetative growth stage of maize crop at Ballari district



Vegetative growth stage of Marigold crop of sample farmer in Kolar district

Annexures

10



Annexures

CHAPTER 10

**Annexure 3.1: Distribution of Beneficiaries by Number of Calls made during
Reference Year July 2016 - June 2017**

Region / District	% to the total					Total
	1 call	2 calls	3 calls	4 calls	5 calls	
Udupi	66.95	16.10	3.39	7.63	5.93	118
Dakshina Kannada	62.96	24.69	3.70	6.17	2.47	81
Uttara Kannada	62.16	19.59	7.43	3.38	7.43	148
Kodagu	57.62	16.65	11.92	6.26	7.56	847
Shivamogga	60.46	19.32	8.80	6.24	5.18	1988
High rainfall Total	60.09	18.64	9.24	6.16	5.88	3182
Chikkamagaluru	54.79	19.97	11.80	7.79	5.65	5840
Bidar	58.93	18.91	10.33	6.81	5.02	4242
Gulbarga	56.85	19.46	10.66	7.27	5.76	8874
Hassan	54.82	18.85	12.13	7.91	6.30	4287
Bangalore rural	56.12	18.42	11.24	9.18	5.05	1504
Bangalore urban	63.99	19.50	5.96	8.03	2.52	436
Belgaum	58.79	18.69	10.27	7.20	5.05	7068
Yadgir	57.22	18.60	11.88	6.77	5.54	3721
Kolar	56.39	18.20	11.31	8.01	6.09	4334
Moderate rainfall Total	56.93	19.02	11.03	7.47	5.55	40306
Ramanagara	59.10	18.44	8.51	7.57	6.38	423
Chikkaballapura	55.84	18.93	10.76	8.26	6.20	6160
Tumakuru	55.61	19.28	11.10	7.88	6.13	10087
Mandya	59.31	18.00	9.83	7.30	5.57	1617
Dharwad	62.80	16.54	9.06	6.55	5.05	2793
Davanagere	56.28	19.40	10.30	8.42	5.60	5192
Raichur	54.57	19.45	11.87	7.96	6.15	11364
Mysore	57.00	17.47	10.40	8.13	7.00	1414
Bijapur	56.73	19.33	11.19	6.90	5.85	8509
Haveri	57.68	19.38	10.98	7.14	4.82	2240
Chamarajanagar	57.30	18.63	11.37	7.50	5.21	2534
Koppal	56.75	18.81	11.55	7.72	5.18	5248
Ballari	56.37	19.29	10.85	7.61	5.88	15663
Bagalkot	56.15	19.22	11.30	7.70	5.63	4725
Gadag	56.18	19.22	11.49	7.49	5.61	2175
Chitradurga	55.79	19.60	11.01	7.70	5.90	7340
Low rainfall Total	56.34	19.12	11.02	7.68	5.83	87484
Grand total	56.61	19.08	10.98	7.58	5.74	130972

Source: Compiled from KSNDMC Database, 2017

Annexure 3.2: Number of Calls made by Farmers of Varuna Mitra during Different Seasons (July 2016 - June 2017)

Region / District	Pre-monsoon				South-West monsoon					Post-monsoon				Winter			Grand total
	Mar	Apr	May	Total	Jun	Jul	Aug	Sep	Total	Oct	Nov	Dec	Total	Jan	Feb	Total	
High Rainfall Region																	
Udupi	56	75	119	250	33	125	37	27	222	40	52	43	135	24	18	42	649
Dakshina Kannada	139	127	43	309	29	40	14	7	90	21	25	43	89	79	39	118	606
Uttara Kannada	17	35	87	139	100	120	75	64	359	112	98	64	274	9	6	15	787
Kodagu	1111	622	344	2077	220	351	171	223	965	355	247	551	1153	987	429	1416	5611
Shivamogga	707	1068	1490	3265	1847	1713	834	525	4919	623	931	1336	2890	411	63	474	11548
Total	2030	1927	2083	6040	2229	2349	1131	846	6555	1151	1353	2037	4541	1510	555	2065	19201
Average	406	385	417	1208	446	470	226	169	1311	230	271	407	908	302	111	413	3840
Moderate Rainfall Region																	
Chikka-magaluru	3351	4486	4484	12321	5452	4285	4960	3042	17739	4109	2760	3310	10179	2744	741	3485	43724
Bidar	1080	775	997	2852	3311	4559	5110	5939	18919	6516	922	1180	8618	575	103	678	31067
Kalaburagi	2014	1526	2081	5621	6777	13049	9867	14219	43912	9523	3082	3410	16015	1074	225	1299	66847
Hassan	3842	4836	4556	13234	4026	3594	4160	3478	15258	4123	2360	3302	9785	2797	670	3467	41744
Bengaluru Rural	1313	1770	1543	4626	1214	1641	1940	1834	6629	2213	1105	1393	4711	944	91	1035	17001
Bengaluru Urban	224	264	290	778	315	285	352	269	1221	312	199	256	767	156	32	188	2954
Belagavi	1761	2099	5251	9111	9029	7850	4043	4903	25825	5191	2063	1692	8946	810	229	1039	44921
Yadgir	597	1628	1484	3709	2332	4674	3404	4105	14515	3788	1344	2477	7609	341	55	396	26229
Kolar	3796	4538	4562	12896	3948	5096	4766	4769	18579	7120	3720	4839	15679	3045	393	3438	50592
Total	17978	21922	25248	65148	36404	45033	38602	42558	162597	42895	17555	21859	82309	12486	2539	15025	325079
Average	1998	2436	2805	7239	4045	5004	4289	4729	18066	4766	1951	2429	9145	1387	282	1669	36120
Low Rainfall Region																	
Ramanagara	309	455	373	1137	271	366	475	337	1449	547	334	394	1275	223	42	265	4126
Chikka-ballapura	4908	5910	6296	17114	7098	8138	10165	8217	33618	8760	4542	5691	18993	3633	398	4031	73756
Tumakuru	7125	10953	10665	28743	8812	7497	9255	7931	33495	10641	5615	6694	22950	4871	802	5673	90861
Mandya	1583	2223	2066	5872	1521	847	999	1027	4394	1210	838	1254	3302	875	224	1099	14667
Dharwad	336	432	899	1667	2640	2684	2174	3204	10702	3639	1528	907	6074	173	67	240	18683
Davanagere	1784	3171	4225	9180	5597	4514	6859	3661	20631	3062	1842	1595	6499	491	175	666	36976
Raichur	1410	2281	2506	6197	6595	12714	13036	9787	42132	9408	4225	12005	25638	1299	147	1446	75413
Mysuru	858	1987	2066	4911	1873	897	685	735	4190	967	500	636	2103	513	97	610	11814
Vijayapura	2674	1959	3029	7662	6969	11738	8073	12099	38879	10104	3210	3944	17258	924	257	1181	64980
Haveri	355	928	1679	2962	3919	2210	1762	1584	9475	1366	903	620	2889	163	56	219	15545
Chamaraja-nagar	1866	3463	3235	8564	3376	2347	2417	2593	10733	3607	1617	1179	6403	916	274	1190	26890
Koppal	976	2012	3406	6394	3864	5042	5497	4227	18630	4653	2162	3385	10200	425	75	500	35724
Ballari	2855	3203	4781	10839	10021	16950	21450	19873	68294	16442	7267	9624	33333	2742	245	2987	115453
Bagalkot	1103	1458	3294	5855	5276	6220	4097	4289	19882	4416	1757	1351	7524	345	114	459	33720
Gadag	184	331	902	1417	1828	2918	2122	1934	8802	2992	1356	806	5154	133	24	157	15530
Chitradurga	3249	5816	7170	16235	7610	8223	9701	6274	31808	6579	3355	3354	13288	1676	297	1973	63304
Total	31575	46582	56592	134749	77270	93305	98767	87772	357114	88393	41051	53439	182883	19402	3294	22696	697442
Average	1973	2911	3537	8422	4829	5832	6173	5486	22320	5525	2566	3340	11430	1213	206	1419	43590
Total	51583	70431	83923	205937	115903	140687	138500	131176	526266	132439	59959	77335	269733	33398	6388	39786	1041722
Percentage	-	-	-	19.77	-	-	-	-	50.52	-	-	-	25.89	-	-	3.82	100.00

Source: Compiled from KSNDC Database, 2017

Annexure 3.3: Distribution of Varuna Mitra Beneficiaries by Caller Group (Jul 2016 - Jun 2017)

Region / District	Farmer			Public			Government Officer			Media			Fishermen			Private Companies		
	No. of C	No. of F	Avg. C	No. of C	No. of F	Avg. C	No. of C	No. of F	Avg. C	No. of C	No. of F	Avg. C	No. of C	No. of F	Avg. C	No. of C	No. of F	Avg. C
High rainfall Region																		
Udupi	636	135	5	3	2	2	0	0	0	0	0	0	10	2	5	0	0	0
Dakshina Kannada	535	100	5	2	2	1	0	0	0	69	3	23	0	0	0	0	0	0
Uttara Kannada	776	176	4	7	2	4	3	2	2	1	1	1	0	0	0	0	0	0
Kodagu	5420	1093	5	11	1	11	179	1	179	0	0	0	1	1	1	0	0	0
Shivamogga	11539	2444	5	5	3	2	2	1	2	0	0	0	0	0	0	1	1	1
Total	18906	3948	5	28	10	3	184	4	46	70	4	18	11	3	4	1	1	1
Average	3781	790	5	6	2	3	37	1	46	14	1	18	2	1	4	0	0	1
Moderate rainfall Region																		
Chikka-magaluru	43707	7817	6	6	5	1	6	4	2	3	1	3	1	1	1	0	0	0
Bidar	31034	5581	6	4	2	2	21	1	21	1	1	1	0	0	0	2	1	2
Kalaburagi	66818	11856	6	10	8	1	14	5	3	1	1	1	1	1	1	2	1	2
Hassan	41714	5936	7	11	7	2	17	5	3	0	0	0	0	0	0	0	0	0
Bengaluru rural	16952	2149	8	9	8	1	15	2	8	3	1	3	2	1	2	4	2	2
Bengaluru urban	2414	414	6	161	71	2	41	8	5	277	29	10	0	0	0	7	4	2
Belagavi	44882	9037	5	10	6	2	24	5	5	2	1	2	0	0	0	2	1	2
Yadgir	26219	4870	5	7	5	1	2	2	1	0	0	0	0	0	0	0	0	0
Kolar	50576	6356	8	9	5	2	5	2	3	0	0	0	0	0	0	0	0	0
Total	324316	54016	6	227	117	2	145	34	4	287	34	8	4	3	1	17	9	2
Average	36035	6002	6	25	13	2	16	4	4	32	4	8	0	0	1	2	1	2
Low Rainfall Region																		
Ramanagara	4122	580	7	3	3	1	1	1	1	0	0	0	0	0	0	0	0	0
Chikkaballapur	73724	9070	8	21	11	2	7	4	2	2	1	2	1	1	1	0	0	0
Tumakuru	90775	14078	6	59	23	3	18	3	6	1	1	1	1	1	1	0	0	0
Mandya	14635	2203	7	14	2	7	11	2	6	0	0	0	0	0	0	0	0	0
Dharwad	18658	3557	5	8	5	2	4	3	1	10	3	3	0	0	0	0	0	0
Davanagere	36955	6809	5	15	10	2	6	5	1	0	0	0	0	0	0	0	0	0
Raichur	75373	14839	5	15	7	2	20	3	7	3	3	1	0	0	0	0	0	0
Mysuru	11782	1918	6	16	4	4	2	1	2	10	2	5	0	0	0	0	0	0
Vijayapura	64967	11425	6	4	2	2	4	2	2	2	2	1	3	2	2	0	0	0
Haveri	15528	2871	5	4	3	1	0	0	0	11	1	11	0	0	0	0	0	0
Chamarajana-nagar	26876	3667	7	7	2	4	5	1	5	0	0	0	0	0	0	0	0	0
Koppal	35696	6839	5	21	3	7	0	0	0	2	2	1	0	0	0	1	1	1
Ballari	115387	20887	6	44	17	3	11	6	2	0	0	0	7	5	1	1	1	1
Bagalkot	33698	6213	5	8	3	3	1	1	1	12	2	6	0	0	0	1	1	1
Gadag	15525	2862	5	3	3	1	0	0	0	0	0	0	0	0	0	0	0	0
Chitradurga	63248	10051	6	23	4	6	20	8	3	8	3	3	4	1	4	0	0	0
Total	696949	117869	6	265	102	3	110	40	3	61	20	3	16	10	2	3	3	1
Average	43559	7367	6	17	6	3	7	3	3	4	1	3	1	1	2	0	0	1
Grand Total	1040171	175833	6	520	229	2	439	78	6	418	58	7	31	16	2	21	13	2
Percentage	99.85	99.75		0.05	0.13		0.04	0.04		0.04	0.03		0.00	0.01		0.00	0.01	

Note: No. of C = Number of Calls ; No. of F = Number of Farmers; Avg. C = Average Calls

Source: Compiled from KSNDMC Database, 2017

Contd....

Annexure 3.3 contd...

Region / District	Educational Institutes			Energy & Power Sector			NGO			Transport Sector			Others			Total		
	No. of C	No. of F	Avg. C	No. of C	No. of F	Avg. C	No. of C	No. of F	Avg. C	No. of C	No. of F	Avg. C	No. of C	No. of F	Avg. C	No. of C	No. of F	Avg. C
High rainfall Region																		
Udupi	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	649	139	0
Dakshina Kannada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	606	105	0
Uttara Kannada	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	787	181	0
Kodagu	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5611	1096	0
Shivamogga	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	11548	2450	1
Total	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	19201	3971	1
Average	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	3840	794	1
Moderate rainfall Region																		
Chikka-magaluru	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	43724	7829	0
Bidar	0	0	0	1	1	1	3	1	3	0	0	0	1	1	1	31067	5589	2
Kalaburagi	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	66847	11873	2
Hassan	1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	41744	5949	0
Bengaluru rural	0	0	0	2	1	2	0	0	0	0	0	0	14	1	14	17001	2165	2
Bengaluru urban	3	1	3	0	0	0	2	1	2	0	0	0	49	3	16	2954	531	2
Belagavi	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	44921	9051	2
Yadgir	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	26229	4878	0
Kolar	0	0	0	2	1	2	0	0	0	0	0	0	0	0	0	50592	6364	0
Total	6	3	2	6	4	2	5	2	3	0	0	0	66	7	9	325079	54229	2
Average	1	0	2	1	0	2	1	0	3	0	0	0	7	1	9	36120	6025	2
Low Rainfall Region																		
Ramanagara	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4126	584	0
Chikkaballapur	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	73756	9088	0
Tumakuru	3	1	3	0	0	0	0	0	0	0	0	0	4	2	2	90861	14109	0
Mandya	0	0	0	0	0	0	0	0	0	0	0	0	7	1	7	14667	2208	0
Dharwad	3	2	2	0	0	0	0	0	0	0	0	0	0	0	0	18683	3570	0
Davanagere	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36976	6824	0
Raichur	0	0	0	0	0	0	1	1	1	0	0	0	1	1	1	75413	14854	0
Mysuru	0	0	0	0	0	0	1	1	1	0	0	0	3	2	2	11814	1928	0
Vijayapura	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	64980	11433	0
Haveri	0	0	0	2	1	2	0	0	0	0	0	0	0	0	0	15545	2876	0
Chamarajana-nagar	0	0	0	1	1	1	0	0	0	0	0	0	1	1	1	26890	3672	0
Koppal	0	0	0	2	1	2	0	0	0	1	1	1	1	1	1	35724	6848	1
Ballari	2	1	2	0	0	0	0	0	0	0	0	0	1	1	1	115453	20918	1
Bagalkot	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	33720	6220	1
Gadag	0	0	0	2	1	2	0	0	0	0	0	0	0	0	0	15530	2866	0
Chitradurga	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	63304	10068	0
Total	8	4	2	7	4	2	2	2	1	1	1	1	20	11	2	697442	118066	1
Average	1	0	2	0	0	2	0	0	1	0	0	1	1	1	2	43590	7379	1
Grand Total	15	8	2	13	8	2	7	4	2	1	1	1	86	18	5	1041722	176266	2
Percentage	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.00	0.00	-	0.01	0.01	-	-	-	

Note: No. of C = Number of Calls ; No. of F = Number of Farmers; Avg. C = Average Calls

Source: Compiled from KSNDMC Database, 2017

Annexure 3.4a: District Wise Distribution of Irrigated Farming Category by Land Holdings

Region / District	% to the total												Total
	Chilli	Cotton	Ground-nut	Jowar	Maize	Onion	Paddy	Ragi	Sugar-cane	Tur	Minor crops	Crop Not specified	
Udupi	0.00	0.00	1.40	0.20	2.79	0.00	26.15	0.00	0.00	0.00	38.12	31.34	202.75
Dakshina Kannada	0.00	2.19	0.00	0.88	2.19	0.00	13.82	0.00	0.00	0.00	54.61	26.32	184.54
Uttara Kannada	0.00	0.00	0.00	3.16	5.42	0.00	22.26	0.00	0.11	1.13	45.20	22.71	358.15
Kodagu	0.01	0.00	0.00	0.14	1.51	0.11	8.36	0.16	0.00	0.07	72.73	16.91	2967.56
Shivamogga	0.19	0.34	0.28	4.28	20.59	0.18	19.23	0.41	0.26	0.41	24.38	29.45	4589.95
High Rainfall Total	0.11	0.24	0.19	2.58	12.27	0.14	15.52	0.28	0.15	0.30	43.56	24.65	8302.94
Chikkamagaluru	0.67	0.28	1.00	1.10	6.66	9.79	3.33	2.14	0.29	0.30	51.19	23.26	15247.76
Bidar	0.31	3.61	0.16	2.06	10.11	0.19	0.84	0.16	5.34	16.16	48.37	12.69	12465.54
Kalaburagi	2.12	11.30	0.29	1.74	5.48	0.37	1.93	0.06	5.29	45.11	12.62	13.68	30494.30
Hassan	0.45	0.12	0.10	2.69	8.80	0.43	6.74	6.66	0.29	0.49	50.13	23.10	11431.57
Bengaluru Rural	0.84	0.10	0.22	1.58	10.15	0.55	0.67	10.88	0.12	0.83	46.41	27.68	3333.80
Bengaluru Urban	1.27	0.00	0.56	0.91	5.49	0.49	4.29	9.77	0.00	0.35	28.34	48.52	575.46
Belagavi	1.02	3.03	0.75	2.77	14.25	2.01	0.86	0.02	20.81	5.16	27.25	22.07	20130.70
Yadgir	1.90	19.11	1.89	1.49	5.60	0.28	17.48	0.28	0.17	19.78	10.93	21.10	11247.03
Kolar	1.48	0.16	1.35	0.56	4.44	0.31	0.95	10.07	0.07	1.74	56.19	22.67	10626.24
Moderate Rainfall Total	1.26	5.83	0.68	1.82	8.04	1.88	3.69	2.29	5.69	16.75	32.72	19.36	115552.42
Ramanagara	0.40	0.00	3.78	1.39	8.91	0.81	3.10	19.43	1.53	5.53	27.89	27.22	899.62
Chikkaballapura	1.28	0.17	2.38	3.88	18.68	1.57	1.26	5.28	0.04	1.06	39.90	24.49	14818.39
Tumakuru	1.11	0.44	9.71	1.37	11.31	1.96	3.04	13.80	0.09	2.12	26.49	28.57	24091.36
Mandya	0.70	0.13	0.44	1.79	5.04	0.31	12.46	6.34	20.49	0.13	11.08	41.10	3517.94
Dharwad	8.90	15.26	4.70	1.91	16.78	4.15	1.60	0.10	0.93	3.63	24.02	18.01	6546.61
Davanagere	1.55	1.91	1.83	2.58	39.76	5.60	5.32	1.67	0.44	0.82	13.52	24.99	12673.55
Raichur	4.82	16.51	0.37	2.62	7.28	0.57	35.66	0.13	0.27	12.05	6.49	13.24	36144.93
Mysuru	0.67	1.49	0.20	1.76	4.83	0.42	11.20	3.64	3.31	0.50	32.99	39.01	3103.13
Vijayapura	1.74	6.13	0.54	1.67	8.21	1.07	0.23	0.62	6.43	37.99	20.58	14.79	27761.86
Haveri	2.95	12.68	2.46	5.14	29.28	1.60	7.54	0.00	1.49	2.63	8.18	26.06	5657.51
Chamarajanagar	0.56	1.80	0.82	3.15	13.78	14.33	1.69	1.85	2.10	0.47	31.37	28.07	6337.38
Koppal	0.93	2.63	3.52	2.12	26.75	1.81	19.20	0.23	3.17	5.04	14.23	20.37	14139.73
Ballari	20.54	10.75	1.94	1.89	23.92	3.88	13.17	0.37	1.22	1.40	5.44	15.48	44426.02
Bagalkot	1.06	2.12	1.25	3.96	18.97	6.39	0.30	0.00	18.87	10.91	18.36	17.82	14517.71
Gadag	5.38	6.12	5.96	4.48	22.65	9.81	1.67	0.21	0.68	2.58	25.83	14.63	6263.33
Chitradurga	1.07	1.40	7.18	1.17	20.75	21.26	0.60	2.12	0.16	1.87	17.76	24.66	19391.74
Low Rainfall Total	5.69	6.67	2.94	2.33	17.51	4.52	10.33	2.41	2.87	8.16	16.61	19.95	240290.81
Total	4.15	6.26	2.16	2.18	14.39	3.58	8.34	2.33	3.70	10.70	22.34	19.87	364146.18

Source: Compiled from KSNDMC Database, 2017

Annexure 3.4b: District-wise Distribution of Irrigated Farming Category by number of farmers

Region / District	% to the total no. of farmers												Total no. of farmers
	Chilli	Cotton	Ground-nut	Jowar	Maize	Onion	Paddy	Ragi	Sugar-cane	Tur	Minor crops	Crop Not specified	
Udupi	0.00	0.00	1.01	1.01	2.02	0.00	21.21	0.00	0.00	0.00	28.28	46.46	99
Dakshina Kannada	0.00	1.41	0.00	2.82	1.41	0.00	11.27	0.00	0.00	0.00	49.30	33.80	71
Uttara Kannada	0.00	0.00	0.00	3.10	3.10	0.00	17.05	0.00	0.78	0.78	32.56	42.64	129
Kodagu	0.12	0.00	0.00	0.82	1.76	0.12	7.50	0.12	0.00	0.12	50.41	39.04	853
Shivamogga	0.22	0.22	0.05	3.62	10.22	0.16	17.51	0.49	0.32	0.32	20.86	46.00	1850
High Rainfall Total	0.17	0.17	0.07	2.70	7.03	0.13	14.62	0.33	0.23	0.27	30.68	43.60	3002
Chikkamagaluru	0.48	0.28	1.00	1.32	5.77	8.42	3.02	2.11	0.30	0.30	33.57	43.43	5392
Bidar	0.54	3.01	0.27	4.04	4.76	0.27	0.30	0.09	3.71	11.03	31.26	40.70	3317
Kalaburagi	1.75	7.37	0.27	3.15	3.97	0.39	0.80	0.07	3.61	27.98	9.70	40.94	6731
Hassan	0.72	0.16	0.16	2.84	7.43	0.40	5.42	3.54	0.26	0.58	36.00	42.49	4295
Bengaluru Rural	0.83	0.19	0.26	2.12	6.10	0.64	0.51	8.60	0.06	0.64	38.77	41.27	1558
Bengaluru Urban	1.40	0.00	0.70	1.75	3.51	0.70	2.11	7.72	0.00	0.35	25.96	55.79	285
Belagavi	0.92	2.44	0.62	3.57	10.09	0.76	0.68	0.05	15.36	2.64	17.90	44.96	6281
Yadgir	1.51	13.53	1.44	2.75	4.60	0.47	10.41	0.17	0.10	12.12	7.99	44.90	2978
Kolar	1.17	0.22	0.80	1.04	2.77	0.28	0.89	7.84	0.02	0.89	43.92	40.15	4615
Moderate Rainfall Total	1.04	3.35	0.60	2.63	5.81	1.67	2.45	2.26	3.84	8.09	25.71	42.56	35452
Ramanagara	0.49	0.00	2.46	2.70	6.88	0.49	3.44	14.74	0.98	2.70	20.88	44.23	407
Chikkaballapura	1.24	0.17	1.83	3.78	11.86	1.16	0.98	4.06	0.05	0.87	33.17	40.85	6458
Tumakuru	0.98	0.32	6.83	1.70	6.50	1.36	2.20	10.77	0.08	1.41	20.53	47.32	9602
Mandya	0.54	0.24	0.42	1.91	3.81	0.30	9.83	5.36	16.87	0.12	8.70	51.91	1678
Dharwad	5.82	9.59	3.18	3.62	8.03	2.74	1.17	0.10	0.64	2.40	15.27	47.43	2043
Davanagere	0.93	1.60	1.62	2.68	25.21	3.59	4.47	0.97	0.51	0.78	10.66	46.99	4514
Raichur	3.98	11.62	0.53	3.26	5.52	0.65	24.25	0.13	0.22	7.90	5.06	36.88	9689
Mysuru	0.86	0.86	0.29	1.86	4.15	0.29	8.86	2.72	3.00	0.36	23.09	53.68	1399
Vijayapura	1.25	4.11	0.40	2.38	5.30	1.04	0.24	0.13	4.11	24.05	15.75	41.24	7513
Haveri	1.50	7.39	1.60	5.07	17.68	1.14	5.38	0.00	0.83	1.14	6.46	51.81	1934
Chamarajanagar	0.61	1.41	0.92	3.43	9.84	11.79	1.30	1.26	1.72	0.38	25.18	42.16	2621
Koppal	1.10	2.05	3.02	3.49	18.45	1.02	12.34	0.13	1.70	2.72	10.44	43.53	4530
Ballari	16.05	7.72	1.57	2.92	15.95	2.63	8.32	0.23	0.75	1.22	4.31	38.32	13584
Bagalkot	0.94	1.57	1.06	4.10	14.29	3.69	0.31	0.00	13.62	6.52	12.55	41.33	4142
Gadag	3.45	4.21	3.57	4.79	14.74	6.19	1.21	0.32	0.70	1.85	14.23	44.74	1567
Chitradurga	1.21	1.09	5.04	2.03	13.61	14.63	0.47	1.63	0.25	1.15	14.19	44.70	6863
Low Rainfall Total	4.19	4.19	2.37	2.92	11.63	3.26	6.44	2.22	1.96	4.54	13.62	42.67	78544
Grand Total	3.13	3.83	1.78	2.82	9.75	2.70	5.44	2.18	2.49	5.51	17.72	42.66	116998

Source: Compiled from KSNDMC Database, 2017

Annexure 3.4c: District-wise distribution of irrigated farming category by no. of calls

Region / District	% to the total no. of calls												Total no. of calls
	Chilli	Cotton	Groundnut	Jowar	Maize	Onion	Paddy	Ragi	Sugarcane	Tur	Minor crops	Crop Not specified	
Udupi	0.00	0.00	1.92	1.44	1.92	0.00	34.29	0.00	0.00	0.00	36.21	24.22	417
Dakshina Kannada	0.00	0.22	0.00	0.45	0.22	0.00	3.14	0.00	0.00	0.00	75.78	20.18	446
Uttara Kannada	0.00	0.17	0.00	0.83	12.11	0.00	23.22	0.00	0.33	0.17	42.79	20.40	603
Kodagu	0.07	0.00	0.00	0.43	0.76	0.04	12.12	0.02	0.00	0.02	63.16	23.37	4455
Shivamogga	0.37	0.14	0.37	4.13	15.73	0.03	26.03	1.80	0.79	0.12	23.29	27.20	8690
High Rainfall Total	0.24	0.10	0.27	2.68	10.15	0.03	21.21	1.07	0.49	0.08	38.22	25.45	14611
Chikkamagaluru	0.51	0.47	1.72	0.81	6.89	11.23	3.37	4.69	0.35	0.23	44.62	25.10	30680
Bidar	0.31	2.02	0.16	2.87	3.49	0.22	0.14	0.06	5.78	18.84	52.73	13.39	18009
Kalaburagi	1.95	9.51	0.34	2.12	3.04	0.33	0.90	0.02	5.55	49.13	12.66	14.45	37493
Hassan	0.68	0.04	0.15	1.67	12.46	0.39	5.27	5.77	0.27	0.44	50.97	21.90	31462
Bengaluru Rural	0.93	0.11	0.54	1.78	8.23	0.69	0.69	12.87	0.01	0.78	57.62	15.76	13417
Bengaluru Urban	1.07	0.00	0.64	1.82	6.10	1.39	1.28	12.63	0.00	0.86	49.25	24.95	1868
Belagavi	0.86	4.17	0.92	2.47	14.33	1.80	1.08	0.01	19.63	3.39	24.75	26.58	31873
Yadgir	2.34	24.67	1.26	1.74	3.91	0.14	15.82	0.10	0.04	22.24	9.79	17.95	15919
Kolar	1.00	0.16	1.17	0.45	2.43	0.23	1.05	12.68	0.01	1.47	60.98	18.39	39585
Moderate Rainfall Total	1.06	4.28	0.80	1.63	6.89	2.06	2.93	4.66	4.35	12.41	39.13	19.80	220306
Ramanagara	0.16	0.03	4.44	1.08	14.79	0.26	2.79	26.73	0.43	3.78	29.78	15.71	3042
Chikkaballapura	1.58	0.12	1.84	2.02	20.11	1.70	1.02	5.08	0.01	1.22	47.89	17.41	56204
Tumakuru	0.92	0.29	12.06	0.99	8.72	2.00	2.89	16.42	0.05	2.35	27.00	26.33	64005
Mandya	0.36	0.04	0.22	1.14	6.56	0.19	13.68	8.40	25.41	0.23	11.82	31.95	11125
Dharwad	11.22	17.40	6.44	2.74	9.38	4.16	4.03	0.09	1.05	2.75	20.90	19.83	10056
Davanagere	1.23	2.64	2.21	1.40	38.90	5.80	4.50	1.28	0.74	0.61	13.49	27.20	25035
Raichur	6.47	19.46	0.58	2.23	3.85	1.07	30.72	0.08	0.13	12.91	7.48	15.02	49647
Mysuru	1.16	0.33	0.24	1.70	5.28	0.10	9.88	4.63	3.81	0.22	33.87	38.78	8698
Vijayapura	1.39	4.77	0.45	1.31	6.53	1.53	0.13	0.07	6.41	40.93	20.78	15.69	43997
Haveri	1.83	12.40	2.96	3.10	25.78	1.02	8.05	0.09	2.22	1.57	9.35	31.63	10693
Chamarajanagar	1.08	2.05	0.84	2.22	14.28	9.28	1.79	1.49	2.42	0.41	39.30	24.85	20331
Koppal	1.65	2.52	4.35	2.35	26.69	2.02	16.50	0.21	3.08	4.46	14.12	22.03	24308
Ballari	26.43	12.45	2.44	1.39	20.20	4.37	10.75	0.12	1.23	2.03	3.98	14.61	78269
Bagalkot	1.27	1.43	1.01	2.83	19.85	6.36	0.21	0.00	19.37	9.65	17.16	20.85	23013
Gadag	7.52	6.12	7.82	2.92	21.33	13.75	0.65	0.13	0.69	2.70	18.40	17.97	7956
Chitradurga	1.50	1.35	7.58	1.14	19.22	22.12	0.33	2.27	0.28	1.50	19.37	23.33	45368
Low Rainfall Total	6.22	5.81	3.81	1.71	15.97	4.95	7.40	3.61	2.80	6.90	20.23	20.60	481747
Grand Total	4.51	5.22	2.82	1.70	13.06	3.96	6.30	3.89	3.23	8.46	26.41	20.45	716664

Source: Compiled from KSNDMC Database, 2017

Annexure 3.4d: District-wise distribution of un-irrigated farming category by land holdings

Region / District	% to the total												Total
	Chilli	Cotton	Groundnut	Jowar	Maize	Onion	Paddy	Ragi	Sugarcane	Tur	Minor crops	Crop Not specified	
Udupi	0.00	0.00	1.29	5.17	0.00	0.00	19.40	0.00	0.00	0.00	15.09	59.05	93.89
Dakshina Kannada	0.00	4.35	0.00	0.00	4.35	0.00	0.00	0.00	0.00	0.00	47.83	43.48	46.54
Uttara Kannada	0.00	4.74	0.28	0.00	16.43	0.00	12.53	0.00	2.79	16.71	27.02	19.50	145.28
Kodagu	0.41	0.00	0.00	0.05	1.45	0.00	7.65	0.00	0.00	0.41	67.11	22.91	782.66
Shivamogga	0.43	1.33	0.10	2.89	24.74	0.10	17.79	0.98	0.03	0.20	22.70	28.71	1608.22
High Rainfall Total	0.38	1.13	0.12	1.94	16.25	0.06	14.29	0.59	0.17	1.15	36.09	27.83	2676.59
Chikkamagaluru	0.50	0.50	2.21	1.98	9.76	14.55	2.90	7.56	0.00	0.66	40.17	19.19	6753.00
Bidar	0.58	1.68	0.33	1.77	3.47	0.08	0.26	0.15	1.69	25.16	53.88	10.95	8574.08
Kalaburagi	1.58	9.63	0.21	1.60	3.03	0.32	0.40	0.10	1.15	59.65	14.19	8.15	27202.18
Hassan	1.81	0.18	0.16	3.01	15.88	0.93	5.95	8.35	0.19	0.51	34.71	28.30	3969.56
Bengaluru Rural	0.94	0.00	0.47	2.66	11.27	0.31	0.43	27.93	0.00	2.07	25.63	28.29	1034.38
Bengaluru Urban	10.31	0.81	0.00	0.81	6.44	3.54	0.48	16.59	0.00	1.61	18.20	41.22	251.31
Belagavi	0.91	5.05	1.11	3.85	15.86	2.22	0.87	0.14	9.41	8.91	28.44	23.25	8692.66
Yadgir	1.94	21.36	0.42	1.90	3.49	0.23	3.80	0.28	0.01	36.85	16.56	13.16	7953.29
Kolar	1.09	0.06	2.15	0.36	4.23	0.41	1.07	25.01	0.00	2.13	34.97	28.53	4055.76
Moderate Rainfall Total	1.31	7.22	0.67	2.00	6.38	1.98	1.45	3.30	1.87	32.51	26.41	14.89	68486.23
Ramanagara	0.50	0.50	1.39	0.63	6.68	0.00	2.90	40.18	0.00	6.42	16.62	24.18	321.32
Chikkaballapura	1.52	0.11	4.93	4.23	25.54	1.29	0.61	11.07	0.00	4.45	21.10	25.15	5545.82
Tumakuru	1.21	0.52	18.02	1.14	9.74	0.99	2.31	21.87	0.46	3.87	14.51	25.36	10313.83
Mandya	0.17	0.00	0.26	2.11	8.20	0.13	9.71	10.23	12.86	0.04	14.63	41.65	937.66
Dharwad	18.92	20.40	12.07	1.86	7.37	6.96	0.65	0.64	0.24	4.05	16.10	10.73	6808.84
Davanagere	2.08	1.98	2.44	2.74	51.08	3.96	1.87	1.96	0.68	2.25	8.97	20.00	6741.66
Raichur	4.18	24.19	0.93	1.95	5.95	0.70	12.10	0.16	0.19	30.58	7.42	11.66	19959.92
Mysuru	0.96	1.24	0.64	2.68	8.01	0.00	8.33	5.69	2.28	0.84	35.54	33.77	1010.10
Vijayapura	1.12	5.69	0.38	1.22	4.20	1.29	0.20	0.09	2.26	60.64	10.58	12.33	16064.42
Haveri	1.67	16.36	5.77	3.18	31.33	2.03	4.84	0.09	0.35	3.09	8.92	22.38	3095.04
Chamarajanagar	0.27	3.77	2.78	3.94	14.82	7.48	2.24	4.90	1.76	1.90	27.60	28.53	2369.84
Koppal	1.33	2.24	4.70	2.05	28.95	3.04	6.23	0.47	0.91	9.23	23.91	16.93	7786.56
Ballari	15.57	17.07	4.51	2.19	28.73	2.79	5.35	0.42	0.45	4.35	4.76	13.82	24943.23
Bagalkot	0.94	1.66	2.03	3.38	15.27	4.04	0.04	0.04	8.47	22.55	23.64	17.93	7375.00
Gadag	7.27	7.75	9.86	2.33	17.98	10.18	1.15	0.40	0.04	5.43	25.44	12.18	5652.65
Chitradurga	1.49	1.82	13.19	1.06	28.81	14.31	0.38	4.00	0.11	4.28	10.27	20.27	9520.64
Low Rainfall Total	5.71	10.20	5.51	2.09	18.71	3.64	4.05	3.14	1.19	16.56	12.64	16.57	128446.53
Grand Total	4.13	9.06	3.78	2.05	14.45	3.02	3.29	3.16	1.41	21.82	17.68	16.14	199609.35

Source: Compiled from KSNDMC Database, 2017

Annexure 3.4e: District-wise distribution of un-irrigated farming category by number of farmers

Region / District	% to the total												Total
	Chilli	Cotton	Groundnut	Jowar	Maize	Onion	Paddy	Ragi	Sugarcane	Tur	Minor crops	Crop Not specified	
Udupi	0.00	0.00	2.78	2.78	0.00	0.00	22.22	0.00	0.00	0.00	16.67	55.56	36
Dakshina Kannada	0.00	3.45	0.00	0.00	3.45	0.00	0.00	0.00	0.00	0.00	24.14	68.97	29
Uttara Kannada	0.00	6.38	2.13	0.00	10.64	0.00	12.77	0.00	2.13	2.13	21.28	42.55	47
Kodagu	0.42	0.00	0.00	0.42	1.25	0.00	9.58	0.00	0.00	0.42	45.83	42.08	240
Shivamogga	0.17	0.84	0.17	2.86	14.65	0.17	17.51	1.01	0.17	0.51	17.17	44.78	594
High Rainfall Total	0.21	0.95	0.32	2.01	10.15	0.11	14.90	0.63	0.21	0.53	24.84	45.14	946
Chikkamagaluru	0.62	0.58	2.14	2.10	9.44	13.53	2.72	6.60	0.00	0.49	27.67	34.10	2425
Bidar	0.84	1.77	0.40	3.00	3.49	0.09	0.27	0.18	1.19	21.78	42.45	24.56	2264
Kalaburagi	1.27	8.60	0.29	2.26	3.53	0.23	0.33	0.18	1.21	46.15	11.41	24.53	5125
Hassan	0.85	0.18	0.12	3.41	14.63	0.98	4.69	8.41	0.18	0.49	26.02	40.04	1641
Bengaluru Rural	0.68	0.00	0.68	2.20	10.15	0.51	0.34	21.66	0.00	1.52	19.97	42.30	591
Bengaluru Urban	1.55	0.78	0.00	0.78	4.65	2.33	0.78	17.83	0.00	0.78	19.38	51.16	129
Belagavi	0.87	3.66	1.05	3.63	14.19	1.38	0.98	0.18	8.56	6.49	20.07	38.93	2756
Yadgir	1.90	18.13	0.58	2.11	3.54	0.32	3.86	0.32	0.05	26.64	11.95	30.60	1892
Kolar	1.21	0.11	1.78	0.80	2.76	0.23	0.86	22.23	0.00	1.84	28.20	39.98	1741
Moderate Rainfall Total	1.08	5.09	0.82	2.47	7.01	2.22	1.53	4.63	1.77	19.41	21.85	32.11	18564
Ramanagara	0.58	0.58	2.89	0.58	5.78	0.00	2.89	29.48	0.00	4.62	11.56	41.04	173
Chikkaballapura	1.26	0.08	3.98	4.52	19.56	0.88	0.50	10.26	0.00	3.37	17.92	37.67	2612
Tumakuru	0.96	0.31	11.89	1.52	7.19	0.74	1.61	20.33	0.07	3.26	12.96	39.16	4476
Mandya	0.19	0.00	0.38	2.10	5.14	0.38	7.81	8.38	10.67	0.19	9.71	55.05	525
Dharwad	13.08	15.39	9.11	1.98	7.60	4.49	0.79	0.79	0.33	4.49	14.46	27.48	1514
Davanagere	1.22	1.35	1.79	2.48	39.43	2.92	1.70	1.87	0.39	2.00	7.89	36.95	2295
Raichur	4.12	18.14	0.78	2.21	4.56	0.66	13.71	0.31	0.19	20.04	6.45	28.83	5150
Mysuru	0.77	0.77	0.58	2.12	7.71	0.00	7.13	5.97	1.93	0.96	25.05	47.01	519
Vijayapura	1.12	4.55	0.46	1.46	4.50	1.02	0.23	0.10	1.66	43.79	10.20	30.90	3912
Haveri	1.81	11.85	3.84	3.42	23.69	1.81	3.52	0.11	0.43	2.24	6.19	41.09	937
Chamarajanagar	0.38	3.25	2.49	4.21	13.48	6.12	1.24	4.02	1.24	1.15	21.32	41.11	1046
Koppal	1.30	2.38	3.07	2.38	23.91	1.78	6.93	0.56	0.78	6.67	15.98	34.26	2309
Ballari	13.91	11.87	3.66	2.37	22.24	2.38	5.35	0.30	0.36	3.41	3.79	30.36	7303
Bagalkot	1.11	1.79	1.88	3.33	14.20	3.57	0.19	0.10	6.04	15.11	17.77	34.91	2071
Gadag	6.02	4.48	8.19	3.40	14.59	8.65	0.77	0.69	0.08	4.79	20.08	28.26	1295
Chitradurga	1.54	1.63	9.57	1.32	20.98	10.70	0.41	3.07	0.16	2.70	8.34	39.59	3188
Low Rainfall Total	4.53	6.64	4.41	2.35	15.34	2.77	3.96	3.98	0.89	10.18	10.68	34.26	39325
Grand Total	3.37	6.06	3.21	2.39	12.63	2.55	3.37	4.13	1.16	12.94	14.44	33.76	58835

Source: Compiled from KSNDMC Database, 2017

Annexure 3.4f: District-wise distribution of un-irrigated farming category by number of calls

Region / District	% to the total												Total
	Chilli	Cotton	Groundnut	Jowar	Maize	Onion	Paddy	Ragi	Sugarcane	Tur	Minor crops	Crop Not specified	
Udupi	0.00	0.00	5.02	0.46	0.00	0.00	12.33	0.00	0.00	0.00	61.64	20.55	219
Dakshina Kannada	0.00	1.12	0.00	0.00	10.11	0.00	1.12	0.00	0.00	0.00	38.20	49.44	89
Uttara Kannada	0.00	13.29	0.58	0.00	16.18	0.00	16.18	0.00	0.58	0.58	36.99	15.61	173
Kodagu	0.10	0.00	0.00	0.62	2.90	0.00	11.50	0.00	0.00	0.10	63.21	21.55	965
Shivamogga	0.04	0.84	0.04	3.33	22.82	0.07	18.64	1.33	0.04	0.91	23.94	28.01	2849
High Rainfall Total	0.05	1.12	0.30	2.37	16.65	0.05	16.25	0.88	0.05	0.65	35.51	26.12	4295
Chikkamagaluru	0.24	0.55	1.56	1.18	12.71	19.88	3.13	8.34	0.02	0.38	32.85	19.16	13027
Bidar	0.30	0.95	0.21	2.54	2.07	0.02	0.21	0.06	1.19	25.10	58.22	9.12	13025
Kalaburagi	1.05	9.61	0.20	2.01	2.27	0.26	0.23	0.10	1.25	59.62	13.69	9.71	29325
Hassan	0.48	0.26	0.62	2.34	19.97	0.62	4.00	11.51	0.05	0.32	37.67	22.15	10252
Bengaluru Rural	1.39	0.14	1.07	1.56	10.98	0.42	1.19	29.42	0.00	1.39	30.18	22.26	3535
Bengaluru Urban	0.73	1.28	0.00	3.11	17.77	0.92	2.75	15.38	0.00	0.18	26.92	30.95	546
Belagavi	0.62	5.30	1.61	2.68	18.23	1.59	1.28	0.18	9.81	7.66	26.61	24.42	13009
Yadgir	1.33	26.14	1.10	0.89	2.20	0.31	5.42	0.15	0.04	38.53	12.38	11.51	10300
Kolar	1.13	0.09	2.28	0.65	4.54	0.92	0.62	30.85	0.00	2.07	36.18	20.67	10991
Moderate Rainfall Total	0.79	6.20	0.93	1.82	7.90	2.97	1.70	6.59	1.74	25.07	28.52	15.76	104010
Ramanagara	0.09	0.09	2.04	0.09	3.89	0.00	1.39	49.44	0.37	2.31	21.94	18.33	1080
Chikkaballapura	1.23	0.01	4.13	2.89	28.57	1.29	1.02	10.13	0.00	3.97	27.77	19.00	17520
Tumakuru	1.24	0.37	15.57	1.17	9.44	0.68	1.77	28.29	0.17	3.67	15.44	22.19	26770
Mandya	0.60	0.00	0.14	3.42	7.41	0.06	11.20	20.48	14.33	0.06	10.74	31.57	3510
Dharwad	18.59	19.41	12.62	1.30	6.81	9.70	0.86	0.44	0.96	2.80	14.55	11.94	8602
Davanagere	1.26	1.59	2.59	1.58	52.45	3.15	1.17	2.21	0.36	1.52	9.07	23.05	11920
Raichur	5.19	26.68	0.50	1.62	3.62	0.73	13.62	0.14	0.10	28.68	7.19	11.95	25726
Mysuru	0.19	1.30	3.73	1.43	10.86	0.10	10.12	7.00	2.01	0.36	24.25	38.65	3084
Vijayapura	1.24	4.44	0.36	1.03	3.68	1.02	0.07	0.06	1.96	61.64	11.57	12.94	20970
Haveri	0.91	19.07	6.74	2.38	30.26	2.73	2.81	0.95	0.19	1.47	7.11	25.38	4835
Chamarajanagar	0.11	4.51	2.83	3.47	19.98	9.09	0.79	3.13	0.76	1.01	29.44	24.87	6545
Koppal	1.81	2.59	4.58	1.87	31.81	2.37	7.47	0.52	1.85	8.47	18.14	18.50	11388
Ballari	18.85	17.98	5.91	1.29	27.25	2.91	5.18	0.22	0.61	3.69	3.90	12.21	37118
Bagalkot	1.92	1.17	1.32	2.49	17.29	4.33	0.28	0.02	6.99	23.98	21.12	19.09	10685
Gadag	12.45	5.63	10.99	2.26	13.94	16.74	0.32	0.13	0.18	4.77	21.56	11.03	7569
Chitradurga	2.05	2.53	13.29	0.96	27.27	15.18	0.41	4.01	0.04	2.27	10.13	21.86	17880
Low Rainfall Total	5.90	8.82	6.14	1.65	19.05	3.97	3.81	5.71	1.13	13.12	13.22	17.47	215202
Total	4.18	7.88	4.38	1.72	15.43	3.60	3.29	5.93	1.31	16.80	18.44	17.04	323507

Source: Compiled from KSNDMC Database, 2017

Annexure 4.1: Details of phone calls of Different newspapers (media)

Name of news papers	Number of calls made
Vijaya Karnataka	126
Prajavani	29
Kannada Prabha	19
Indian Express	35
Hosa Digantha	2
Deccan Herald	6
ETV News	2
Vijayavani	4
Sanjevani	1
Vishwa Vani	6
Udaya Vani	10
Others (Not Specified)	46
Total	286

Source: Primary data collected during Aug-Sep, 2017

Annexure 5.1: Cropping pattern in irrigated area by crops

Crop categories	Crops	High rainfall region				Moderate rainfall region				Low rainfall region				Total
		D.Kamada & Udupi	Kodagu	Shivamogga	Sub Total	Chikka-magaluru	Hassan	Kolar	Sub Total	Tumakuru	Ballari	Raichur	Sub Total	
Cereals	Jowar	-	-	-	-	-	-	-	-	-	77.5 (72.26)	8 (0)	85.5 (65.5)	85.5 (65.5)
	Maize	-	-	12 (18.33)	12 (18.33)	4 (50)	-	-	4 (50)	-	245 (79.59)	-	245 (79.59)	261 (76.32)
	Paddy	58 (71.55)	26 (96.15)	121.5 (75.72)	205.5 (77.13)	61.5 (100)	-	11.5 (26.09)	73 (86.36)	21 (85.71)	123.5 (69.64)	173.5 (63.4)	318 (67.3)	596.5 (73.26)
	Ragi	-	-	-	-	-	2 (0)	53.75 (100)	55.75 (96.41)	13 (100)	-	-	13 (100)	68.75 (97.09)
	Others	-	-	-	-	-	-	-	-	-	3 (0)	4.5 (100)	7.5 (60)	7.5 (60)
Pulses	Sub total	58 (71.55)	26 (96.15)	133.5 (70.56)	217.5 (73.89)	65.5 (96.95)	2 (0)	65.25 (86.97)	132.75 (90.58)	34 (91.18)	449 (75.06)	186 (61.56)	669 (72.12)	1019.25 (74.9)
	Bengal gram	-	-	-	-	-	-	-	-	-	5 (0)	4 (62.5)	9 (27.78)	9 (27.78)
	Red gram	-	-	-	-	-	-	4 (0)	4 (0)	-	3 (0)	38 (78.95)	41 (73.17)	45 (66.67)
	Other	-	-	-	-	-	-	3.5 (28.57)	3.5 (28.57)	-	-	2.5 (0)	2.5 (0)	6 (16.67)
	Sub total	-	-	-	-	-	-	7.5 (13.33)	7.5 (13.33)	-	8 (0)	44.5 (73.03)	52.5 (61.9)	60 (55.83)
Oil seeds & Cash crops	Cotton	-	-	1 (0)	1 (0)	-	-	-	-	-	143 (100)	530 (97.74)	673 (98.22)	674 (98.07)
	Groundnut	-	-	3 (0)	3 (0)	2 (100)	-	89 (67.42)	91 (68.13)	-	8 (75)	-	8 (75)	102 (66.67)
	Others	9.25 (0)	-	3 (0)	12.25 (0)	-	-	-	-	21 (0)	73 (0)	-	94 (0)	106.25 (0)
	Sub total	9.25 (0)	-	7 (0)	16.25 (0)	2 (100)	-	89 (67.42)	91 (68.13)	21 (0)	224 (66.52)	530 (97.74)	775 (86.06)	882.25 (82.63)
	Mango	-	-	-	-	-	-	78 (0)	78 (0)	-	-	-	-	78 (0)
Fruits	Others	9.25 (64.86)	-	7 (85.71)	16.25 (73.85)	2 (0)	-	11 (77.27)	13 (65.38)	35 (97.14)	-	-	35 (97.14)	64.25 (84.82)
	Sub total	9.25 (64.86)	-	7 (85.71)	16.25 (73.85)	2 (0)	-	89 (9.55)	91 (9.34)	35 (97.14)	-	-	35 (97.14)	142.25 (38.31)
	Jasmine	-	-	-	-	-	-	-	-	-	1 (0)	-	1 (0)	1 (0)
	Marigold	-	-	-	-	-	-	20.25 (14.81)	20.25 (14.81)	-	-	-	-	20.25 (14.81)
	Sub total	-	-	-	-	36.75 (8.16)	-	20.25 (14.81)	20.25 (14.81)	-	1 (0)	-	1 (0)	21.25 (14.12)
Plantation crops	Areca nut	296 (85.81)	-	248.625 (59.53)	544.625 (73.81)	238 (69.33)	20 (85)	-	258 (70.54)	62 (51.61)	-	-	62 (51.61)	864.625 (71.24)
	Coffee	-	529 (100)	3 (0)	532 (99.44)	667.5 (93.3)	-	-	667.5 (93.3)	-	-	-	-	1199.5 (96.02)
	Others	52 (21.54)	-	2 (0)	54 (20.74)	-	191.75 (92.93)	-	191.75 (92.93)	42 (23.81)	-	-	42 (23.81)	287.75 (69.3)
	Sub total	348 (76.21)	529 (100)	253.625 (58.35)	1130.625 (83.33)	905.5 (86.94)	211.75 (92.18)	-	1117.25 (87.98)	104 (40.38)	-	-	104 (40.38)	2351.875 (83.64)
	Tomato	-	-	-	-	-	-	261 (100)	261 (100)	-	-	-	-	261 (100)
Vegetables	Chilly	-	3 (0)	-	3 (0)	-	-	9.5 (0)	9.5 (0)	-	180.5 (100)	80 (100)	260.5 (100)	273 (95.42)
	Others	-	-	-	-	68.5 (96.35)	8 (100)	177.25 (66.15)	253.75 (75.37)	9 (155.56)	23.5 (42.55)	3 (100)	35.5 (76.06)	289.25 (75.45)
	Sub total	-	3 (0)	-	3 (0)	68.5 (96.35)	8 (100)	447.75 (84.48)	524.25 (86.27)	9 (155.56)	204 (93.38)	83 (100)	296 (97.13)	823.25 (89.86)
	Others	7 (0)	-	104.5 (100)	111.5 (93.72)	9 (100)	-	46.5 (38.71)	55.5 (48.65)	-	-	35 (0)	35 (0)	202 (65.1)
	Grand Total	431.5 (72.47)	558 (99.28)	505.625 (69.76)	1495.125 (81.56)	1052.5 (88.15)	221.75 (91.63)	765.25 (68.67)	2039.5 (81.24)	203 (59.61)	886 (76.35)	878.5 (85.15)	1967.5 (78.55)	5502.125 (80.37)

Note: Figures in parenthesis indicates percentage of area to the respective total for which farmers have been benefited using Varuna Mitra information.

Annexure 5.2: Cropping pattern in un-irrigated area by crops

Crop categories	Crops	High rainfall region				Moderate rainfall region				Low rainfall region				Total
		D.Kannada & Udupi	Kodagu	Shivamogga	Sub Total	Chikka-magaluru	Hassan	Kolar	Sub Total	Tumakuru	Ballari	Raichur	Sub Total	
Cereals	Jowar	-	-	-	-	-	-	-	-	34.5(39.13)	52.5(8.57)	68.5(35.04)	155.5(27.01)	155.5(27.01)
	Maize	1(0)	-	142(17.04)	143(16.92)	20.5(73.17)	12(16.67)	3.5(0)	36(47.22)	19(5.26)	484.5(48.63)	20(80)	523.5(48.25)	702.5(41.82)
	Paddy	140(65.36)	51(0)	202.525(97.28)	393.525(73.31)	89.125(91.02)	7.5(0)	-	96.625(83.95)	-	3(0)	-	3(0)	493.15(74.95)
	Ragi	-	-	-	-	11(100)	182(100)	105.5(100)	298.5(100)	194(100)	29(100)	-	223(100)	521.5(100)
	Others	-	-	-	-	-	-	-	-	-	5(0)	36(52.78)	41(46.34)	41(46.34)
Pulses	Sub total	141(64.89)	51(0)	344.525(64.21)	536.525(58.28)	120.625(88.8)	201.5(91.32)	109(96.79)	431.125(92)	247.5(84.24)	574(46.88)	124.5(47.39)	946(56.72)	1913.65(65.11)
	Bengal gram	-	-	-	-	3(0)	-	-	3(0)	-	6(0)	267(56.18)	273(54.95)	276(54.35)
	Red gram	5(0)	-	-	5(0)	-	-	2(0)	2(0)	-	15(26.67)	406(56.16)	421(55.11)	428(54.21)
	Other	22.5(4.44)	-	-	22.5(4.44)	-	35(0)	4.5(0)	39.5(0)	94(23.94)	2(0)	9(0)	105(21.43)	167(14.07)
	Sub total	27.5(3.64)	-	-	27.5(3.64)	3(0)	35(0)	6.5(0)	44.5(0)	94(23.94)	23(17.39)	682(49.56)	799(50.63)	871(46.56)
Oil seeds & Cash crops	Cotton	-	-	2(0)	2(0)	-	-	-	-	1(0)	3(100)	413(100)	417(99.76)	419(99.28)
	Ground nut	7.5(93.33)	-	1.25(20)	8.75(82.86)	10.5(90.48)	-	3(33.33)	13.5(77.78)	1(0)	39.5(70.89)	7(85.71)	47.5(71.58)	69.75(74.19)
	Others	-	-	-	-	4(100)	-	-	4(100)	-	7(0)	13(0)	20(0)	24(16.67)
	Sub total	7.5(93.33)	-	3.25(7.69)	10.75(67.44)	14.5(93.1)	-	3(33.33)	17.5(82.86)	2(0)	49.5(62.63)	433(96.77)	484.5(92.88)	512.75(92)
	Mango	2(100)	-	-	2(100)	-	-	222(26.22)	222(26.22)	-	-	-	-	224(26.88)
Fruits	Others	0.5(0)	3(0)	0.5(0)	4(0)	-	-	5.5(27.27)	5.5(27.27)	-	5(40)	-	5(40)	14.5(24.14)
	Sub total	2.5(80)	3(0)	0.5(0)	6(33.33)	-	-	227.5(26.24)	227.5(26.24)	-	5(40)	-	5(40)	238.5(26.71)
	Jasmine	0.5(0)	-	-	0.5(0)	-	-	-	-	-	9(0)	-	9(0)	9.5(0)
	Marigold	-	-	-	-	-	-	-	-	-	6(0)	-	6(0)	6(0)
	Sub total	0.5(0)	-	-	0.5(0)	-	-	-	-	-	15(0)	-	15(0)	15.5(0)
Plantation crops	Areca nut	23.5(46.81)	-	16(37.5)	39.5(43.04)	6(58.33)	-	-	6(58.33)	-	-	-	-	45.5(45.05)
	Coffee	-	111(95.5)	-	111(95.5)	-	-	-	-	-	-	-	-	111(95.5)
	Others	36.75(95.24)	-	19(89.47)	55.75(93.27)	-	96(84.38)	-	96(84.38)	59.5(78.99)	-	-	59.5(78.99)	211.25(85.21)
	Sub total	60.25(76.35)	111(95.5)	35(65.71)	206.25(84.85)	6(58.33)	96(84.38)	-	102(82.84)	59.5(78.99)	-	-	59.5(78.99)	367.75(83.34)
	Tomato	-	-	-	-	-	-	13.5(0)	13.5(0)	-	-	-	-	13.5(0)
Vegetables	Chilly	-	-	-	-	-	-	2.5(0)	2.5(0)	-	18(100)	-	18(100)	20.5(87.8)
	Others	1.5(0)	-	-	1.5(0)	54.5(110.09)	-	22.5(68.89)	77(98.05)	-	-	2(50)	2(50)	80.5(95.03)
	Sub total	1.5(0)	-	-	1.5(0)	54.5(110.09)	-	38.5(40.26)	93(81.18)	-	18(100)	2(100)	20(95)	114.5(82.53)
	Others	-	-	49.75(98.49)	49.75(98.49)	12.75(47.06)	5.5(100)	30(10)	48.25(30.05)	-	-	215(66.89)	215(66.89)	313(66.24)
	Grand Total	240.75(61.27)	165(64.24)	433.025(67.77)	838.775(65.21)	211.375(89.94)	338(80.03)	414.5(44.56)	963.875(66.95)	403(68.98)	684.5(47.35)	1456.5(66.04)	2544(63.01)	4346.65(64.31)

Note: Figures in parenthesis indicates percentage of area to the respective total for which farmers have been benefited using Varuna Mitra information.

Annexure 5.3: Cropping pattern in both irrigated and un-irrigated area by crops

Crop categories	Crops	High rainfall region				Moderate rainfall region				Low rainfall region				Total
		D.Kannada & Udupi	Kodagu	Shivamogga	Sub Total	Chikka-magaluru	Hassan	Kolar	Sub Total	Tumakuru	Ballari	Raichur	Sub Total	
Cereals	Jowar	-	-	-	-	-	-	-	-	34.5(39.13)	130(46.54)	76.5(31.37)	241(40.66)	241(40.66)
	Maize	1(0)	-	154(17.14)	155(17.03)	24.5(69.39)	12(16.67)	3.5(0)	40(47.5)	19(5.26)	729.5(69.03)	20(80)	768.5(58.24)	963.5(51.17)
	Paddy	198(67.17)	77(32.47)	324.03(69.19)	599.03(74.62)	150.625(94.69)	7.5(0)	11.5(26.09)	169.63(85.85)	21(85.71)	126.5(67.98)	173.5(63.4)	321(66.67)	1089.65(74.03)
	Ragi	-	-	-	-	11(100)	184(98.91)	159.25(100)	354.25(99.44)	207(100)	29(100)	-	236(100)	590.25(99.66)
	Others	-	-	-	-	-	-	-	-	-	8(0)	40.5(58.02)	48.5(48.45)	48.5(48.45)
Pulses	Sub total	199(66.83)	77(32.47)	478.03(65.98)	754.03(62.78)	186.125(91.67)	203.5(90.42)	174.25(93.11)	563.88(91.66)	281.5(85.08)	1023(59.25)	310.5(55.88)	1615(63.1)	2932.9(68.51)
	Bengal gram	-	-	-	-	3(0)	-	-	3(0)	-	11(0)	271(56.27)	282(64.08)	285(53.51)
	Red gram	5(0)	-	-	5(0)	-	-	6(0)	6(0)	-	18(22.22)	444(59.11)	462(56.71)	473(55.39)
	Other	22.5(4.44)	-	-	22.5(4.44)	-	35(0)	8(12.5)	43(2.33)	94(23.94)	2(0)	11.5(0)	107.5(20.93)	173(14.16)
	Sub total	27.5(3.64)	-	-	27.5(3.64)	3(0)	35(0)	14(7.14)	52(1.92)	94(23.94)	31(12.9)	726.5(56.5)	851.5(51.32)	931(47.15)
Oil seeds & Cash crops	cotton	-	-	3(0)	3(0)	-	-	-	-	1(0)	146(100)	943(98.73)	1090(98.81)	1093(98.54)
	ground nut	7.5(93.33)	-	4.25(5.88)	11.75(61.7)	12.5(92)	-	92(86.3)	104.5(69.38)	1(0)	47.5(71.58)	7(85.71)	55.5(72.07)	171.75(69.72)
	others	9.25(0)	-	3(0)	12.25(0)	4(100)	-	-	4(100)	21(0)	80(0)	13(0)	114(0)	130.25(30.7)
	Sub total	16.75(41.79)	-	10.25(2.44)	27(26.85)	16.5(93.94)	-	92(86.3)	108.5(70.51)	23(0)	273.5(65.81)	963(97.3)	1259.5(88.69)	1395(86.08)
	mango	2(100)	-	-	2(100)	-	-	300(19.4)	300(19.4)	-	-	-	-	302(19.93)
Fruits	others	9.75(61.54)	3(0)	7.5(80)	20.25(59.26)	2(0)	-	16.5(60.61)	18.5(54.05)	35(97.14)	5(40)	-	40(90)	78.75(73.65)
	Sub total	11.75(68.09)	3(0)	7.5(80)	22.25(62.92)	2(0)	-	316.5(21.55)	318.5(21.41)	35(97.14)	5(40)	-	40(90)	380.75(31.04)
	Jasmine	0.5(0)	-	-	0.5(0)	-	-	-	-	-	10(0)	-	10(0)	10.5(0)
	Marigold	-	-	-	-	-	-	20.25(14.81)	20.25(14.81)	-	6(0)	-	6(0)	26.25(11.43)
	Sub total	0.5(0)	-	-	0.5(0)	-	-	20.25(14.81)	20.25(14.81)	-	16(0)	-	16(0)	36.75(8.16)
Plantation crops	Areca nut	319.5(82.94)	-	264.63(58.2)	584.13(71.73)	244(69.06)	20(85)	-	264(70.27)	62(51.61)	-	-	62(51.61)	910.13(69.94)
	Coffee	-	640(99.22)	3(0)	643(98.76)	667.5(93.3)	-	-	667.5(93.3)	-	-	-	-	1310.5(95.97)
	Others	88.75(62.06)	-	21(80.95)	109.75(57.59)	-	287.75(90.08)	-	287.75(90.08)	101.5(56.16)	-	-	101.5(56.16)	499(76.03)
	Sub total	408.25(76.23)	640(99.22)	288.63(59.25)	1336.88(83.57)	911.5(86.81)	307.75(89.75)	-	1219.25(87.55)	163.5(54.43)	-	-	163.5(54.43)	2719.63(83.6)
	Tomato	-	-	-	-	-	-	274.5(95.08)	274.5(95.08)	-	-	-	-	274.5(95.08)
Vegetables	Chilly	-	3(0)	-	3(0)	-	-	12(0)	12(0)	-	198.5(100)	80(100)	278.5(100)	293.5(94.89)
	Others	1.5(0)	-	-	1.5(0)	123(102.44)	8(100)	199.75(66.46)	330.75(80.65)	9(155.56)	23.5(42.55)	5(80)	37.5(74.67)	369.75(79.72)
	Sub total	1.5(0)	3(0)	-	4.5(0)	123(102.44)	8(100)	486.25(80.98)	617.25(85.5)	9(155.56)	222(93.92)	85(98.82)	316(96.99)	937.75(88.96)
	Others	7(0)	-	154.25(99.51)	161.25(95.19)	21.75(69.97)	5.5(100)	76.5(27.45)	103.75(40)	-	-	250(57.53)	250(57.53)	515(65.79)
	Grand Total	655.5(69.14)	723(91.29)	928.4(69.57)	2306.9(76.25)	1247.38(88.42)	559.75(84.63)	1087.75(59.68)	2894.88(76.89)	583(68.44)	1297(63.27)	1372(59.17)	3252(62.47)	9848.78(73.28)

Note: Figures in parenthesis indicates percentage of area to the respective total for which farmers have been benefited using Varuna Mitra information.

Annexure 7.1: Details of number of farmers and land per beneficiary - Irrigated (Land in acres)

Region / District	Arecanut		Coffee		Cotton		Paddy		Maize		Ragi		Redgram	
	No. of Beneficiary	Land per Beneficiary	No. of Beneficiary	Land per Beneficiary	No. of Beneficiary	Land per Beneficiary	No. of Beneficiary	Land per Beneficiary	No. of Beneficiary	Land per Beneficiary	No. of Beneficiary	Land per Beneficiary	No. of Beneficiary	Land per Beneficiary
Dakshina Kannada & Udupi	68.00	3.74	-	-	-	-	15.00	2.77	-	-	-	-	-	-
Kodagu	-	-	105.00	5.04	-	-	-	-	-	-	-	-	-	-
Shivamogga	61.00	2.43	-	-	-	-	46.00	2.00	2.00	1.10	-	-	-	-
High Rainfall total	129.00	3.12	105.00	5.04	-	-	61.00	2.19	2.00	1.10	-	-	-	-
Chikkamagaluru	60.00	2.75	71.00	8.77	-	-	25.00	2.46	1.00	2.00	-	-	-	-
Hassan	8.00	2.13	-	-	-	-	-	-	-	-	-	-	-	-
Kolar	-	-	-	-	-	-	2.00	1.50	-	-	25.00	2.15	-	-
Moderate Rainfall total	68.00	2.68	71.00	8.77	-	-	27.00	2.39	1.00	2.00	26.00	2.14	-	-
Tumakuru	37.00	0.86	-	-	-	-	17.00	1.06	-	-	5.00	2.60	-	-
Ballari	-	-	-	-	35.00	4.09	22.00	3.91	36.00	5.42	-	-	-	-
Raichur	-	-	-	-	62.00	8.35	20.00	5.50	-	-	-	-	9.00	7.78
Low rainfall total	37.00	0.86	-	-	97.00	6.81	59.00	3.63	36.00	5.42	5.00	2.60	9.00	7.78
Grand Total	234.00	2.63	176.00	6.54	98.00	6.76	147.00	2.80	39.00	5.11	31.00	2.22	9.00	7.78

Region / District	Chilli		Mango		Jowar		Tomato		Others		Total	
	No. of Beneficiary	Land per Beneficiary	No. of Beneficiary	Land per Beneficiary	No. of Beneficiary	Land per Beneficiary	No. of Beneficiary	Land per Beneficiary	No. of Beneficiary	Land per Beneficiary	No. of Beneficiary	Land per Beneficiary
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	2.00	3.25	85.00	3.55
Kodagu	-	-	-	-	-	-	-	-	34.00	4.62	139.00	4.94
Shivamogga	-	-	-	-	-	-	-	-	34.00	3.31	143.00	2.47
High Rainfall total	-	-	-	-	-	-	-	-	70.00	3.94	367.00	3.65
Chikkamagaluru	-	-	-	-	-	-	-	-	48.00	3.76	205.00	5.02
Hassan	-	-	-	-	-	-	-	-	4.00	2.00	12.00	2.08
Kolar	-	-	-	-	-	-	83.00	1.98	79.00	1.98	189.00	2.47
Moderate Rainfall total	-	-	-	-	-	-	83.00	2.63	131.00	2.63	407.00	3.72
Tumakuru	-	-	-	-	-	-	-	-	31.00	1.55	90.00	1.23
Ballari	39.00	4.63	-	-	4.00	14.00	-	-	19.00	6.82	155.00	5.10
Raichur	11.00	7.27	-	-	-	-	-	-	13.00	2.00	115.00	6.99
Low rainfall total	50.00	5.21	-	-	4.00	14.00	-	-	63.00	3.23	360.00	4.74
Grand Total	50.00	5.21	-	-	4.00	14.00	83.00	3.12	264.00	3.12	1135.00	4.02

Source: Primary data collected during Aug-Sep, 2017

Annexure 7.2: Details of number of farmers and land per beneficiary - unirrigated (Land in acres)

Region / District	Areacanut		Coffee		Cotton		Paddy		Maize		Ragi		Redgram	
	No. of Beneficiary	Land per Beneficiary	No. of Beneficiary	Land per Beneficiary	No. of Beneficiary	Land per Beneficiary	No. of Beneficiary	Land per Beneficiary	No. of Beneficiary	Land per Beneficiary	No. of Beneficiary	Land per Beneficiary	No. of Beneficiary	Land per Beneficiary
Dakshina Kannada & Udupi	6.00	1.83	-	-	-	-	49.00	1.87	-	-	-	-	-	-
Kodagu	-	-	35.00	3.03	-	-	16.00	1.56	-	-	-	-	-	-
Shivamogga	3.00	2.00	-	-	-	-	75.00	2.63	8.00	3.03	-	-	-	-
High Rainfall total	9.00	1.89	35.00	3.03	-	-	140.00	2.24	8.00	3.03	0.00	-	0.00	-
Chikkamagaluru	1.00	3.50	-	-	-	-	36.00	2.25	5.00	3.00	6.00	1.83	-	-
Hassan	-	-	-	-	-	-	-	-	1.00	2.00	101.00	1.80	-	-
Kolar	-	-	-	-	-	-	-	-	-	-	43.00	2.45	-	-
Moderate Rainfall total	1.00	3.50	0.00	-	-	-	36.00	2.25	6.00	2.83	150.00	1.99	0.00	-
Tumakuru	-	-	-	-	-	-	-	-	1.00	1.00	128.00	1.52	-	-
Ballari	-	-	-	-	-	-	-	-	30.00	7.85	11.00	2.64	1.00	4.00
Raichur	-	-	-	-	61.00	6.77	-	-	4.00	4.00	-	-	28.00	6.71
Low rainfall total	0.00	-	0.00	-	61.00	6.62	0.00	-	35.00	7.22	139.00	1.60	29.00	6.62
Grand Total	10.00	2.05	35.00	3.03	61.00	6.45	176.00	2.24	49.00	6.00	289.00	1.80	29.00	6.62

Region / District	Chilli		Mango		Jowar		Tomato		Others		Total	
	No. of Beneficiary	Land per Beneficiary	No. of Beneficiary	Land per Beneficiary	No. of Beneficiary	Land per Beneficiary	No. of Beneficiary	Land per Beneficiary	No. of Beneficiary	Land per Beneficiary	No. of Beneficiary	Land per Beneficiary
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	14.00	2.10	69.00	1.91
Kodagu	-	-	-	-	-	-	-	-	-	-	51.00	2.57
Shivamogga	-	-	-	-	-	-	-	-	28.00	1.25	114.00	2.28
High Rainfall total	0.00	-	0.00	-	0.00	-	0.00	-	42.00	1.53	234.00	2.19
Chikkamagaluru	-	-	-	-	-	-	-	-	25.00	2.56	73.00	2.39
Hassan	-	-	-	-	-	-	-	-	68.00	2.68	170.00	2.15
Kolar	-	-	12.00	4.85	-	-	8.00	1.69	11.00	1.86	74.00	2.63
Moderate Rainfall total	-	-	12.00	4.85	0.00	-	8.00	1.69	104.00	2.56	317.00	2.27
Tumakuru	-	-	-	-	10.00	1.35	-	-	40.00	1.15	179.00	1.42
Ballari	5.00	3.60	-	-	3.00	1.50	-	-	9.00	3.33	59.00	5.40
Raichur	-	-	-	-	6.00	4.00	-	-	24.00	7.35	123.00	6.65
Low rainfall total	5.00	3.60	0.00	-	19.00	2.21	0.00	-	73.00	3.46	361.00	4.01
Grand Total	5.00	3.60	12.00	4.85	19.00	2.21	8.00	1.69	219.00	2.66	912.00	2.92

Source: Primary data collected during Aug-Sep, 2017

Annexure 7.3: Cost of cultivation production and net returns of the sample who availed VM Service during the Year 2016-17 (Irrigated area)

Season: Kharif, Rabi and summer

(COC in Rupees; Prod. in Qlts and Net Return in Rupees)

Region / District	Arecanut			Coffee			Cotton			Paddy			Maize			Ragi		
	COC	Prod.	N.Return	COC	Prod.	N.Return	COC	Prod.	N.Return	COC	Prod.	N.Return	COC	Prod.	N.Return	COC	Prod.	N.Return
Dakshina Kannada & Udupi	25456.00	11.23	255294.00	-	-	-	-	-	-	-	17425.00	16.00	10451.00	-	-	-	-	-
Kodagu	-	-	-	29974.48	9.94	34483.93	-	-	-	-	-	-	-	-	-	-	-	-
Shivamogga	22659.00	10.97	273531.00	-	-	-	-	-	-	20456.00	19.50	17561.00	13563.23	15.36	20000.00	-	-	-
High Rainfall total	24426.26	11.13	262008.12	29974.48	9.94	34483.93	-	-	-	19513.78	18.41	15350.78	13563.23	15.36	20000.00	-	-	-
Chikkamagaluru	21369.00	10.35	222518.00	31100.71	9.02	35414.83	-	-	-	12211.00	13.70	11528.00	14234.23	16.80	7000.00	-	-	-
Hassan	20156.00	8.36	188844.00	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kolar	-	-	-	-	-	-	-	-	-	16453.00	15.00	14265.00	-	-	-	8651.12	11.32	16723.00
Moderate Rainfall total	21255.70	10.16	219372.63	31100.71	9.02	35414.83	-	-	-	12408.30	13.76	11655.30	14234.23	16.80	7000.00	8651.12	11.32	16723.00
Tumakuru	22619.72	8.25	166993.72	-	-	-	-	-	-	15000.00	16.28	14952.00	-	-	-	7256.36	10.13	14373.51
Ballari	-	-	-	-	-	-	27034.96	14.52	29153.14	26452.00	23.00	25995.00	15324.17	16.52	15264.00	-	-	-
Raichur	-	-	-	-	-	-	28782.82	14.25	28922.97	29453.00	23.22	26532.00	-	-	-	-	-	-
Low rainfall total	22619.72	8.25	166993.72	-	-	-	28404.69	14.31	28972.77	27031.32	22.55	25342.18	15324.17	16.52	15264.00	7256.36	10.51	13563.00
Grand Total	23395.66	10.70	244475.46	30583.43	9.44	34987.27	28404.69	14.31	28972.77	22306.13	19.83	19961.95	15143.98	16.51	15233.33	8379.48	11.16	16107.57

Region / District	Redgram			Chilli			Mango			Jowar			Tomato			Others			Average	
	Cost.C	Prod.	N.Return	Cost.C	Prod.	N.Return	Cost.C	Prod.	N.Return	Cost.C	Prod.	N.Return	Cost.C	Prod.	N.Return	Cost.C	Prod.	N.Return	Cost.C	N.Return
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	72617.00	97500.00	25367.46	218252.13	
Kodagu	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	32652.00	28929.00	30587.27	33212.61	
Shivamogga	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	76086.00	51196.00	38976.59	135048.63	
High Rainfall total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51297.28	39620.12	31629.43	101733.63	
Chikkamagaluru	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	39126.00	29074.00	29789.72	62748.62	
Hassan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	42631.00	28427.00	27348.00	137510.56	
Kolar	-	-	-	-	-	-	-	-	-	-	-	-	75839.08	104.77	60372.03	39451.00	34937.00	55849.32	46746.12	
Moderate Rainfall total	-	-	-	-	-	-	-	-	-	-	-	-	75839.08	104.77	60372.03	39354.63	31716.25	37819.25	59014.41	
Tumakuru	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	85724.00	93560.00	46873.11	92708.74	
Ballari	-	-	-	33889.19	7.64	34218.28	-	-	-	12281	11.36	9207.80	-	-	-	67724.00	54264.00	31270.98	29240.73	
Raichur	9563.26	7.23	19369.00	33625.00	8.89	27837.50	-	-	-	-	-	-	-	-	-	26896.00	25041.00	27621.96	27530.49	
Low rainfall total	9563.26	7.23	19369.00	33786.21	8.31	31627.33	-	-	-	12281	11.36	9207.80	-	-	-	66753.34	59799.18	30407.19	32514.29	
Grand Total	9563.26	7.23	19369.00	33786.21	8.31	31627.33	-	-	-	12281	11.36	9207.80	75839.08	104.77	60372.03	50118.12	41296.28	33237.24	61673.91	

Source: Primary data collected during Aug-Sep, 2017

Annexure 7.4: Cost of cultivation production and net returns of the sample who availed VM Service during the Year 2016-17 (un-irrigated area)

Season: Kharif, Rabi and summer

(COC in Rupees; Prod. in Qtls and Net Return in Rupees)

Region / District	Arecanut			Coffee			Cotton			Paddy			Maize			Ragi	
	COC	Prod.	N.Return	COC	Prod.	N.Return	COC	Prod.	N.Return	COC	Prod.	N.Return	COC	Prod.	N.Return	COC	Prod.
Dakshina Kannada & Udupi	18563.00	5.63	127817.00	-	-	-	-	-	-	12653.00	12.00	10235.00	-	-	-	-	-
Kodagu	-	-	-	38609.09	6.04	30863.64	-	-	-	12362.00	10.50	10256.00	-	-	-	-	-
Shivamogga	16538.00	6.56	127782.00	-	-	-	-	-	-	11236.00	11.50	10539.00	11170.00	12.31	27701.00	-	-
High Rainfall total	18963.81	6.33	135792.44	38609.09	6.04	30863.64	-	-	-	11739.35	11.57	10427.71	11170.00	12.31	27701.00	-	-
Chikkamagaluru	17635.00	6.33	140615.00	-	-	-	-	-	-	12307.00	10.30	10110.00	9786.00	11.29	7893.00	4318.18	7.36
Hassan	-	-	-	-	-	-	-	-	-	-	-	-	11500.00	11.29	7500.00	5241.76	8.69
Kolar	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7510.31	7.86
Moderate Rainfall total	17635.00	6.33	140615.00	-	-	-	-	-	-	12307.00	10.30	10110.00	9987.65	11.29	7846.76	6009.51	8.35
Tumakuru	-	-	-	-	-	-	-	-	-	-	-	-	9756.00	11.36	15000.00	6090.46	8.71
Ballari	-	-	-	-	-	-	23333.33	8.67	18753.00	-	-	-	9186.00	13.00	12391.00	7172.41	7.56
Raichur	-	-	-	-	-	-	23048.43	9.67	19619.85	-	-	-	15000.00	12.50	15000.00	-	-
Low rainfall total	-	-	-	-	-	-	23050.48	9.66	19613.60	-	-	-	9556.52	12.96	12566.59	6231.16	8.56
Grand Total	18725.31	6.33	136658.03	38609.09	6.04	30863.64	23050.48	9.66	19613.60	11856.04	11.31	10362.40	9714.37	12.81	13540.09	6104.29	8.44

Region / District	Redgram			Chilli			Mango			Jowar			Tomato			Others		Average	
	Cost.C	Prod.	N.Return	Cost.C	Prod.	N.Return	Cost.C	Prod.	N.Return	Cost.C	Prod.	N.Return	Cost.C	Prod.	N.Return	Cost.C	Prod.	Cost.C	N.Return
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20718.28	24619.28	14943.59	23247.13
Kodagu	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33600.11	26930.89
Shivamogga	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	61854.53	63032.00	18107.83	21812.53
High Rainfall total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	43168.78	45594.87	21225.53	23720.52
Chikkamagaluru	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	38419.00	31861.70	21264.30	20340.28
Hassan	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	13258.94	17297.13	9265.26	12110.17
Kolar	-	-	-	-	-	-	13665.00	35.00	45000.00	-	-	-	-	-	-	50208.03	38226.90	14199.05	22348.47
Moderate Rainfall total	-	-	-	-	-	-	13665.00	35.00	45000.00	-	-	-	-	-	-	22169.40	22436.52	13422.49	16707.21
Tumakuru	-	-	-	-	-	-	-	-	-	5333.00	10.00	14750.00	-	-	-	9088.00	17498.33	6577.02	9197.84
Ballari	9186.00	8.23	12391.00	34444.44	7.33	25055.56	-	-	-	5277.00	8.30	8003.00	-	-	-	21333.33	24685.18	11609.73	13818.92
Raichur	8753.23	7.92	15000.00	-	-	-	-	-	-	9655.00	8.50	12021.00	-	-	-	11349.73	19828.48	16685.12	18288.78
Low rainfall total	8762.25	7.93	14945.65	-	-	-	-	-	-	7796.71	8.96	12467.68	-	-	-	12122.39	19984.16	13297.91	15129.50
Grand Total	8762.25	7.93	14945.65	34444.44	7.33	25055.56	13665.00	35.00	45000.00	7796.71	8.96	12263.79	-	-	-	20138.04	23932.10	15138.08	17433.37

Source: Primary data collected during Aug-Sep, 2017

Annexure 7.5: Distribution of farmers based on cost component (Irrigated)

Region / District	Areca nut		Coffee		Cotton		Paddy		Maize		Ragi		Redgram	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	-	46.34	-	-	-	-	-	17.24	-	-	-	-	-	-
Kodagu	-	-	48.00	56.41	-	-	-	-	-	-	-	-	-	-
Shivamogga	27.27	32.93	-	-	-	-	-	34.48	-	-	-	-	-	-
High Rainfall total	27.27	79.27	48.00	56.41	-	-	-	51.72	-	-	-	-	-	-
Chikkamagaluru	72.73	12.20	52.00	43.59	-	-	-	10.34	-	-	-	-	-	-
Hassan	-	2.44	-	-	-	-	-	-	-	-	-	-	-	-
Kolar	-	-	-	-	-	-	-	-	-	-	-	100.00	-	-
Moderate Rainfall total	72.73	14.63	52.00	43.59	-	-	-	10.34	-	-	-	100.00	-	-
Tumakuru	-	6.10	-	-	-	-	-	10.34	-	-	-	-	-	-
Ballari	-	-	-	-	10.00	29.41	-	8.62	-	100.00	-	-	-	-
Raichur	-	-	-	-	90.00	70.59	-	18.97	-	-	-	-	-	100.00
Low rainfall total	-	6.10	-	-	100.00	100.00	-	37.93	-	100.00	-	-	-	100.00
Grand Total	11	82	25	39	10	68	-	58	-	2	-	5	-	1

Region / District	Chilli		Mango		Jowar		Tomato		Others		Total	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	0.85	-	-	11.50
Kodagu	-	-	-	-	-	-	-	-	21.19	22.86	-	11.03
Shivamogga	-	-	-	-	-	-	-	-	13.56	4.29	-	14.79
High Rainfall total	-	-	-	-	-	-	-	-	35.59	27.14	-	37.32
Chikkamagaluru	-	-	-	-	-	-	-	-	19.49	30.00	-	13.15
Hassan	-	-	-	-	-	-	-	-	-	-	-	0.47
Kolar	-	-	-	-	-	-	100.00	100.00	29.66	20.00	-	16.90
Moderate Rainfall total	-	-	-	-	-	-	100.00	100.00	49.15	50.00	-	30.52
Tumakuru	-	-	-	-	-	-	-	-	0.85	-	-	2.82
Ballari	-	71.43	-	-	-	-	-	-	10.17	5.71	-	12.68
Raichur	100.00	28.57	-	-	-	-	-	-	4.24	17.14	-	16.67
Low rainfall total	100.00	100.00	-	-	-	-	-	-	15.25	22.86	-	32.16
Grand Total	2	21	-	-	-	-	11	32	118	70	-	426

Source: Primary data collected during Aug-Sep, 2017

Annexure 7.6: Distribution of farmers based on cost component (Un-irrigated)

Region / District	Areca nut		Coffee		Cotton		Paddy		Maize		Ragi		Redgram	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	-	80.00	-	-	-	-	100.00	19.23	-	-	-	-	-	-
Kodagu	-	-	-	100.00	-	-	-	-	-	-	-	-	-	-
Shivamogga	-	-	-	-	-	-	-	80.77	-	16.67	-	-	-	-
High Rainfall total	-	80.00	-	100.00	-	-	100.00	100.00	-	16.67	-	-	-	-
Chikkamagaluru	-	20.00	-	-	-	-	-	-	-	-	-	-	-	-
Hassan	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kolar	-	-	-	-	-	-	-	-	-	-	-	41.86	-	-
Moderate Rainfall total	-	20.00	-	-	-	-	-	-	-	-	-	41.86	-	-
Tumakuru	-	-	-	-	-	-	-	-	-	-	-	58.14	-	-
Ballari	-	-	-	-	-	2.78	-	-	-	83.33	-	-	-	-
Raichur	-	-	-	-	100.00	97.22	-	-	-	-	-	-	-	100.00
Low rainfall total	-	-	-	-	100.00	100.00	-	-	-	83.33	-	58.14	-	100.00
Grand Total		5		17	7	36	1	26		6		43		1

Region / District	Chilli		Mango		Jowar		Tomato		Others		Total	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	4.55	6.12	6.67	6.25
Kodagu	-	-	-	-	-	-	-	-	-	-	-	7.08
Shivamogga	-	-	-	-	-	-	-	-	-	17.35	-	16.25
High Rainfall total	-	-	-	-	-	-	-	-	4.55	23.47	6.67	29.58
Chikkamagaluru	-	-	-	-	-	-	-	-	-	11.22	-	5.00
Hassan	-	-	-	-	-	-	-	63.64	63.64	19.39	46.67	7.92
Kolar	-	-	-	100.00	-	-	-	13.64	13.64	6.12	10.00	12.08
Moderate Rainfall total	-	-	-	100.00	-	-	-	77.27	77.27	36.73	56.67	25.00
Tumakuru	-	-	-	-	-	66.67	-	-	9.09	21.43	6.67	20.00
Ballari	-	-	-	-	-	-	-	-	9.09	2.04	6.67	3.33
Raichur	-	-	-	-	-	33.33	-	-	-	16.33	23.33	22.08
Low rainfall total	-	-	-	-	-	100.00	-	-	18.18	39.80	36.67	45.42
Grand Total				5		3			22	98	30	240

Source: Primary data collected during Aug-Sep, 2017

Annexure 7.7: Impact of Varuna Mitra Helpdesk Services on cost component (irrigated)

Region / District	Arecanut		Coffee(Rs)		Cotton(Rs)		Paddy(Rs)		Maize(Rs)		Ragi(Rs)		Redgram (Rs)	
	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)
Dakshina Kannada & Udupi	-	3465 (13.61)	-	-	-	-	-	632 (3.63)	-	-	-	-	-	-
Kodagu	-	-	3290 (10.98)	7250 (24.19)	-	-	-	-	-	-	-	-	-	-
Shivamogga	449.84 (1.99)	568.44 (2.51)	-	-	-	-	-	495 (2.42)	-	-	-	-	-	-
High Rainfall total	449.84 (1.84)	2261.81 (9.26)	3290 (10.98)	7250 (24.19)	-	-	-	540.67 (2.77)	-	-	-	-	-	-
Chikkamagaluru	581 (2.72)	776 (3.63)	3650 (11.74)	4500 (14.47)	-	-	-	448.33 (3.67)	-	-	-	-	-	-
Hassan	-	403 (2)	-	-	-	-	-	-	-	-	-	-	-	-
Kolar	-	-	-	-	-	-	-	-	-	-	950 (10.98)	-	-	-
Moderate Rainfall total	581 (2.73)	713.83 (3.36)	3650 (11.74)	4500 (14.47)	-	-	-	448.33 (3.61)	-	-	950 (10.98)	-	-	-
Tumakuru	-	391.26 (1.73)	-	-	-	-	-	575 (3.83)	-	-	-	-	-	-
Ballari	-	-	-	-	1253.61 (4.64)	1606.66 (5.94)	-	795 (3.01)	-	683.33 (4.46)	-	-	-	-
Raichur	-	-	-	-	947.22 (3.29)	1139.03 (3.96)	-	743 (2.52)	-	-	-	-	-	583.33 (6.1)
Low rainfall total	-	391.26 (1.73)	-	-	977.86 (3.44)	1276.57 (4.56)	-	709 (2.62)	-	683.33 (4.46)	-	-	-	583.33 (6.1)
Grand Total	703.68 (3.01)	2530.60 (10.82)	3477.2 (11.37)	6051.28 (19.79)	977.86 (3.44)	1276.57 (4.56)	-	996.91 (4.47)	-	683.33 (4.51)	-	950 (10.98)	-	583.33 (6.1)

Region / District	Chilli(Rs)		Mango(Rs)		Jowar(Rs)		Tomato(Rs)		Others(Rs)		Total(Rs)	
	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	-	1000 (1.38)	-	2836.53 (11.18)
Kodagu	-	-	-	-	-	-	-	-	326.52 (1)	427.12 (1.31)	2549.13 (8.33)	3620.81 (11.84)
Shivamogga	-	-	-	-	-	-	-	-	-	884 (1.16)	449.84 (1.15)	625.27 (1.6)
High Rainfall total	-	-	-	-	-	-	-	-	326.52 (0.64)	614.81 (1.2)	2217.66 (7.01)	2192.2 (6.93)
Chikkamagaluru	-	-	-	-	-	-	-	-	-	478.7 (1.22)	2480.86 (8.33)	1749.29 (5.87)
Hassan	-	-	-	-	-	-	-	-	-	0 (0)	-	403 (1.47)
Kolar	-	-	-	-	-	-	-	2687.97 (3.54)	360 (0.91)	650.64 (1.65)	2189.12 (3.92)	1367.9 (2.45)
Moderate Rainfall total	-	-	-	-	-	-	-	2687.97 (3.54)	360 (0.91)	582.46 (1.48)	2364.16 (6.25)	1517.35 (4.01)
Tumakuru	-	-	-	-	-	-	-	-	-	266.67 (0.31)	-	472.75 (1.01)
Ballari	-	1225.51 (3.62)	-	-	-	-	-	-	748.62 (1.11)	949.62 (1.4)	874.87 (2.8)	1245.43 (3.98)
Raichur	1790 (5.32)	1200 (3.57)	-	-	-	-	-	-	169 (0.63)	432.99 (1.61)	1022.83 (3.7)	1025.28 (3.71)
Low rainfall total	1790 (5.3)	1218.22 (3.61)	-	-	-	-	-	-	603.72 (0.9)	768.17 (1.15)	985.84 (3.24)	1063.65 (3.5)
Grand Total	1790 (5.3)	1218.22 (3.61)	-	-	-	-	-	2687.97 (3.54)	436.45 (0.87)	622.3 (1.24)	2034.25 (6.12)	1795.35 (5.4)

Source: Primary data collected during Aug-Sep, 2017

Annexure 7.8: Impact of Varuna Mitra Helpdesk Services on cost component (un-irrigated land)

Region / District	Areca nut (Rs)		Coffee (Rs)		Cotton (Rs)		Paddy (Rs)		Maize (Rs)		Ragi (Rs)		Redgram (Rs)	
	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)
Dakshina Kannada & Udupi	-	3041 (16.38)	-	-	-	-	558 (4.41)	158 (1.25)	-	-	-	-	-	-
Kodagu	-	-	-	6782 (17.57)	-	-	-	-	-	-	-	-	-	-
Shivamogga	-	-	-	-	-	-	-	861 (7.66)	-	480 (4.3)	-	-	-	-
High Rainfall total	-	3041 (16.04)	-	6782 (17.57)	-	-	558 (4.75)	841.38 (7.17)	-	480 (4.3)	-	-	-	-
Chikkamagaluru	-	470 (2.67)	-	-	-	-	-	-	-	-	-	-	-	-
Hassan	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kolar	-	-	-	-	-	-	-	-	-	-	-	691.38 (9.21)	-	-
Moderate Rainfall total	-	470 (2.67)	-	-	-	-	-	-	-	-	-	691.38 (11.50)	-	-
Tumakuru	-	-	-	-	-	-	-	-	-	-	-	512.96 (8.42)	-	-
Ballari	-	-	-	-	-	1166.65 (5)	-	-	-	604 (6.58)	-	-	-	-
Raichur	-	-	-	-	742.86 (3.18)	1163.41 (5.05)	-	-	-	-	-	-	-	587.5 (6.71)
Low rainfall total	-	-	-	-	742.86 (3.18)	1163.5 (5)	-	-	-	604 (6.32)	-	512.96 (8.23)	-	587.5 (6.70)
Grand Total	-	2526.8 (13.49)	-	6782 (17.57)	742.86 (3.18)	1163.5 (5)	558 (4.70)	841.38 (7.10)	-	583.33 (6.00)	-	989.62 (6.21)	-	587.5 (6.70)

Region / District	Chilli (Rs)		Mango (Rs)		Jowar (Rs)		Tomato (Rs)		Others (Rs)		Total (Rs)	
	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	500 (2.41)	276.16 (1.33)	529 (3.54)	1174.4 (7.86)
Kodagu	-	-	-	-	-	-	-	-	-	-	-	6782 (20.18)
Shivamogga	-	-	-	-	-	-	-	-	-	684.64 (1.11)	-	774.36 (4.28)
High Rainfall total	-	-	-	-	-	-	-	-	500 (1.16)	578.08 (1.34)	529 (2.49)	2297.32 (10.82)
Chikkamagaluru	-	-	-	-	-	-	-	-	-	363.17 (0.95)	-	372.07 (1.75)
Hassan	-	-	-	-	-	-	-	-	433.27 (3.27)	789 (5.95)	433.27 (4.68)	789 (8.52)
Kolar	-	-	1268.39 (9.28)	1268.39 (9.28)	-	-	-	-	1066.18 (2.12)	896 (1.78)	1066.18 (7.51)	833.2 (5.87)
Moderate Rainfall total	-	-	-	-	-	-	-	-	544.96 (2.46)	676.72 (3.05)	544.96 (4.06)	726.98 (5.42)
Tumakuru	-	-	-	-	-	-	500 (9.40)	-	45 (0.5)	563 (6.21)	45 (0.68)	534.31 (8.12)
Ballari	-	-	-	-	-	-	-	-	116.67 (0.55)	425 (1.99)	116.67 (1)	629.58 (5.42)
Raichur	-	-	-	-	-	-	500 (5.18)	-	-	214.25 (1.89)	742.86 (4.45)	853.49 (5.12)
Low rainfall total	-	-	-	-	-	-	500 (6.43)	-	80.84 (0.67)	412.85 (3.41)	502.12 (3.78)	688.24 (5.18)
Grand Total	-	-	1268.39 (9.28)	-	-	-	500 (6.43)	-	458.53 (2.28)	548.56 (2.72)	528.19 (3.49)	1245.96 (8.23)

Source: Primary data collected during Aug-Sep, 2017

Annexure 7.9: Distribution of farmers based on yield component (Irrigated)

Region / District	Arecanut		Coffee		Cotton		Paddy		Maize		Ragi		Redgram	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	10.00	-	-	-	-	-	5.26	-	-	-	-	-	-	-
Kodagu	-	-	60.53	100.00	-	-	-	-	-	-	-	-	-	-
Shivamogga	-	-	-	-	-	-	26.32	-	14.81	-	-	-	-	-
High Rainfall total	10.00	-	60.53	100.00	-	-	31.58	-	14.81	-	-	-	-	-
Chikkamagaluru	70.00	100.00	39.47	-	-	-	15.79	-	25.93	-	-	-	-	-
Hassan	6.67	-	-	-	-	-	-	-	-	-	-	-	-	-
Kolar	-	-	-	-	-	-	2.63	-	-	-	75.00	-	-	-
Moderate Rainfall total	76.67	100.00	39.47	-	-	-	18.42	-	25.93	-	75.00	-	-	-
Tumakuru	13.33	-	-	-	-	-	18.42	-	-	-	25.00	-	-	-
Ballari	-	-	-	-	14.52	33.30	15.79	100.00	59.26	100.00	-	-	-	-
Raichur	-	-	-	-	85.48	66.70	15.79	-	-	-	-	-	100.00	-
Low rainfall total	13.33	-	-	-	100.00	100.00	50.00	100.00	59.26	100.00	25.00	-	100.00	-
Grand Total	60	1	38	13	62	6	38	1	27	13	8	-	3	-

Region / District	Chilli		Mango		Jowar		Tomato		Others		Total	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	3.03	-	2.9	-
Kodagu	-	-	-	-	-	-	-	-	2.02	-	6.6	19.70
Shivamogga	-	-	-	-	-	-	-	-	20.20	10	8.97	3.03
High Rainfall total	-	-	-	-	-	-	-	-	25.25	10	18.47	22.73
Chikkamagaluru	-	-	-	-	-	-	-	-	15.15	5	22.43	3.03
Hassan	-	-	-	-	-	-	-	-	13.13	35	4.49	10.61
Kolar	-	-	-	-	-	-	100.00	100.00	18.18	15	13.46	10.61
Moderate Rainfall total	-	-	-	-	-	-	100.00	100.00	46.46	55	40.37	24.24
Tumakuru	-	-	-	-	-	-	-	-	14.14	5	8.18	1.52
Ballari	82.35	100.00	-	-	100.00	100.00	-	-	5.05	15	13.46	40.91
Raichur	17.65	-	-	-	-	-	-	-	9.09	15	19.52	10.61
Low rainfall total	100.00	100.00	-	-	100.00	100.00	-	-	28.28	35	41.16	53.03
Grand Total	17	6	-	-	1	2	26	4.00	99	20	379	66

Source: Primary data collected during Aug-Sep, 2017

Annexure 7.10: Distribution of farmers based on yield component (Unirrigated)

Region / District	Arecanut		Coffee		Cotton		Paddy		Maize		Regi		Redgram	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	-	-	-	-	-	-	58.82	-	-	-	-	-	-	-
Kodagu	-	-	100.00	-	-	-	41.18	-	-	-	-	-	-	-
Shivamogga	-	-	-	-	-	-	-	-	15.38	15.38	-	-	-	-
High Rainfall total	-	-	100.00	-	-	-	100.00	-	15.38	15.38	-	-	-	-
Chikkamagaluru	-	-	-	-	-	-	-	-	23.08	23.08	1.45	-	-	-
Hassan	-	-	-	-	-	-	-	-	7.69	7.69	43.48	72.00	-	-
Kolar	-	-	-	-	-	-	-	-	-	-	18.84	8.00	-	-
Moderate Rainfall total	-	-	-	-	-	-	-	-	30.77	30.77	63.77	80.00	-	-
Tumakuru	-	-	-	-	-	-	-	-	-	-	34.78	16.00	-	-
Ballari	-	-	-	-	2.50	0.00	-	-	61.54	53.85	1.45	4.00	-	-
Raichur	-	-	-	-	97.50	100.00	-	-	-	-	-	-	100.00	-
Low rainfall total	-	-	-	-	100.00	100.00	-	-	61.54	53.85	36.23	20.00	100.00	-
Grand Total	-	-	45.00	-	40.00	10.00	17.00	-	26.00	13.00	69.00	25.00	7.00	-

Region / District	Chilli		Mango		Jowar		Tomato		Others		Total	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	3.61	-	4.45	-
Kodagu	-	-	-	-	-	-	-	-	-	-	17.81	-
Shivamogga	-	-	-	-	-	-	-	-	14.46	-	5.48	2.82
High Rainfall total	-	-	-	-	-	-	-	-	18.07	-	27.74	2.82
Chikkamagaluru	-	-	-	-	-	-	-	-	21.69	10.53	8.56	7.04
Hassan	-	-	-	-	-	-	-	-	10.84	26.32	13.36	33.80
Kolar	-	-	100.00	-	-	-	-	-	9.64	5.26	7.53	4.23
Moderate Rainfall total	-	-	100.00	-	-	-	-	-	42.17	42.11	29.45	45.07
Tumakuru	-	-	-	-	-	-	-	-	12.05	15.79	11.64	9.86
Ballari	-	-	-	-	-	-	-	-	3.61	15.79	7.19	15.49
Raichur	-	-	-	-	100.00	-	-	-	24.10	26.32	23.97	23.76
Low rainfall total	-	-	-	-	100.00	-	-	-	39.76	57.89	42.81	52.11
Grand Total	-	-	1.00	-	4.00	-	-	-	83	19	292	71

Source: Primary data collected during Aug-Sep, 2017

Annexure 7.11: Impact of Varuna Mitra Helpdesk Services on yield (irrigated)

Region / District	Arecanut		Coffee		Cotton		Paddy		Maize		Ragi	
	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)
Dakshina Kannada & Udupi	0.3 (2.67)	-	-	-	-	-	0.66 (4.13)	-	-	-	-	-
Kodagu	-	-	1.14 (11.47)	0.4 (4.02)	-	-	-	-	-	-	-	-
Shivamogga	-	-	-	-	-	-	0.39 (2)	-	1.33 (8.66)	-	-	-
High Rainfall total	0.3 (2.69)	-	1.14 (11.47)	0.4 (4.02)	-	-	0.44 (2.36)	-	1.33 (8.66)	-	-	-
Chikkamagaluru	0.5 (4.83)	0.3 (2.9)	1.71 (18.96)	-	-	-	0.32 (2.34)	-	0.89 (5.3)	-	-	-
Hassan	0.16 (1.91)	-	-	-	-	-	-	-	-	-	-	-
Kolar	-	-	-	-	-	-	0.56 (3.73)	-	-	-	0.67 (5.92)	-
Moderate Rainfall total	0.47 (4.63)	0.3 (2.95)	1.71 (18.96)	-	-	-	0.35 (2.57)	-	0.89 (5.3)	-	0.67 (5.92)	-
Tumakuru	0.15 (1.82)	-	-	-	-	-	0.24 (1.47)	-	-	-	0.81 (8)	-
Ballari	-	-	-	-	0.6 (4.13)	1.01 (6.96)	0.28 (1.22)	0.57 (2.48)	0.74 (4.48)	0.37 (2.24)	-	-
Raichur	-	-	-	-	0.45 (3.16)	0.56 (3.93)	0.25 (1.08)	-	-	-	-	-
Low rainfall total	0.15 (1.82)	-	-	-	0.47 (3.3)	0.71 (4.96)	0.26 (1.13)	0.57 (2.53)	0.74 (4.48)	0.37 (2.24)	0.81 (7.71)	-
Grand Total	0.41 (3.84)	0.3 (2.8)	1.37 (14.46)	0.4 (4.24)	0.47 (3.3)	0.71 (4.96)	0.33 (1.66)	0.57 (2.87)	0.87 (5.27)	0.37 (2.24)	0.71 (6.36)	-

Region / District	Redgram		Chilly		Mango		Jowar		Tomato	
	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	-	-
Kodagu	-	-	-	-	-	-	-	-	-	-
Shivamogga	-	-	-	-	-	-	-	-	-	-
High Rainfall total	-	-	-	-	-	-	-	-	-	-
Chikkamagaluru	-	-	-	-	-	-	-	-	-	-
Hassan	-	-	-	-	-	-	-	-	-	-
Kolar	-	-	-	-	-	-	-	-	2.36 (2.25)	3.41 (3.25)
Moderate Rainfall total	-	-	-	-	-	-	-	-	2.36 (2.25)	3.41 (3.25)
Tumakuru	-	-	-	-	-	-	-	-	-	-
Ballari	-	-	0.38 (4.97)	0.35 (4.58)	-	-	0.77 (6.78)	0.67 (5.9)	-	-
Raichur	0.48 (6.64)	-	0.3 (3.38)	-	-	-	-	-	-	-
Low rainfall total	0.48 (6.64)	-	0.37 (4.4)	0.35 (4.21)	-	-	0.77 (6.78)	0.67 (5.9)	-	-
Grand Total	0.48 (6.64)	-	0.37 (4.4)	0.35 (4.21)	-	-	0.77 (6.78)	0.67 (5.9)	2.36 (2.25)	3.41 (3.25)

Source: Primary data collected during Aug-Sep, 2017

Annexure 7.12: Impact of Varuna Mitra Helpdesk Services on yield (un-irrigated)

Region / District	Arecanut		Coffee		Cotton		Paddy		Maize		Ragi	
	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)
Dakshina Kamada & Udupi	-	-	-	-	-	-	0.46 (3.83)	-	-	-	-	-
Kodegu	-	-	0.26 (4.3)	-	-	-	0.61 (5.81)	-	-	-	-	-
Shivamogga	-	-	-	-	-	-	-	-	1.6 (13)	0.43 (3.49)	-	-
High Rainfall total	-	-	0.26 (4.3)	-	-	-	0.52 (4.51)	-	1.6 (13)	0.43 (3.49)	-	-
Chikkamagaluru	-	-	-	-	-	-	-	-	0.81 (7.17)	0.41 (3.63)	0.57 (7.74)	-
Hassan	-	-	-	-	-	-	-	-	-	0.49 (4.34)	0.73 (8.4)	0.41 (4.72)
Kolar	-	-	-	-	-	-	-	-	-	-	0.91 (11.58)	0.53 (6.74)
Moderate Rainfall total	-	-	-	-	-	-	-	-	0.81 (7.17)	0.43 (3.81)	0.78 (9.34)	0.42 (5.06)
Tumakuru	-	-	-	-	-	-	-	-	-	-	0.79 (9.07)	0.62 (7.12)
Ballari	-	-	-	-	0.45 (5.19)	-	-	-	0.64 (4.92)	0.47 (3.62)	0.56 (7.41)	0.4 (5.29)
Raichur	-	-	-	-	0.45 (4.66)	0.48 (4.97)	-	-	-	-	-	-
Low rainfall total	-	-	-	-	0.45 (4.98)	0.48 (5.32)	-	-	0.64 (4.94)	0.47 (3.63)	0.78 (9.12)	0.58 (6.73)
Grand Total	-	-	0.26 (4.3)	-	0.45 (4.98)	0.48 (5.32)	0.52 (4.6)	-	0.83 (6.48)	0.45 (3.51)	0.78 (9.24)	0.45 (5.37)

Region / District	Redgram		Chilly		Mango		Jowar		Tomato	
	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)
Dakshina Kamada & Udupi	-	-	-	-	-	-	-	-	-	-
Kodegu	-	-	-	-	-	-	-	-	-	-
Shivamogga	-	-	-	-	-	-	-	-	-	-
High Rainfall total	-	-	-	-	-	-	-	-	-	-
Chikkamagaluru	-	-	-	-	-	-	-	-	-	-
Hassan	-	-	-	-	-	-	-	-	-	-
Kolar	-	-	-	-	1.2 (3.43)	-	-	-	-	-
Moderate Rainfall total	-	-	-	-	1.2 (3.43)	-	-	-	-	-
Tumakuru	-	-	-	-	-	-	-	-	-	-
Ballari	-	-	-	-	-	-	-	-	-	-
Raichur	0.26 (3.28)	-	-	-	-	-	0.38 (4.47)	-	-	-
Low rainfall total	0.26 (3.28)	-	-	-	-	-	0.38 (4.24)	-	-	-
Grand Total	0.26 (3.28)	-	-	-	1.2 (3.43)	-	0.38 (4.24)	-	-	-

Source: Primary data collected during Aug-Sep, 2017

Annexure 7.13: Distribution of farmers based on income component (Irrigated)

Region / District	Areca nut		Coffee		Cotton		Paddy		Maize		Ragi		Redgram	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	16.98	50.00	-	-	-	-	2.74	-	-	-	-	-	-	-
Kodagu	-	-	74.19	63.16	-	-	-	-	-	-	-	-	-	-
Shivamogga	52.83	50.00	-	-	-	-	54.79	-	20.00	-	-	-	-	-
High Rainfall total	69.81	100.00	74.19	63.16	-	-	57.53	-	20.00	-	-	-	-	-
Chikkamagaluru	22.64	-	25.81	36.84	-	-	5.48	-	10.00	-	-	-	-	-
Hassan	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kolar	-	-	-	-	-	-	-	-	-	-	81.25	-	-	-
Moderate Rainfall total	22.64	-	25.81	36.84	-	-	5.48	-	10.00	-	81.25	-	-	-
Tumakuru	7.55	-	-	-	-	-	4.11	-	-	-	18.75	-	-	-
Ballari	-	-	-	-	12.07	33.33	24.66	-	70.00	100.00	-	-	-	-
Raichur	-	-	-	-	87.93	66.67	8.22	-	-	-	-	-	100.00	100.00
Low rainfall total	7.55	-	-	-	100.00	100.00	36.99	-	70.00	100.00	18.75	-	100.00	100.00
Grand Total	106	6	31	19	58	6	73	-	10	14	16	-	8	6

Region / District	Chilli		Mango		Jowar		Tomato		Others		Total	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	1.00	-	4.93	4.23
Kodagu	-	-	-	-	-	-	-	-	25.00	46.67	11.27	26.76
Shivamogga	-	-	-	-	-	-	-	-	12.00	-	25.82	4.23
High Rainfall total	-	-	-	-	-	-	-	-	38.00	46.67	42.02	35.21
Chikkamagaluru	-	-	-	-	-	-	-	-	36.00	20.00	17.14	14.08
Hassan	-	-	-	-	-	-	-	-	11.00	26.67	2.58	5.63
Kolar	-	-	-	-	-	-	100.00	-	8.00	6.67	5.63	1.41
Moderate Rainfall total	-	-	-	-	-	-	100.00	-	55.00	53.33	25.35	21.13
Tumakuru	-	-	-	-	-	-	-	-	8.00	-	5.16	-
Ballari	83.33	100.00	-	-	100.00	-	-	-	3.00	-	12.44	29.58
Raichur	16.67	-	-	-	-	-	-	-	7.00	-	17.61	14.08
Low rainfall total	100.00	100.00	-	-	100.00	-	-	-	18.00	-	35.21	43.66
Grand Total	18	5	-	-	3	3	3	-	100	15	426	71

Source: Primary data collected during Aug-Sep, 2017

Annexure 7.14: Distribution of farmers based on income component (Unirrigated)

Region / District	Areca nut		Coffee		Cotton		Paddy		Maize		Ragi		Redgram	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	50.00	-	-	-	-	-	18.52	100.00	-	-	-	-	-	-
Kodagu	-	-	100.00	-	-	-	16.67	-	-	-	-	-	-	-
Shivamogga	50.00	-	-	-	-	-	46.30	-	-	-	-	-	-	-
High Rainfall total	100.00	-	100.00	-	-	-	81.48	100.00	-	-	-	-	-	-
Chikkamagaluru	-	-	-	-	-	-	18.52	-	-	-	1.64	-	-	-
Hassan	-	-	-	-	-	-	-	-	-	-	27.87	80.00	-	-
Kolar	-	-	-	-	-	-	-	-	-	-	24.59	20.00	-	-
Moderate Rainfall total	-	-	-	-	-	-	18.52	-	-	-	54.10	100.00	-	-
Tumakuru	-	-	-	-	-	-	-	-	-	-	40.98	-	-	-
Ballari	-	-	-	-	3.45	-	-	-	100.00	100.00	4.92	-	-	-
Raichur	-	-	-	-	96.55	100.00	-	-	-	-	-	-	100.00	100.00
Low rainfall total	-	-	-	-	100.00	100.00	-	-	100.00	100.00	45.90	-	100.00	100.00
Grand Total	6.00	-	11.00	-	29.00	7.00	54.00	30.00	5.00	8.00	61.00	10.00	8.00	10.00

Region / District	Chilli		Mango		Jowar		Tomato		Others		Total	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	3.60	-	5.78	29.70
Kodagu	-	-	-	-	-	-	-	-	-	-	6.80	-
Shivamogga	-	-	-	-	-	-	-	-	25.23	-	19.05	-
High Rainfall total	-	-	-	-	-	-	-	-	28.83	-	31.63	29.70
Chikkamagaluru	-	-	-	-	-	-	-	-	21.62	-	11.90	-
Hassan	-	-	-	-	-	-	-	-	19.82	48.57	13.27	24.75
Kolar	-	-	100.00	-	-	-	-	-	0.90	-	5.78	1.98
Moderate Rainfall total	-	-	100.00	-	-	-	-	-	33.33	77.14	27.55	36.63
Tumakuru	-	-	-	-	33.33	-	-	-	19.82	22.86	16.67	7.92
Ballari	100.00	-	-	-	33.33	-	-	-	3.60	-	5.78	7.92
Raichur	-	-	-	-	33.33	-	-	-	41.44	28.57	28.57	27.72
Low rainfall total	100.00	-	-	-	100.00	-	-	-	64.86	51.43	51.02	43.56
Grand Total	2.00	-	1.00	-	6.00	-	-	-	111.00	35.00	294.00	101.00

Source: Primary data collected during Aug-Sep, 2017

Annexure 7.15: Impact of Varuna Mitra Helpdesk Services on income component (Irrigation)

Region / District	Arecanut		Coffee		Cotton		Paddy		Maize		Ragi		Redgram	
	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)
Dakshina Kannada & Udupi	699 (0.27)	777 (0.3)	-	-	-	-	546 (5.22)	-	-	-	-	-	-	-
Kodagu	-	-	4105 (11.9)	2950 (8.55)	-	-	-	-	-	-	-	-	-	-
Shivamogga	4536 (1.66)	4540.61 (1.66)	-	-	-	-	470 (2.68)	-	942.5 (4.71)	-	-	-	-	-
High Rainfall total	3602.67 (1.38)	2658.81 (1.01)	4105 (11.9)	2950 (8.55)	-	-	473.62 (3.09)	-	942.5 (4.71)	-	-	-	-	-
Chikkamagaluru	3089 (1.39)	-	4735 (13.37)	4500 (12.71)	-	-	690 (5.99)	-	750 (10.71)	-	-	-	-	-
Hassan	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kolar	-	-	-	-	-	-	-	-	-	-	773.87 (4.63)	-	-	-
Moderate Rainfall total	3089 (1.41)	-	4735 (13.37)	4500 (12.71)	-	-	690 (5.92)	-	750 (10.71)	-	773.87 (4.63)	-	-	-
Tumakuru	2908 (1.74)	-	-	-	-	-	533 (3.56)	-	-	-	602.67 (4.19)	-	-	-
Ballari	-	-	-	-	2136 (7.33)	1856 (6.37)	673 (2.59)	-	888.52 (5.82)	387.63 (2.54)	-	-	-	-
Raichur	-	-	-	-	1862.7 (6.44)	1266.96 (4.38)	526 (1.98)	-	-	-	-	-	-	-
Low rainfall total	2908 (1.74)	-	-	-	1895.68 (6.54)	1463.31 (5.05)	624.78 (2.47)	-	888.52 (5.82)	387.63 (2.54)	602.67 (4.44)	-	576.12 (2.97)	377.36 (1.95)
Grand Total	3433.94 (1.4)	2658.81 (1.09)	4267.58 (12.2)	3521.05 (10.06)	1895.68 (6.54)	1463.31 (5.05)	541.38 (2.71)	-	885.46 (5.81)	487.63 (3.2)	198.02 (1.23)	-	576.12 (2.97)	377.36 (1.95)

Region / District	Chilli		Mango		Jowar		Tomato		Others		Total	
	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	900 (0.92)	-	694 (0.32)	777 (0.36)
Kodagu	-	-	-	-	-	-	-	-	684.29 (2.37)	521.42 (1.8)	2323.38 (7)	2055.26 (6.19)
Shivamogga	-	-	-	-	-	-	-	-	654 (1.28)	-	2568.63 (1.9)	4540.61 (3.36)
High Rainfall total	-	-	-	-	-	-	-	-	680.4 (1.72)	521.42 (1.32)	2282.93 (2.24)	2200.11 (2.16)
Chikkamagaluru	-	-	-	-	-	-	-	-	772.23 (2.66)	545 (1.87)	1963.37 (3.13)	3313.5 (5.28)
Hassan	-	-	-	-	-	-	-	-	541 (1.9)	354.78 (1.25)	541 (0.39)	354.78 (0.26)
Kolar	-	-	-	-	-	-	3375.03 (5.59)	-	528.92 (1.51)	204.7 (0.59)	1017.37 (2.18)	204.7 (0.44)
Moderate Rainfall total	-	-	-	-	-	-	3375.03 (5.59)	-	690.59 (2.18)	407.35 (1.28)	1608.28 (2.73)	2317.25 (3.93)
Tumakuru	-	-	-	-	-	-	-	-	774 (0.83)	-	1493.77 (1.61)	-
Ballari	1689.68 (5.06)	1420.99 (4.26)	-	-	588.9 (6.4)	-	-	-	461.79 (0.85)	-	1165.72 (3.99)	773.51 (2.65)
Raichur	1563 (4.57)	-	-	-	-	-	-	-	273.06 (1.09)	-	1458.17 (5.3)	733.2 (2.66)
Low rainfall total	1668.57 (5.99)	1720.99 (6.18)	-	-	588.9 (6.4)	-	-	-	527.16 (0.88)	-	1360.06 (4.18)	760.51 (2.34)
Grand Total	1668.57 (5.28)	1720.99 (5.44)	-	-	588.9 (6.4)	-	3375.03 (5.59)	-	733.27 (1.78)	460.58 (1.12)	1825.47 (2.96)	1616.02 (2.62)

Source: Primary data collected during Aug-Sep, 2017

Annexure 7.16: Impact of Varuna Mitra Helpdesk Services on income component

Region / District	Arecanut		Coffee		Cotton		Paddy		Maize		Ragi		Redgram	
	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)
Dakshina Kannada & Udupi	623 (0.49)	-	-	-	-	-	451.8 (4.41)	350 (3.42)	-	-	-	-	-	-
Kodagu	-	-	2152 (6.97)	-	-	-	406.23 (3.96)	-	-	-	-	-	-	-
Shivamogga	3124 (2.44)	-	-	-	-	-	325 (3.08)	-	-	-	-	-	-	-
High Rainfall total	1873.5 (1.38)	-	2152 (6.97)	-	-	-	370.43 (3.55)	350 (3.36)	-	-	-	-	-	-
Chikkamagaluru	-	-	-	-	-	-	427 (4.22)	-	-	-	320 (4.29)	-	-	-
Hassan	-	-	-	-	-	-	-	-	-	-	405.19 (5.82)	350 (5.02)	-	-
Kolar	-	-	-	-	-	-	-	-	-	-	494.09 (7.29)	385 (5.68)	-	-
Moderate Rainfall total	-	-	-	-	-	-	427 (4.22)	-	-	-	443.02 (6.41)	357 (5.16)	-	-
Tumakuru	-	-	-	-	-	-	-	-	-	-	371.3 (5.41)	-	-	-
Ballari	-	-	-	-	750.12 (4)	-	-	-	497.43 (4.01)	257.71 (2.08)	419.44 (5.38)	-	-	-
Raichur	-	-	-	-	958.82 (4.89)	707.62 (3.61)	-	-	-	-	-	-	983.23 (6.55)	318.05 (2.12)
Low rainfall total	-	-	-	-	951.62 (4.85)	707.62 (3.61)	-	-	497.43 (3.96)	257.71 (2.05)	376.46 (5.39)	-	983.23 (6.58)	318.05 (2.13)
Grand Total	1873.5 (1.37)	-	2152 (6.97)	-	951.62 (4.85)	707.62 (3.61)	192.02 (1.85)	150 (1.45)	497.43 (3.67)	257.71 (1.9)	412.47 (5.94)	357 (5.14)	983.23 (6.58)	318.05 (2.13)

Region / District	Chilli		Mango		Jowar		Tomato		Others		Total	
	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	250.01 (1.02)	-	434.53 (1.87)	350 (1.51)
Kodagu	-	-	-	-	-	-	-	-	-	-	1366.4 (5.07)	-
Shivamogga	-	-	-	-	-	-	-	-	861.45 (1.37)	-	743.17 (3.41)	-
High Rainfall total	-	-	-	-	-	-	-	-	785.02 (1.72)	-	820.78 (3.46)	350 (1.48)
Chikkamagaluru	-	-	-	-	-	-	-	-	422.72 (1.33)	-	421.01 (2.07)	-
Hassan	-	-	-	-	-	-	-	-	419.17 (2.42)	196.02 (1.13)	413.08 (3.41)	245.29 (2.03)
Kolar	-	-	1125 (2.5)	-	-	-	-	-	569.85 (1.49)	-	535.66 (2.4)	385 (1.72)
Moderate Rainfall total	-	-	1125 (2.5)	-	-	-	-	-	538.83 (2.4)	196.02 (0.87)	493.23 (2.95)	239.53 (1.43)
Tumakuru	-	-	-	-	-	-	-	-	185.59 (1.06)	308.35 (1.76)	290.52 (3.16)	308.35 (3.35)
Ballari	1250 (4.99)	-	-	-	355.56 (4.44)	-	-	-	238.89 (0.97)	-	509.55 (3.69)	257.71 (1.86)
Raichur	-	-	-	-	333 (2.77)	260 (2.16)	-	-	614.65 (3.1)	554.65 (2.8)	757.77 (4.14)	497.87 (2.72)
Low rainfall total	-	-	-	-	374.52 (3)	260 (2.09)	-	-	462.67 (2.32)	520.68 (2.61)	577 (3.81)	450.63 (2.98)
Grand Total	1250 (4.99)	-	1125 (2.5)	-	374.52 (3.05)	260 (2.12)	-	-	439.99 (1.84)	417.55 (1.74)	554.77 (3.18)	328.12 (1.88)

Source : Primary data collected during Aug-Sep. 2017

Annexure 7.17: Distribution of farmers based on Post-Harvest component (Irrigated)

Region / District	Areca nut		Coffee		Cotton		Paddy		Maize		Ragi		Redgram	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	42.86	15.00	-	-	-	-	-	2.70	-	-	-	-	-	-
Kodagu	-	-	32.00	55.56	-	-	-	-	-	-	-	-	-	-
Shivamogga	57.14	55.00	-	-	-	-	-	51.35	-	-	-	-	-	-
High Rainfall total	100.00	70.00	32.00	55.56	-	-	-	54.05	-	-	-	-	-	-
Chikkamagaluru	-	8.00	68.00	44.44	-	-	-	-	-	-	-	-	-	-
Hassan	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kolar	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Moderate Rainfall total	-	8.00	68.00	44.44	-	-	-	-	-	-	-	-	-	-
Tumakuru	-	22.00	-	-	-	-	-	8.11	-	-	-	-	-	-
Ballari	-	-	-	-	100.00	112.50	-	29.73	-	-	-	-	-	-
Raichur	-	-	-	-	-	62.50	-	8.11	-	-	-	-	-	-
Low rainfall total	-	22.00	-	-	100.00	100.00	-	45.95	-	-	-	-	-	-
Grand Total	7.00	100.00	25.00	90.00	1.00	8.00	-	37.00	-	-	-	-	-	-

Region / District	Chilli		Mango		Jowar		Tomato		Others		Total	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	-	-	5.26	4.52
Kodagu	-	-	-	-	-	-	-	-	-	3.81	14.04	15.26
Shivamogga	-	-	-	-	-	-	-	-	12.50	12.38	12.28	24.58
High Rainfall total	-	-	-	-	-	-	-	-	12.50	16.19	31.58	44.35
Chikkamagaluru	-	-	-	-	-	-	-	-	29.17	15.24	42.11	18.08
Hassan	-	-	-	-	-	-	-	-	25	14.29	10.53	4.24
Kolar	-	-	-	-	-	-	-	-	-	18.10	-	5.65
Moderate Rainfall total	-	-	-	-	-	-	-	-	54.17	47.62	52.63	27.96
Tumakuru	-	-	-	-	-	-	-	-	-	13.33	-	11.30
Ballari	-	75.00	-	-	-	-	-	-	12.50	7.62	7.02	10.45
Raichur	-	25.00	-	-	-	-	-	-	20.83	15.24	8.77	7.63
Low rainfall total	-	100.00	-	-	-	-	-	-	33.33	36.19	15.79	27.68
Grand Total	-	12.00	-	-	-	-	-	-	24	105	57	354

Source: Primary data collected during Aug-Sep, 2017

Annexure 7.18: Distribution of farmers based on Post-Harvest component (Unirrigated)

Region / District	Areca nut		Coffee		Cotton		Paddy		Maize		Ragi		Redgram	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	18.92	-	-	-	-	-	-
Kodagu	-	-	-	100.00	-	-	-	-	-	-	-	-	-	-
Shivamogga	-	100.00	-	-	-	-	-	67.57	-	-	-	-	-	-
High Rainfall total	-	100.00	-	100.00	-	-	-	86.49	-	-	-	-	-	-
Chikkamagaluru	-	-	-	-	-	-	-	13.51	-	-	-	-	-	-
Hassan	-	-	-	-	-	-	-	-	-	-	100.00	29.09	-	-
Kolar	-	-	-	-	-	-	-	-	-	-	-	4.55	-	-
Moderate Rainfall total	-	-	-	-	-	-	-	13.51	-	-	100.00	33.64	-	-
Tumakuru	-	-	-	-	-	-	-	-	-	-	-	62.73	-	-
Ballari	-	-	-	-	-	-	-	-	-	-	-	3.64	-	-
Raichur	-	-	-	-	100.00	100.00	-	-	-	-	-	-	-	100.00
Low rainfall total	-	-	-	-	100.00	100.00	-	-	-	-	-	66.36	-	100.00
Grand Total	-	1	-	29	1	100	-	37	-	3	14	110	-	9

Region / District	Chilli		Mango		Jowar		Tomato		Others		Total	
	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease	Increase	Decrease
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	-	-	-	1.76
Kodagu	-	-	-	-	-	-	-	-	-	11.58	-	10.05
Shivamogga	-	-	-	-	-	-	-	-	11.76	14.74	5.8	10.30
High Rainfall total	-	-	-	-	-	-	-	-	11.76	26.32	5.8	22.11
Chikkamagaluru	-	-	-	-	-	-	-	-	23.53	12.63	11.76	4.27
Hassan	-	-	-	-	-	-	-	-	23.53	13.68	52.94	11.31
Kolar	-	-	-	100.00	-	-	-	-	-	14.74	-	6.03
Moderate Rainfall total	-	-	-	100.00	-	-	-	-	47.06	41.05	64.71	21.61
Tumakuru	-	-	-	-	-	-	-	-	-	7.37	-	19.35
Ballari	-	100.00	-	-	-	60.00	-	-	17.65	14.74	8.82	6.53
Raichur	-	-	-	-	100.00	40.00	-	-	23.53	10.53	20.59	30.40
Low rainfall total	-	100.00	-	-	100.00	100.00	-	-	41.18	32.63	29.41	56.28
Grand Total	-	4	-	5	2	5	-	-	17	95	34	398

Source: Primary data collected during Aug-Sep, 2017

Annexure 7.19: Impact of Varuna Mitra Helpdesk Services on post-harvest component (Irrigated)

Region / District	Arecanut		Coffee		Cotton	Paddy	Maize	Ragi
	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)
Dakshina Kannada & Udupi	0.29 (2.58)	0.4 (3.56)	-	-	-	0.48 (3)	-	-
Kodagu	-	-	1.2 (12.07)	1.49 (14.99)	-	-	-	-
Shivamogga	0.25 (2.28)	0.33 (3.01)	-	-	-	0.62 (3.18)	-	-
High Rainfall total	0.27 (2.4)	0.34 (3.08)	1.2 (12.07)	1.49 (14.99)	-	0.61 (3.33)	-	-
Chikkamagaluru	-	0.23 (2.22)	1.21 (13.41)	1.8 (19.96)	-	-	-	-
Hassan	-	-	-	-	-	-	-	-
Kolar	-	-	-	-	-	-	-	0.4 (3.53)
Moderate Rainfall total	-	0.23 (2.26)	1.21 (13.41)	1.8 (19.96)	-	-	-	0.4 (3.53)
Tumakuru	-	0.38 (4.61)	-	-	-	0.46 (2.83)	-	0.64 (6.32)
Ballari	-	-	-	-	0.68 (4.68)	0.73 (3.17)	-	-
Raichur	-	-	-	-	1.01 (7.09)	0.48 (2.07)	-	-
Low rainfall total	-	0.38 (4.61)	-	-	0.89 (6.19)	0.64 (2.83)	0 (0)	0.64 (6.09)
Grand Total	0.27 (2.5)	0.34 (3.2)	1.21 (12.78)	1.63 (17.24)	0.89 (6.19)	0.62 (3.15)	0 (0)	0.52 (4.66)

Region / District	Redgram		Chilli		Mango		Jowar		Tomato	
	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	-	-
Kodagu	-	-	-	-	-	-	-	-	-	-
Shivamogga	-	-	-	-	-	-	-	-	-	-
High Rainfall total	-	-	-	-	-	-	-	-	-	-
Chikkamagaluru	-	-	-	-	-	-	-	-	-	-
Hassan	-	-	-	-	-	-	-	-	-	-
Kolar	-	-	-	-	-	-	-	-	-	-
Moderate Rainfall total	-	-	-	-	-	-	-	-	-	-
Tumakuru	-	-	-	-	-	-	-	-	-	-
Ballari	-	-	-	0.58 (7.59)	-	-	-	-	-	-
Raichur	-	-	-	0.99 (11.14)	-	-	-	-	-	-
Low rainfall total	-	-	-	0.68 (8.21)	-	-	-	-	-	-
Grand Total	-	-	-	0.68 (8.21)	-	-	-	-	-	-

Source: Primary data collected during Aug-Sep, 2017

Annexure 7.20: Impact of Varuna Mitra Helpdesk Services on post-harvest component (un-irrigated)

Region / District	Areca nut		Coffee		Cotton		Paddy		Maize		Ragi	
	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	0.53 (4.42)	-	-	-	-
Kodagu	-	-	-	0.4 (6.62)	-	-	-	-	-	-	-	-
Shivamogga	-	0.22 (3.35)	-	-	-	-	-	0.65 (5.65)	-	0.6 (4.87)	-	-
High Rainfall total	-	0.22 (3.48)	-	0.4 (6.62)	-	-	-	0.62 (5.39)	-	0.6 (4.87)	-	-
Chikkamagaluru	-	-	-	-	-	-	-	0.68 (6.6)	-	-	-	-
Hassan	-	-	-	-	-	-	-	-	-	-	0.79 (9.09)	1.09 (12.54)
Kolar	-	-	-	-	-	-	-	-	-	-	0 (0)	0.27 (3.44)
Moderate Rainfall total	-	-	-	-	-	-	-	0.68 (6.6)	-	-	0.79 (9.46)	0.97 (11.73)
Tumakuru	-	-	-	-	-	-	-	-	-	0.24 (2.11)	0 (0)	0.11 (1.26)
Ballari	-	-	-	-	-	-	-	-	-	0.21 (1.62)	0 (0)	0.25 (3.31)
Raichur	-	-	-	-	1.2 (12.41)	0.33 (3.41)	-	-	-	-	-	-
Low rainfall total	-	-	-	-	1.2 (13.29)	0.33 (3.65)	-	-	-	0.23 (1.74)	0 (0)	0.12 (1.37)
Grand Total	-	0.22 (3.48)	-	0.4 (6.62)	1.2 (13.29)	0.33 (3.65)	-	0.63 (5.58)	-	0.35 (2.73)	0.79 (9.36)	0.41 (4.82)

Region / District	Redgram		Chilli		Mango		Jowar		Tomato	
	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)	Increase (%)	Decrease (%)
Dakshina Kannada & Udupi	-	-	-	-	-	-	-	-	-	-
Kodagu	-	-	-	-	-	-	-	-	-	-
Shivamogga	-	-	-	-	-	-	-	-	-	-
High Rainfall total	-	-	-	-	-	-	-	-	-	-
Chikkamagaluru	-	-	-	-	-	-	-	-	-	-
Hassan	-	-	-	-	-	-	-	-	-	-
Kolar	-	-	-	-	0.84 (2.4)	-	-	-	-	-
Moderate Rainfall total	-	-	-	-	0.84 (2.4)	-	-	-	-	-
Tumakuru	-	-	-	-	-	-	-	-	-	-
Ballari	-	-	-	0.44 (6)	-	-	-	0.45 (5.42)	-	-
Raichur	-	0.28 (3.54)	-	-	-	-	0.56 (6.59)	0.56 (6.59)	-	-
Low rainfall total	-	0.28 (3.53)	-	-	-	-	0.56 (6.25)	0.49 (5.51)	-	-
Grand Total	-	0.28 (3.53)	-	0.44 (6)	0.84 (2.4)	-	0.56 (6.25)	0.49 (5.51)	-	-

Source: Primary data collected during Aug-Sep, 2017

Annexure 7.21: Net gain realised across crops (Irrigated)

Region / District	Crop categories (Rs)												
	Arecanut	Coffee	Cotton	Paddy	Maize	Ragi	Redgram	Chilli	Mango	Jowar	Tomato	Others	Overall
Dakshina Kannada & Udupi	10503.14	-	-	2014.28	-	-	-	-	-	-	-	1900	6153.29
Kodagu	-	12471.62	-	-	-	-	-	-	-	-	-	10968.72	6549.45
Shivamogga	12312.18	-	-	2173.75	942.5	-	-	-	-	-	-	5568.84	4214.43
High Rainfall total	12537.17	12471.62	-	2175.05	942.5	-	-	-	-	-	-	3831.35	5136.81
Chikkamagaluru	8681.6	8047.29	-	1138.33	750	-	-	-	-	-	-	1861.89	3400.5
Hassan	403	-	-	-	-	2591.78	-	-	-	-	-	302.13	705.13
Kolar	-	-	-	-	-	1614.52	-	-	-	-	4337.8	5465.55	5455.04
Moderate Rainfall total	8729.99	8047.29	-	1138.33	750	3878.84	-	-	-	-	4337.8	4261.31	4196.44
Tumakuru	12035.18	-	-	1954.31	-	466.23	-	-	-	-	-	7008.78	5509.69
Ballari	-	-	3810.6	3132.62	721.08	494.89	-	7232.98	-	4042.25	-	11513.31	7704.54
Raichur	-	-	6534.46	2426.31	-	-	750.82	8861.96	-	-	-	6094.45	5471.61
Low rainfall total	12035.18	-	4256.91	2816.25	721.08	484.3	750.82	7260.76	-	4042.25	-	8975.1	6295.7
Grand Total	12757.59	10661.26	4256.91	2869.5	767.82	2927.41	750.82	7260.76	-	588.9	4337.8	4886.27	5176.99

Source: Primary data collected during Aug-Sep, 2017

Annexure 7.2.2: Net gain realised across crops (Unirrigated)

Region / District	Crop categories (Rs.)												
	Arecanut	Coffee	Colton	Paddy	Maize	Ragi	Redgram	Chilli	Mango	Jowar	Tomato	Others	Overall
Dakshina Kannada & Udupi	623.00	-	-	1564.84	-	-	-	-	-	-	-	415.29	1729.45
Kodagu	-	13534.84	-	406.23	-	-	-	-	-	-	-	-	9082.42
Shivamogga	11005.00	-	-	2416.76	2374.61	-	-	-	-	-	-	4363.76	2826.95
High Rainfall total	7251.54	13534.84	-	2201.05	2374.61	-	-	-	-	-	-	4178.51	4556.11
Chikkamagaluru	-	-	-	1906.96	-	320.00	-	-	-	-	-	4995.86	3720.59
Hassan	-	-	-	-	-	2755.31	-	-	-	-	-	3760.17	1921.10
Kolar	470.00	-	-	-	-	1572.70	-	-	3618.95	-	-	811.79	1699.64
Moderate Rainfall total	-	-	-	1906.96	-	3703.32	-	-	3618.95	-	-	3962.34	2040.15
Tumakuru	-	-	-	-	523.01	1047.82	-	-	-	935.00	-	4639.05	813.36
Ballari	-	-	1916.77	-	985.28	914.33	-	4820.00	-	972.39	-	862.25	1884.06
Raichur	5399.93	-	2177.52	-	-	-	1119.80	-	-	635.33	-	2165.98	6348.70
Low rainfall total	2526.80	-	2188.91	-	1020.76	1071.05	1119.80	1250.00	-	909.23	-	1717.55	2633.85
Grand Total	4400.30	13534.84	2188.91	2160.13	1271.81	3073.09	1119.80	4820.00	3618.95	909.23	-	3498.51	2750.65

Source: Primary data collected during Aug-Sep, 2017

Annexure 7.23: Net yield realised across crops (Irrigated)

Region / District	Crop categories (q)										
	Arecanut	Coffee	Cotton	Paddy	Maize	Ragi	Redgram	Chilli	Mango	Jowar	Tomato
Dakshina Kannada & Udupi	0.30	-	-	0.66	-	-	-	-	-	-	-
Kodagu	-	0.58	-	-	-	-	-	-	-	-	-
Shivamogga	-	-	-	0.39	1.33	-	-	-	-	-	-
High Rainfall total	0.30	0.58	-	0.44	1.33	-	-	-	-	-	-
Chikkamagaluru	0.48	1.71	-	0.32	0.89	-	-	-	-	-	-
Hassan	0.16	-	-	-	-	-	-	-	-	-	-
Kolar	-	-	-	0.56	-	0.67	-	-	-	-	1.59
Moderate Rainfall total	0.45	1.71	-	0.35	0.89	0.67	-	-	-	-	1.59
Tumakuru	0.15	-	-	0.24	-	0.81	-	-	-	-	-
Ballari	-	-	0.31	0.16	0.24	-	-	0.16	-	0.05	-
Raichur	-	-	0.38	0.25	-	-	0.48	0.30	-	-	-
Low rainfall total	0.15	-	0.37	0.21	0.24	0.81	0.48	0.18	-	0.05	-
Grand Total	0.40	0.92	0.37	0.31	0.46	0.71	0.48	0.18	-	0.05	1.59

Source: Primary data collected during Aug-Sep, 2017

Annexure 7.24: Net yield realised across crops (Un-Irrigated)

Region / District	Crop categories (q)										
	Arecanut	Coffee	Cotton	Paddy	Maize	Ragi	Redgram	Chilli	Mango	Jowar	Tomato
Dakshina Kannada & Udupi	-	-	-	0.46	-	-	-	-	-	-	-
Kodagu	-	0.26	-	0.61	-	-	-	-	-	-	-
Shivamogga	-	-	-	-	1.06	-	-	-	-	-	-
High Rainfall total	-	0.26	-	0.52	1.06	-	-	-	-	-	-
Chikkamagaluru	-	-	-	-	0.54	0.57	-	-	-	-	-
Hassan	-	-	-	-	-	0.30	-	-	-	-	-
Kolar	-	-	-	-	-	0.72	-	-	1.20	-	-
Moderate Rainfall total	-	-	-	-	0.54	0.40	-	-	1.20	-	-
Tumakuru	-	-	-	-	-	0.59	-	-	-	-	-
Ballari	-	-	0.45	-	0.30	0.08	-	-	-	-	-
Raichur	-	-	0.26	-	-	-	0.26	-	-	0.38	-
Low rainfall total	-	-	0.26	-	0.30	0.55	0.26	-	-	-	-
Grand Total	-	0.26	0.26	0.52	0.41	0.45	0.26	-	1.20	0.38	-

Source: Primary data collected during Aug-Sep, 2017

Annexure 8.1: Command Area of Tele Metric Rain Gauges and Tele Metric Weather Stations

District	Grama panchayat	Hoblis	Geographical Area	Installed TRG	TWS's	Average Area covered by TRG (Sq. Km.)	Average Area covered by TWS (Sq. Km.)
Bengaluru Urban	86	17	2,196	195	19	11.3	115.6
Bengaluru Rural	98	17	2298	108	17	21.3	135.2
Ramanagara	130	18	3516	132	18	26.6	195.3
Kolar	156	27	3979	161	27	24.7	147.4
Chikkaballapura	151	26	4244	164	26	25.9	163.2
Tumakuru	321	50	10597	341	83	31.1	127.7
Chitradurga	185	22	8436	190	23	44.4	366.8
Davanagere	230	24	5924	236	37	25.1	160.1
Chamarajanagara	120	16	5648	119	24	47.5	235.3
Mysuru	235	33	6307	278	31	22.7	203.5
Mandya	232	31	4962	239	30	20.8	165.4
Ballari	189	27	8461	211	27	40.1	313.4
Koppala	134	20	5570	162	29	34.4	192.1
Raichur	164	37	8442	189	53	44.7	159.3
Kalaburagi	220	32	10954	248	55	44.2	199.2
Bidar	175	30	5448	192	42	28.4	129.7
Belagavi	485	35	13433	507	35	26.5	383.8
Bagalkote	161	18	6552	211	18	31.1	364.0
Vijayapura	199	18	10498	225	40	46.7	262.5
Gadag	106	11	4657	214	26	21.8	179.1
Haveri	208	19	4823	215	19	22.4	253.8
Dharwad	127	14	4260	149	15	28.6	284.0
Shivamogga	260	40	8478	258	39	32.9	217.4
Hassan	258	38	6814	274	38	24.9	179.3
Chikkamagaluru	226	34	7202	230	43	31.3	167.5
Kodagu	98	16	4102	102	16	40.2	256.4
Dakshina Kannada	203	17	4861	223	17	21.8	285.9
Udupi	146	9	3582	157	9	22.8	398.0
Uttara Kannada	207	35	10277	237	35	43.4	293.6
Yadgir	117	16	5270	120	29	43.9	181.7
State	5627	747	191791	6287	920	30.7	208.5

Source: KSNMDC



Inception meeting
28th June 2017



Final Discussion Meeting
23rd May 2018





Agricultural Development and Rural Transformation Centre
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