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# ICT Intervention in the Socio-Economic Development of Udupi Jasmine

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## Abstract

Jasmine growing community in coastal Karnataka of India is a successful viable community-based enterprise. For this community despite having other sources of income, jasmine cultivation has provided them with a sustained regular income. It safeguards them against poverty even if their other sources of income diminish. This study explores the areas in this community-based enterprise where information and communication technology (ICT) can be integrated. Thus, focus of the study was to visualize how this community-based enterprise works, understand the challenges faced and to provide possible ICT solution to overcome these challenges. ICT awareness among the growers and agents involved in the supply chain was also captured. Willingness of accepting ICT among the agents was analyzed using logistic regression and K-NN classifier machine learning models. Study showed a significant socio-economic impact of jasmine production on growers. To overcome the challenges faced, ICT solutions are proposed in place of current crude system.

## Keywords

Udupi jasmine, ICT, community-based enterprise, socio-economic, policy making, agriculture.

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## Introduction

India is one of the centers of origin of jasmine. The genus Jasminum is reported to comprise of 500 species. A critical analysis of these species, however, has revealed the number of true species to be only 89, of which 40 inhabit the Indian sub-continent (Lakshmi and Ganga, 2017). Udupi Jasmine which has got a Geographical Indication Tag is one of these species belongs to Jasminum Sambac–1 species of jasmine (Ashok and Sarma, 2016). Majority of the Udupi jasmine is grown in the Shankarapura region of Udupi district of coastal Karnataka, India. Udupi jasmine is coveted for its exquisite scent. It is a favored flower in ceremonial events and for personal use. Udupi jasmine flower growing community of coastal Karnataka have maintained a community-based enterprise for more than 85 years. Many of the farmers of this region depend directly on cultivation of Udupi jasmine for their livelihood (Krishnamurthy et al., 1995). With efficient system of pricing and distribution, trust and cooperation among the community and an accepted method of matching demand and supply just by thumb rule, the community has kept poverty away for nearly three generations.

In an era where information and communication technology (ICT) is pervading in all service sectors and business development models (Kramer et al., 2007) keeping up with the demands of this digitally driven market becomes crucial for surviving one's business. Access to information has increased considerably due to the usage of mobile phones. The number of mobile phones per 100 people in developing countries often exceeds access to other information technologies, such as landlines (Jensen, 2010), newspapers, and radios. ICT in agriculture have the potential to facilitate greater access to information that drive or support knowledge sharing. The application of ICT can play a pivotal role in efficient dissemination of information. ICT can deliver fast, reliable and accurate information in a user-friendly manner for practical utilization by the end user (USAID, 2010). The growth of ICT in developing countries offers a new technology and new opportunities for accessing information.

One of the mechanisms is sharing information via agricultural extension, which has long been plagued with problems related to scale, sustainability, relevance, and responsiveness (Aker, 2011). Although its application is evolving in the agriculture sector, ICT has demonstrated its ability to reach the farmer community (Ali and Kumar, 2011).

ICTs in agriculture have the potential to facilitate greater access to information that drive or support knowledge sharing. ICTs essentially facilitates the creation, management, storage, retrieval, and dissemination of any relevant data, knowledge, and information that may have been already been processed and adapted (Batchelor, 2002; Chapman and Slaymaker, 2002; Rao, 2007; Heeks, 2002). There are several instances in India where ICT has been used to improve the agricultural system. The application of ICT in Madhya Pradesh, Uttar Pradesh and Tamil Nadu among farmers have helped them in reducing transaction cost that involved information acquisition and facilitating transactions in input and output markets (Adhiguru and Devi, 2012). Similarly, in Uttar Pradesh use of ICT by life stock farmers has helped them to make better decisions than non-ICT users (Ali, 2011). In a study, (Jensen, 2007) shows, using micro-level survey data, that the adoption of mobile phones by fishermen and wholesalers in South India is associated with a dramatic reduction in price dispersion, the complete elimination of waste and an increase in both consumer and producer welfare. This paper presents robust empirical evidence that information improves the functioning of rural markets by increasing the competitiveness of buyers.

The way in which ICT projects access, assess, apply, and deliver content may increase the likelihood of ICT use by farmers and thus may become an important factor in a project's success. To address the information needs of farmers, relevant content is a key component of ICT projects. The extent to which content is customized and localized to a farmer's condition influences its relevance (Glendenning and Ficarelli, 2011). Local content has been defined as content that is intended for a specific local audience, as defined by geographic location, culture, or language or as content that is socially, culturally, economically, and politically relevant to a given society (Glendenning and Ficarelli, 2011). Hence localization of content is important, where a question and answer approach or the direct involvement of users in content production can improve such localization. The content sources tend to be local experts and organizations with expert local knowledge. This can support localization of content (Glendenning and Ficarelli, 2011).

Udupi jasmine is synonymous with Udupi district and is an important aspect of life for the actors associated with it. Thus, the present study was envisaged to analyze the working of this local enterprise, identify the key correspondents that drive this enterprise and check for the socio-economic impact of jasmine cultivation.

This would also shed light in understanding the challenges faced by the key correspondents involved. Thus, the convergence of the study is to provide necessary ICT intervention to overcome these challenges which in turn would help in the socio-economic development of Udupi Jasmine.

## Materials and methods

The study was conducted in Udupi Jasmine growing regions of Shirva, Shankarapura, Belle (Moodubelle and Padubelle) of Udupi district, India. The correspondents for the study were Jasmine growers, agents and traders. In total 240 growers, 95 agents and 6 traders were identified. Snowballing technique was employed to identify the correspondents.

Interactions based on personal interview was conducted to understand the working of the whole system and how the actors played their role in the system. Various challenges were identified with these interactions. To understand the socio-economic impact of jasmine on growers and to gauge the awareness of ICT among the grower's community relevant questionnaire was used. Variables such as involvement of family members, total land used for cultivation, average income per week, jasmine cultivation as primary source of income and employment were identified to understand the socio-economic impact. For ICT awareness, variables such as availability and usage of smartphones, internet access and usage, mode of communication for price details and knowledge of using computers were used.

For the agents a separate questionnaire was used to understand the knowledge of ICT and their willingness to adopt ICT in the existing system. Variables identified were type of phone used, knowledge to use SMS facility, use of mobile banking services, social network, knowledge of computers, mobile banking services and willingness to automate the existing system. Logistic regression and K-NN classifier are best

suited prediction models on linearly separable data set. As the data set consists of linearly separable variables, Logistic regression and K-NN classifier predication models was used to predict the willingness of agents to automate the existing system.

### System overview

The first approach to this study was to understand the working of this whole enterprise. The excerpt of the working of the enterprise is given below:

Jasmine crop is a year-round crop and it mostly involves the entire family. Jasmine buds are collected and tied together to a 6-inch chain approximately. Then they are wrapped in banana leaves with a slip containing information like household name, number of buds put inside. This entire process is finished by 10 am. This proves advantages to the growers as they can tend to other jobs. From here these bundles of tied buds are collected by agents. Each household is connected to one among 150 agents who operate in the Shankarapura area.

Responsibility of the agent is to collect the buds from the household and then arranging them for commercial units called as "chendu" comprising of 800 - 805 buds each. Four "chendus" make one "atte" (bundle) for which price is fixed by traders each day. As not all households will be able to produce a unit (chendu) with desired number of buds, the agents form these units with whatever buds they have collected from multiple households. Each agent is connected to multiple households from whom they collect these buds. The agents also collect the slips of each household and are stored in a small plastic Box. A separate book is also maintained with the information of each farmer and price to be given for that day. Every seven days the farmer gets the payment based on the flowers supplied.

Once the agents create these commercial units, they are then given to a designated trader in Shankarapura. The traders sell the collected units from agents to wholesale dealers from outside the region. These units reach wholesalers as far as Mumbai and Dubai. The traders keep track of the units received from agents and appropriate payments are made to them on weekly basis. Everyday units arrive Shankarapura by 11 a.m. There are 6 traders who operate from Shankarapura region who contact their wholesalers across the country to determine the demand for the day. Once the demand is established the six traders determine the price and the amount that they need to pay for each unit to the growers.

There is a unique method in determining daily price for one "atte" (bundle) of jasmine. For example, one of the 6 traders based on the demand from his wholesalers establishes a price X for that day. If this price X is not acceptable by the wholesalers of other 5 traders, they decrease their demand. So, these 5 traders are left with excess supply of jasmine for that day. The price X will be agreed upon by the other 5 traders only if the trader who quoted price X agrees to buy the excess supply that remaining 5 traders have. Hence the 6 traders with negotiations on price X and will reach on a consensus in establishing a price for jasmine for that day. The overall price for jasmine for that day is determined on the demand the 6 traders receive from their wholesalers. The wholesalers purchase decision depends on the overall market demand. Based on the demand and the supply for that day, price to be given to the growers is determined. The traders pay the agents on the amount of buds received. Finally, growers receive appropriate payments on weekly basis from the agents who keep track of the grower's produce. This process has been followed for decades is still in practice.

## Results and discussion

### Scio-economic impact and ICT awareness

The socio-economic impact of Jasmine cultivation and the ICT awareness among growers analyzed through questioner and the results in percentage is shown in Table 1.

Jasmine cultivation has a significant impact on the socio-economic development of growers. It provides full time employment for nearly 46.17% of the growers and for more than half (51.9%) of the of the growers it serves as a primary source of income. Even with small land holdings (<2178 sq. Ft.) jasmine cultivation proves to be a significant source of income for majority of the growers (71.7%).

ICT awareness among growers was found to be significantly low. Majority (84.75%) of the growers used feature phones for daily use, hence the knowledge of internet usage was considerably low (9.17%).

Similarly, the agents were subjected to a questionnaire about their ICT awareness and willingness to adopt ICT in the existing system. The results in percentage are shown in Table 2. Among agent's ICT awareness was found to be

considerably high. Majority (91.5%) of the agents used smartphones for daily transactions and usage. Most of the agents (92.6%) were active on social networking applications available on smartphones. Significant ICT awareness among agents and the role they played in the enterprise provides ample opportunity for ICT interventions.

| | Category | Percentage |
|---|---|---|
| Involvement of family members in Jasmine cultivation | Husband & Wife | 45.64 |
| | All | 55 |
| Total land used | Small (<2178 sq. Ft.) | 43.33 |
| | Medium (2178 - 4356 sq. Ft.) | 36.67 |
| | Large (>4356 sq. Ft.) | 20 |
| Average income per week | < ₹. 2000 | 71.7 |
| | ₹. 2000 – ₹.3000 | 16.52 |
| | > ₹. 3000 | 11.78 |
| Jasmine cultivation as a source of income | Primary | 51.9 |
| | Secondary | 48.1 |
| Jasmine cultivation as a source of employment | Full time | 46.17 |
| | Part time | 42.16 |
| | Hobby | 11.67 |
| Availability and Usage of smartphones | Personally | 15.25 |
| | Someone in family | 84.75 |
| Internet access and usage | Yes | 9.17 |
| | No | 90.83 |
| Contacting Agents/traders for price details | Calls | 88.64 |
| | SMS | 11.36 |
| Knowledge of using computers | Yes | 4.7 |
| | No | 95.3 |

Source: own research and processing

Table 1: Socio-economic impact and ICT awareness among growers. (N=240).

| | Category | Percentage |
|---|---|---|
| Type of phone used | Smart phone | 91.5 |
| | Featured phone | 8.5 |
| Knowledge to use SMS facility | Yes | 100 |
| | No | 0 |
| Mode of Contact with respect to Farmer/ Trader | Call | 100 |
| | SMS | 0 |
| Usage of Mobile Banking services | Yes | 1 |
| | No | 99 |
| Use of social networking using mobile phones. | Yes | 92.6 |
| | No | 7.4 |
| Online purchases using mobile phones. | Yes | 4.3 |
| | No | 95.7 |
| Knowledge of using computers | Yes | 5.3 |
| | No | 94.7 |
| Opinion on whether they will use mobile app to automate their current process | Yes | 87 |
| | No | 13 |

Source: own research and processing

Table 2: ICT awareness and willingness to adopt ICT among agents. (N = 95).

### Identification of challenges

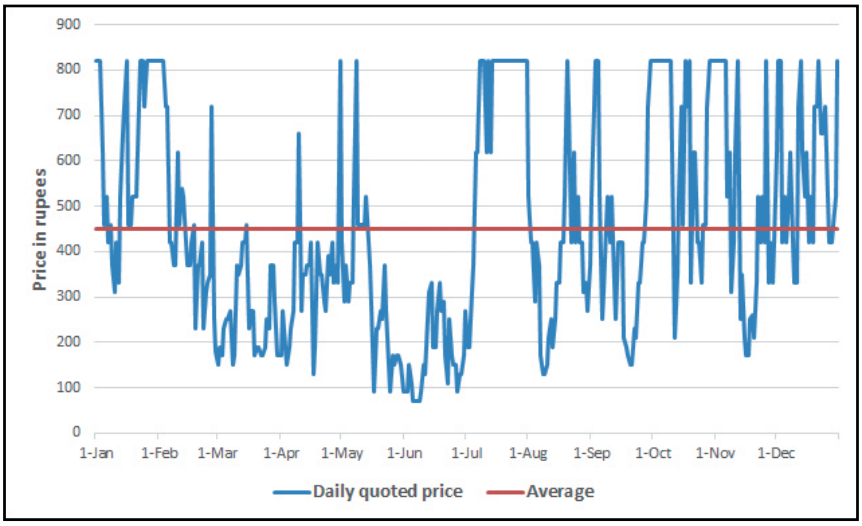
1. Generally, 88.64% of communication between the growers and agents/traders is done through calls and usually it's for price information which is quite difficult to manage on daily basis. Growers lively hood depends on the price that they get on the jasmine production for that day. For more than half (51.9%) of the correspondent's jasmine cultivation serves as primary source of income. Growers have no control on the price decision, collection and on the distribution of jasmine trade. Decision on the price for that day lies entirely on the six traders which leaves the grower particularly exposed. This makes the growers condition particularly vulnerable. While taking the daily price for one "atte" (bundle) of jasmine for the year 2016 (Graph 1), it was seen that maximum price received was ₹. 820 and minimum was ₹. 70. So, on an average, grower gets a sum of ₹. 448 (SD=235.12). Price fluctuation is major cause of worry as this impacts the socio-economic status of growers.
2. There are no digital records of information of jasmine grower and daily jasmine production. Electronic data storage is more efficient and important for reasons such as policy making, timely intervention in farming practices etc.
3. Agents find it difficult to manage data such as amount to be paid to growers, quantity of jasmine produced on daily basis etc., as the data is stored on a hard copy. Digitizing records is an essential step in moving towards harnessing the potential of ICT.

### ICT as a solution

The rate at which technology innovations like the internet information is adopted by consumers constitutes an important part of the technology change or integration (Jamaluddin, 2013). Availability of timely information can enhance quality decisions made by farmers on what crops to grow given the preceding weather conditions, resources available, and market place supply chain. The use and availability of ICT can be used to improve agricultural productivity of farmers (Glendenning and Ficarelli, 2011). It is strongly believed and has been demonstrated that ICTs, primarily mobile phones, have the potential to reduce information asymmetry and can play a role in facilitating the adoption of technologies community (Ali and Kumar, 2011). ICT can be used as an effective tool to cater to the challenges found in the study.

### Communication between growers and agents/ traders

Communication is a corner stone for any enterprise to flourish. Majority (88.64%) of the growers used call feature as a primary source of contact. This is tedious on daily basis for the agents and traders to receive calls and communicate during the peak working time. Price updates can be given to growers through a mobile application but only 15.25% of growers used smart phones personally. When most of the growers use feature phones, sending SMS to all the growers regarding price information seemed to be a more viable solution.




Source: own research and processing

Graph 1: Jasmine price variation in the year 2016.

This can be achieved using a SMS application, based on python using raspberry pie. GSM Module is interfaced to raspberry-pie to send SMS to growers on prices daily as soon as the price is decided. The same information can also be stored in the system for future analysis. The entire SMS module is cost effective to build and can be easily deployed.

**Need to create demand for a stable price**

Presently the system relies heavily on the 6 traders for demand and fixing of price. Price fluctuations (as discussed in identification of challenges) is a major cause of worry as it has a significant impact on the socio-economic development of growers. Along with the traders if the agents too can quote their demand then price fluctuations can be minimized. Demand can be increase if product is made available for a larger set of customers.

ICT gives an opportunity (with finite framework investment) to link individual actors in the jasmine growing chain together irrespective of their location. This has the potential to increase market access through online transactions exposing the market to a wide range of customer across geographic locations. E-Commerce may offer solutions by integrating individual actors to improve organizational structures. Many aspects of business, even at the farm level, may be managed through the Internet. The advantage of an e-Marketplace is their ability to replicate offline behavior online. This is achieved by offering a range of applications tailored to meet the needs of both target buyers and sellers (Paul. 2001). An e-commerce model for jasmine can be developed where jasmine will be available for general customers online as well as retailers of other districts and states. Using the available data from the study conducted e-commerce model can be easily developed.

Digital repository

One of the biggest benefits agricultural community can get is through statistical analysis of growing pattern, increase or decrease in production of their agricultural products. The present system does not have a database of Jasmine farmers and their agricultural output.

There are two ways to create and maintain this database using ICT:

1. Involve Jasmine growers to update their daily agricultural outputs.
2. Involve agents to update the grower's agricultural outputs.

Involvement of grower poses several practical difficulties:

1. ICT awareness among farmers is very less. Majority (84.75%) of the growers do not use smart phones and nearly 90.83% them do not know about internet usage.
2. There is no motivational factor for them to update flower quantity data on daily basis as it is not necessary for them.
3. It's practically difficult to identify all farmers and persuade them to give this information.

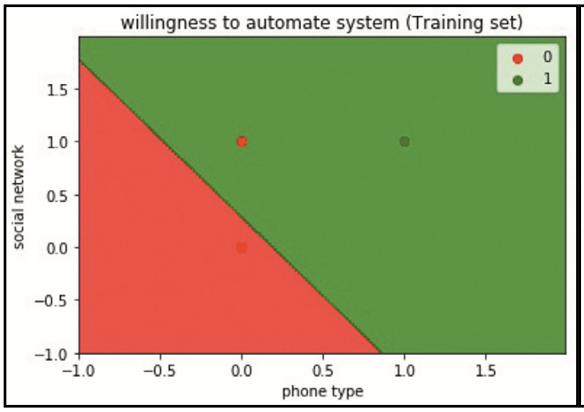
On the other hand, involving the agents would be a better approach. The following reasons can be taken into considerations of taking this approach:

1. The agents collect information about the daily quantity of jasmine produced by the growers. Although this data is in written format it can be converted into digital format.
2. Nearly 91.5% of the agents use smartphones and they have significant level of awareness in usage.

To classify and predict the willingness of agents to automate the existing system using ICT, Logistic regression and K-NN classifier machine learning algorithms was used on the data set. The results are shown in Figure 1 and Figure 2.

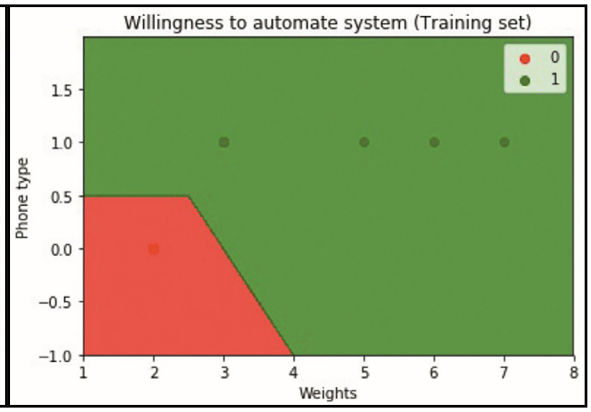
Logistic Regression model was used, where phone type and social network vs willing to automate are taken as variables. Here phone type and Social network are taken as independent variables and willingness to automate is taken as dependent variable. The result is shown in Figure 1. Similarly, in Figure 2, shows the graph where K-NN model is used. Here phone type, the average of the all the other variables except willingness to automate are considered as weights and are taken as independent variables. Willingness to automate is taken as dependent variable. From both the prediction models (Figure 1 and 2) there is a clear (green section) indication that the probability for the willingness of agents to use ICT to automate the existing system. To automate the system a mobile application can be developed that will assist them in their daily work with respect to Jasmine. The application will give reports such as sales, money to be given to farmers etc.

Information about jasmine growers, quantity of jasmine grown by them and price can be tracked using a backend database of the mobile application. This data can be used to have complete information on the jasmine output in the district




Source: own research and processing

Figure 1: Logistic Regression model for phone type, social network vs willing to automate.




Source: own research and processing

Figure 2: K-NN model for phone type, weights vs willing to automate.

for each grower. The data can be used to monitor each grower and timely intervention can be given if there are negative variations in the growing pattern. This is valuable for government policy building so that a fully-fledged strategy is formed to harness ICT's potential for assisting overall development.

## Conclusion

There is a positive correlation between price and the livelihood of the jasmine growing community. For most of the people jasmine growing community jasmine cultivation has an influence in the economics of their daily life. Jasmine cultivation has a significant socio-economic impact on Udupi jasmine growing community. This community-based enterprise has been facing some significant challenges. While there is a substantial ICT awareness among the agents and growers, ICT has not been used to overcome the challenges faced. The correspondents involved still use crude techniques in communicating and storing information. With India moving rapidly ahead with digital literacy in all spheres, use of ICT in agriculture is the need of the hour. With the identification of the challenges involved, the study suggests the possible ICT solutions to overcome these challenges. If these solutions are used effectively a complete effective ecosystem can be created that can work as a single system.

With the help of the study conducted future scope would be:

1. To build and develop a model for mobile application for the agents and price SMS module for growers for efficient dissemination of information.
2. Build an e-commerce model exclusive to market Udupi jasmine. While there have been successful Indian ICT projects in agriculture like Gyandoot, iKisan, e-Choupal, TARAhaat etc., the protentional of e-commerce in marketing agricultural product is yet to be explored. Agricultural e-commerce models cannot be similar to other the traditional of e-commerce models. It needs to evolve based on the geographical area, policies governing that area, entities involved in the production and distribution of that agricultural crop. Although agriculture e-commerce development is facing several challenges, the development of agriculture and new e-business models, e-commerce will have more application in agricultural production and business activities. Thus, an e-commerce model for jasmine, will help in building a web application which will provide a market to a wide range of consumers.

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