# RURAL WOMEN'S EMPOWERMENT THROUGH ICT FOR IMPROVING NUTRITION KNOWLEDGE AND PRACTICES

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**ABSTRACT**

*There has been a lot of interest during the last two decades in employing Information and Communication Technologies [ICTs] for achieving sustainable agriculture and rural development. While many of these initiatives have benefited rural women by way of access to new information and new employment opportunities, women still face a number of constraints in accessing ICTs especially in the agriculture nutritional aspect. This paper explores the role of ICTs in empowering Indian rural women, through a review of ICT initiatives in India in the field of agriculture nutritional awareness. The paper concludes that, while most of the ICT initiatives are disseminating new information and knowledge useful for rural women, many are not able to make use of it, due to lack of access to complementary sources of support and services. There is immense potential for ICTs to create new employment opportunities for rural women and to contribute significant gains in efficiency and effectiveness in rural women enterprises. While ICTs can play an important role in empowering rural women, women's access and use of ICTs and empowerment clearly depends on the vision and operational agenda of the organization applying the ICTs. ICTs have become a strong ally in strengthening individuals' healthy lifestyle, taking into account nutrition intake and physical activity levels. Nutrition applications provide the means for automatic dietary intake and energy expenditure measurements as well as personalized counselling and educational services. Therefore, strengthening the ICT initiatives can go a long way in empowering rural women. Besides generating locally relevant content and enhancing the capacities of rural women in accessing ICTs, efforts are also needed to bridge the different types of digital divide [rural-urban; men-women].*

***Keywords: Agriculture Nutrition, ICT, Nutrition Education and Rural Empowerment***

## I. INTRODUCTION

Agriculture is considered a prime driver for nutrition sensitive programming because a large share of the malnourished resides in rural areas and agriculture is the source of food and other ecological services for both rural and urban people [1]. Consensus has been reached to explore all possible ways through which agriculture may achieve nutrition sensitivity. Agriculture is considered as a direct and indirect source of food at household level, as a driver of food prices; as an entry-point for enhancing women's control over resources, knowledge and status. Reviews conducted over the past several years indicate that the overall evidence base for these pathways is weak, especially in regards to anthropometric data. The studies that do exist are usually poorly powered due to sample size and time frame [2]. Largely overlooked by past research is the question of how to incentivize

farmers and other professionals working in agriculture to include nutrition in their objectives [3]. Also largely overlooked is the related question of what is logistically feasible in terms of evaluation. As most conventionally designed agricultural projects do not include nutrition indicators in their design, there are little evaluative data available on the subject. This is one of the reasons for the weak evidence base and, when considered within the context of the incentives issue, poses a challenge to proponents of nutrition sensitive agriculture. Another reason is that farm women are having various constraints in attaining agriculture nutrition education or knowledge. Following table explains the reach of farm women in attaining any agricultural technology.

**Table 1: Rural Farm Women Accessing Modern Agricultural /Nutritional Technology**

| S. No | Source | % of hrs |
|---|---|---|
| 1. | Participation in Training | 0.9 |
| 2. | Krishi Vigyan Kendra [KVK] | 0.7 |
| 3. | Extension worker | 5.7 |
| 4. | Television | 9.3 |
| 5. | Radio | 13.0 |
| 6. | Newspaper | 7.0 |
| 7. | Village fair | 2.0 |
| 8. | Government demonstration | 2.0 |
| 9. | Input dealer | 13.1 |
| 10. | Other progressive farmers | 16.7 |
| 11. | Farmers' study tour | 0.2 |
| 12. | Para-technician / private agency / NGO | 0.6 |
| 13. | Primary cooperative society | 3.6 |
| 14. | Output buyers / food processor | 2.3 |
| 15. | Credit agency | 1.8 |
| 16. | Others | 1.7 |
| 17. | Any Source [all of the Above] | 40.4 |

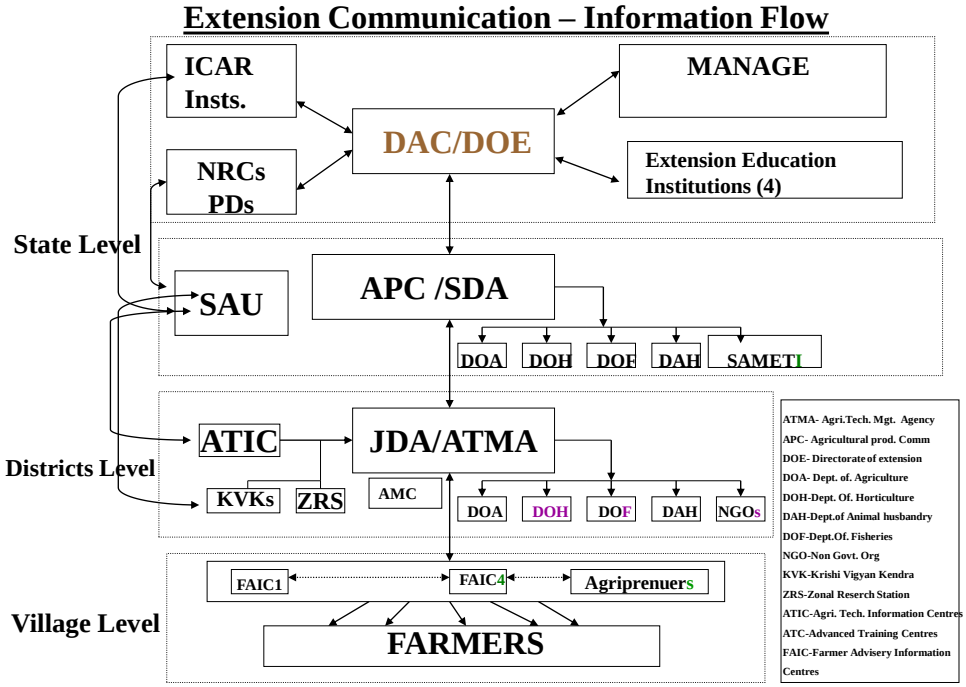
### 1.1 Empowerment of Rural Women

Empowering rural women is considered absolutely fundamental to increasing nutrition sensitivity in agriculture as women make up a large percentage of the agricultural labor force in developing countries. Beside this the resources and income flows that women control have been shown to have disproportionately positive impacts on nutrition security, [4]. The key areas through which women can exercise their autonomy in agriculture are: agricultural production; resources and assets; income; leadership and time allocation [5]. Although women's empowerment in each of these domains poses challenges, time allocation is of particular concern because women's increased participation in paid and unpaid agricultural labor reduces time spent on activities that affect household nutritional status, namely caring for children, food preparation, water and fuel collection, shopping, housekeeping, and family health care. As such, it is critical to take a "do no harm" approach to guard against the unintentional negative consequences of agriculture based activities aiming to promote gender equality. In addition to the issue of time allocation, other risks include gender-based violence as well as the ill-health effects

that can come from working in unsafe agricultural environments. In order to avoid these unintended consequences, identification and tracking of potential "gender harms", together with development of a feasible mitigation plan, are essential to agriculture programmes aspiring to nutrition sensitivity.

Integrating nutrition education into agricultural and food system interventions which aspire to nutrition sensitivity is essential to achieving the social and behavioral change necessary for improved nutrition practices. This is because improved food security and purchasing power, while certainly associated with improved nutrition, may not be enough, in and of themselves, to improve nutrition outcomes [6]. Simply put, improved access and availability do not automatically translate into improved dietary intake. This fact underlies the entire premise of nutrition sensitive programming in agriculture.

In India, Government has taken number of initiatives for nutritional security among rural mass. But, agriculture nutritional programme or information are going through a long chain and takes a lot of time and energies. It is not possible to knock every door of rural farm women to educate them about nutritional sensitivity with existing model.




Hence, contemporary nutrition-related issues in conjunction with innovations in information and communication technologies [ICTs] are the core-elements of the present state of- the-art article. In an attempt to address to the societal needs for continuous health and nutrition preservence and care, ICTs provide the means to the realization of effective state policies and scientific interventions. Target audience of such applications is individuals at home or at work as well as professional caregivers. In both cases, the goal of the nutrition interventions implemented should be lifestyle- oriented. In order to fulfill these goals, applications should enhance end-users' self-monitoring and self-management skills. ICTs are an in adversely strong determinant factor as to the massive, immediate and low-cost deployment of nutrition-related interventions. Nutrition applications go far beyond the boundaries of mere consumption of low-calorie foods and one-way dietary interventions. They have to do with individuals' physical and psychological health as a unity. Therefore, manual, visual or audio dietary intake entry combined with activity level recordings or total energy expenditure measurements, should both be accompanied by counseling for raising self-awareness and self-efficacy levels. In

essence, individuals are trained to change their behaviour by realizing their nutritional and lifestyle, less beneficiary habits. During the whole process, support and guidance are predictive factors of long-term engagement in a program. That is the reason why nutrition applications should adapt to individuals' personal profile and character for goal setting as well as for intervention evaluation purposes. Tailored feedback towards individuals has been found to raise their accountability and offer them encouragement. Thus, the more personalized the feedback the more effective the intervention. Effective applications should therefore be interactive in order to maintain individuals' interest as well as flexible and reusable in order to apply to as many individuals as possible at the minimum cost. Individuals' motivation is also enhanced through accessible, convenient and reliable applications, especially for multi-variable settings, such as life-long diseases and/or socially impaired target groups, who come up against a variety of everyday adversities. Professional careers are also in need of such applications as they seek to satisfy their constant need for efficient and high-quality counseling services. In general, nutrition applications provide quality and standardization of health intervention studies in an attempt to improve all people's nutritional and lifestyle behaviors.

**II. REVIEW OF ICT APPLICATIONS:** The different ICT based applications in the field of nutrition security are presented below-

### 2.1 Mobile Based Nutritional Awareness

Today, mobile is the strongest and fastest medium to reach the unreached for agriculture nutritional awareness. Though, use of mobile for nutritional awareness for rural youth in India still needs attention. But, for advisiory services in other allied activities of agriculture is gaining popularity. In developed countries a lot of initiatives were taken in this regard. Hebden et al, describe the process of developing four smartphone applications to raise young adults' motivation in the improvement of their nutrition and physical activity behaviours [7]. The purpose of the applications was to enhance subjects' self-reflection on their physical activity and consumption of take-out foods [fast food], fruit, vegetables and sugar-sweetened drinks. The realisations of such intriguing, cost-effective, long-term health interventions, focusing on subject's self-assessment and awareness, necessitate, therefore, continuous encouragement and support in the form of personalised feedback. Kerr et al., reported that a 6-month nutrition intervention project aiming at young adults' improvement of eating behaviors, makes use of a mobile application called "CHAT" that keeps a record of the food images consumed as well as invites the intervention group to perform dietary changes through tailored feedback on their food intake via a text message [8]. In this case, nutritional messages referred to consumption of fruit, vegetable and junk food are related to age, gender and behavioral characteristics. Not only are the content, frequency and length of text message important, but also the adequate time of receiving it in order for the participants to build their self-efficacy on healthy eating habits. Vandelanotte et al. [9] performed a pilot-study concerning middle-aged, Australian men views on mobile phone delivered physical activity and nutrition interventions. Middle-aged men prefer tailor-made, self-monitoring and intervention delivery applications performed especially in smartphones, with an emphasis on maximum simplicity, speed and convenience in their operation. Medhi et al.,[10] present observations and findings from a three-month field study in rural India, during which an easy-to use application, deployed in low-cost mobile phones, substituted paper-based data for a more accurate and accessible, digital database concerning the combat against children's malnutrition. Data entry and management was upgraded, whereas infrastructure deficiencies should be diminished by staff training and easy-to access technical support.

### 2.2 Web Based Nutrition Expert System

It is very effective tool and can be implemented at community level with little hands of training. In this area, search is centered in the development of multi-level systems, designed to offer multi-purposed services for covering a variety of needs on behalf of their users. Much advanced form of this application are using at rural and urban areas in developed countries. Chena *et al.*, [11] launches a web-based nutrition diagnosis expert system for dietetic professionals in Taiwan. This expert system assists in the nutrition-related decision making. Agri -Nutrition expert system offers a holistic approach in nutrition diagnosis and management, as it comprises both identification of the problem and the means to deal with it in a standardized, profound and efficient way . Lewis et al. argue that information technology may influence consumers' food choices by increasing their personal interest in looking after their own health status [12]. Especially, hand-held devices or phones could record daily nutrient information during food intake and furthermore, a more personalized profile of the consumers' nutritional needs would be possible. Also, devices such as the 'bodybugg' that measures the total energy expenditure of a whole day and sends it to an online database could provide the interested party with the necessary feedback in order to achieve body weight goals. Koch et al. bring to light an expanding, cross-disciplinary research subject concerning the delivery of care to older people, such as their nutrition, physical activity and medication with the assistance of information technology, sensor technology, and information systems [13]. It seems that elderly population's perspectives towards their care differentiate according to the stage of their aging process as well as to their gender. Lopez et al., motion sensors inside a mobile phone convert accelerometry counts into energy expenditure by taking into account heart rate, body and environment temperature under free-living conditions [14]. Bickmorea et al. launch an ontology of health behavior change, deployed for diet promotion [15]. The notable efficacy of this automated, media-based intervention is attributed both to its capacity to emulate the behaviour of an expert counsellor and to its reusability and interoperability. In this way, patients' health behavior change applications can become a strong health counseling tool, taking into account the reduction of their dissemination cost. Takahashi et al. present an Automatic Nutrient Calculation System on the web, which identifies and calculates the amount of the ingredients in grams included in almost 1 million registered recipes as well as the total amount of nutrients in each one of the ingredients [16].. Amft at al. argue that on-body sensors can make rough estimations on ratio of fluid and solid foods consumed and also they can capture food category and timing information [17]. Thus, behavioral-based, nutrition interventions can become more solid and precise. The three sensing domains are arm and trunk movements, chewing of foods and swallowing activity. Evidently, recognition of dietary activity events was realized by means of quantitative detection and classification, accounting for automatic dietary monitoring. Ayres et al. made a record on the necessary nutrition informatics competencies in dietetics. Informatics includes the efficiency to collect, store, retrieve and study data [18]. Nutrition informatics is the intersection of information, nutrition, and technology, a future-holding, cross-disciplinary innovation in dietetics and health care in general. In Delphi study presented, registered dieticians are convinced of the fact that they should be able to select, implement and maintain sufficiently, information management systems across all levels of their practice.

### 2.3 TELE Based - Agri Nutrition Education

Applications belonging in telenutrition research field are easy-to-use and cost-effective, as they enhance the adaption of long-lasting, self-monitoring health behavior change. Hercberg et al. investigate the relationship between nutrition and health outcomes in a 10-year follow-up, web based study called "The Nutrinet-Sante

Study", located in France [19]. At the starting point of the study, volunteers record three 24h dietary intake, socio-demographic and lifestyle questionnaires, health, anthropometric questionnaires and physical activity questionnaires. Every year, the participants must once again fill in the abovementioned questionnaires as well as the three 24h dietary records. Moreover, every month they will receive informative e-mails, reminding them of the necessity to update their personal profiles on their food behaviour, nutritional and health by filling out a new questionnaire via the website. Neuenschwander et al. made a comparative study between a web-based and an in-person nutrition education program for low-income adults. The technical part of the interventions, such as their content and duration was similar. Traditional in-person nutrition education and web based nutrition education, both showed significant nutrition- related behaviour outcomes [20]. Moreover, the nutrition related changes were equivalent in both intervention groups. Web-based participants also reported willingness to use the website again, taking into account its efficacious design, decreased cost of accessibility and easy implementation. Vandelanotte et al. made a pilot-study aimed to examine middle-aged, Australian men's opinions and perceptions regarding the use of internet in the improvement of their physical activity and nutrition behaviors. It is noteworthy that the aforementioned target group show low commitment levels to engagement in health intervention programs. Indeed, middle-aged men support the use of websites as a means to self-monitor their physical activity and nutrition behaviours on the condition that delivered interventions are accessible, understandable, appealing, reliable and concise [21]. Gibney et al. argue that the use of web-based, personalized nutrition applications for the collection of food data in an intervention study should be, first of all, plausible and user-friendly, even though precise and exact data entry from the participants is less possible. Furthermore, personalized feedback towards the participants should be easy-to-use, based on simple visual tools, instead of any numeric data. Food choice advice should be focused on meal intake and ranges of nutrient intake, presented on the computer screen by making a classification, depending on the participant's average nutritional needs [22]. Hong et al. created a kid-friendly, web-based nutrition education searching system, combining both video scripts of the cooking process of healthy recipes and easily learned nutrition information with plenty of searching methods. Children can seek for a menu of their preference by using a key word expression such as food materials, age group, menu type, menu style and nutrients or the upper and lower bound of the calories and the nutrients they opt for. Hong et al. created a web expert system for nutrition management and counselling, which takes into consideration gender, age and diseases so as to compose general and therapeutic meals. The system compares e-databases, originating from user's information and experts' recommendations in the sense that the latest assess on-line the nutrients and calories included in a meal, chosen by the user of the system [23]. Vereecken et al. made a comparative study on the feasibility of young children's nutrition assessment, based on their dietary habits and their parents' sociodemographic variables, by implementing either an on-line assessment tool or a paper and pencil questionnaire. No significant differences were found in relation to nutrient and food group recordings, except from water. Parents that preferred to fill in the pencil food diary were younger and had a lower education level. From the parents that completed the on-line questionnaire, the majority indicated that it was user-friendly, attractive and clear [24].

## III. INDIAN CONTEXT

Presently in India most of the agriculture nutrition education or awareness programmes are going through personal contacts, campaign, print media [newspaper, wall paintings, leaflets etc.,] or e- media like television or

radio. For speedy and cost effective transfer of nutritional technologies or to create agri - nutritional awareness for empowerment of rural women's, other effective tools can be Kissan Call Centre, Community Radio Stations, Farmers Kiosk at village level, expert system in online and offline mode and different multimedia models. There is an urgent need to develop ICT based tools in line with our traditional and healthy nutrition practices in the Indian context.

**TABLE 2: Area of Application of ICT in Nutritional Empowerment**

| S.No. | ICT Tools | Application |
|---|---|---|
| 1. | Mobile | • Audio-Video messages through mobile phones, mobile apps, alert calls regarding nutritional uptake of rural mass and regular health checkups<br>• Package of practices of nutrient rich varieties<br>• Monitoring and feedback mechanism through mobile based applications |
| 2. | Web | • Dissemination of recommended dietary requirement [carbohydrate, protein, fat, vitamin , minerals and dietary fibre) to rural mass<br>• Nutritional Campaigns organization and mass awareness in villages |
| 3. | Expert System | • To analyse the dietary intake and calorie requirement<br>• To analyse the required quantity carbohydrate, protein, fat, vitamin, minerals and dietary fibre<br>• Content Development regarding best nutrition practices |
| 4. | Nutritional Portal | • All sources of different nutrients according to age group<br>• Package of practices of nutrient rich varieties<br>• Nutrition related diseases and cure |
| 5. | e-Video Library | • Best Cooking practices of vegetables and nutria rich foods<br>• Various nutrient rich diet combinations according to age group<br>• Development of Multimedia CD's |

## IV. CONCLUSION

Most of the ICTs are disseminating new information and knowledge on agriculture, health and nutrition among rural women. However, due to the continuing digital divide between urban and rural areas and also between men and women, many rural women are yet to fully benefit from the potential of ICTs. Research data on nutrition & ICTs show the importance of behaviour-based applications in individuals' health preservance. Dietary intake and physical activity in everyday life are both constituents of a healthy lifestyle. Self regulatory skills are vital for life-long behavioural changes. Nutrition applications should also be genuily intriguing as they need to provoke individuals' long-term engagement in an intervention program. For that purpose, personalized communication as well as tailored feedback according to individuals' personal profile, are predominant for treatment alterations and psychological support. Moreover, flexible, multiple purpose and cost-effective nutrition applications offer the opportunity of serving the needs of a large number of the population at a low cost, thus enhancing preventive medicine and reducing the inherent difficulties of the deprived part of the society. Finally, such applications should be accurate and trustworthy in order to gain interested party's

acknowledgement and acceptance, ranging from healthcare professionals to individuals, concerned about their health status.

While new information and knowledge is necessary, it is not sufficient to bring about women empowerment. To make use of the information, women would need access to other sources of support and services. Women who are part of other development initiatives or groups and those who have access to other sources of service and support were able to better use the information and knowledge disseminated through ICTs. The potential of ICT tools varied widely in reaching rural women. There is no ideal ICT tool that fits all situations. Need to develop a basket of ICTs effective tools to empower rural farm women's through nutritional awareness under various agriculture nutritional projects

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