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### ICT to Enhance The Triangle of Life: A Case Study

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## ICT to enhance the triangle of life: the soil, the seed, and the life-giver farmer

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### Abstract

*This paper reports on the outcomes of an ICT enabled social sustainability project “Green Lanka<sup>1</sup>” trialled in the Wilgamuwa village, which is situated in the Dambulla district of Sri Lanka. The main goals of the project were focused towards the provision of information about market prices, transportation options, agricultural decision support and modern agriculture practices of the farmer communities to improve their livelihood with the effective use of technologies. The project used Web and Mobile (SMS) enabled systems. The Green Lanka project was sponsored by the Information Communication Technology Agency (ICTA) of Sri Lanka under the Institutional Capacity Building Programme (ICBP) grant scheme which was sponsored by the World Bank. Six hundred families in Wilgamuwa village participated in the project activities. The project was designed, executed and studied through an Action Research approach. The lessons learned through the project activities provide an important understanding of the complex interaction between different stakeholders in the process of implementation of ICT enabled solutions within digitally divided societies. The paper analyses the processes used to reduce the resistance to change and improved involvement of farmer communities in ICT enabled projects. It also analyses the interaction between stakeholders involved in design and implementation of the project activities to improve the chances of project success.*

### Keywords:

Mobile Agriculture Information Systems, Social Sustainability, Action Research, ICT in developing countries.

### INTRODUCTION

Agriculture is a fundamental economic sector for human survival. Rukuni (2006) identified agriculture as a key factor for a nation’s economic growth. Survival of approximately 1.1 billion people living under extreme poverty conditions depends on agriculture (Båge 2006). Sri Lanka is a developing nation where 80% of the population is rural; however, the GDP contribution of the agriculture sector is continuously declining together with a significant increase in the unemployment rate (World Bank, 2012). Justine and Ddembe et al. (2005) emphasised that knowledge and information are the basic essentials for facilitating rural development and bringing about social and economic change.

Green Lanka is a Sri Lankan organisation incorporated with a vision to bring about an agricultural resurgence to Sri Lanka by adopting new technology and innovation to its agricultural practices through the support of local as well as international counterparts. Under the ICT Capacity Building Project (ICTA 2009) sponsored by the Information Communication Technology Agency (ICTA)<sup>2</sup> of the Government of Sri Lanka, Green Lanka embarked on an Agri-social sustainability and capacity building project to promote e-services<sup>3</sup> by building a culture of communication and innovation using an SMS and Web based agriculture information management system for the farmers. The concept of a ‘Mobile Farmer Network’ was designed to improve knowledge sharing and transfer of best practices among farmer communities. Agricultural information relevant to the smallholder farmer was collected, organized and then made widely accessible. Under the project, activities were planned to motivate farmers to participate as individuals and farmer organizations to build a knowledge bank of traditional

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<sup>1</sup> The original name has been kept anonymous to protect the identity of the organization.

<sup>2</sup> The Information and Communication Technology Agency (ICTA) ([www.icta.lk](http://www.icta.lk)) of Sri Lanka is the single apex body involved in ICT policy and implementation for development projects.

<sup>3</sup> E-Services is an umbrella term used in this paper to describe services on the Internet using web/web-enabled technologies.

practices, better farming techniques, relevant technologies, information on crops, markets, prices, transportation solutions, storage, packaging and handling and other relevant agribusiness value chain information. The project outcomes were expected to enhance the capacity of rural farmers and empower them to become agricultural entrepreneurs.

The project applied an action research approach, and this paper reports the details of a single action research cycle. The remainder of this paper will first provide an overview of the applied research approach, and will then describe the core phases of the project, before it concludes with an overview of lessons learned and an outlook on the future plans.

## **PROJECT METHODOLOGY**

The project was conceived as an action research project. The primary author of this paper was an active member of the project planning and implementation team and was primarily responsible for the Information Technology and Systems areas of the project activities. The observations and experiences of the author over the period of approximately two years were documented to provide an insight on a real life project using ICT for socioeconomic development.

Action research is a scientific research methodology established by Kurt Lewin in 1946 for the implementation of social research (cited in Susman & Evered, 1978, p. 586). Action research has the three primary purposes of developing practice, practitioners, and theory (McCormack, Manley, & Garbett, 2004). It emphasises collaborative research within the workplace and resolution of group issues and challenges in practice.

Implementation of action research can vary but most action research follows a reflexive ‘plan-do-check’ approach (Chein, Cook & Harding, 1948). The methodology for the project described was adapted from the Susman and Evered (1978) five-phase action research model, following an ‘experimental action research’ approach (Chein et al., 1948; Susman & Evered, 1978). The five core phases of the model are: (i) diagnosing (ii) action planning (iii) action taking (iv) evaluating and (v) specifying learning. The next section will provide an overview of the case study under investigation and describes each of the phases and their outcomes in detail.

## **DEVELOPMENT AND IMPLEMENTATION OF THE PROGRAM**

### **Phase One - Diagnosing**

Phase one is focussed on identifying and defining the problems to be addressed by the project. First an overview of the context is provided below followed by a presentation of the project goals.

The Green Lanka project selected the Wilgamuwa Provincial Secretariat Division in Hettipola, Matale District as the area to be transformed into an “Integrated Organic Supply Village”. Wilgamuwa has a total land base of 262 sq. KMs. with a population of 31,758 in 7,953 households. The demography of Wilgamuwa consists of 16,033 females as compared to 15,725 males. The selected village falls under the category of the Sri Lankan “dry zones” areas where the average annual rainfall remains under 1000mm and is therefore faced with significantly higher levels of poverty and food shortages. As a result of land fragmentation and acclimatization, most families in the dry zone have only a small extent of land and less food and hence they seek alternative and supplementary sources of income. The area suffers a high rate (46%) of unemployment; the income generated through farming is very limited and due to unavailability of alternative sources of income, these farmer families tend to abandon their livelihoods and move to cities in pursuit of better prospects, mostly as hired labour in various sectors.

Traditionally, the farming profession is limited to simply harvesting and production of crops with no involvement in other areas of the agriculture supply chain. As a result, farmers have very limited knowledge of financial, logistical and marketing planning factors. In the absence of this knowledge, farmers in Sri Lanka face many issues related to information about the products, weather patterns, market conditions and other relevant areas in which decisions can be made about their agricultural production. A farmer owns an average of 2 to 3 acres of land of which almost 50% of the land is used for paddy cultivation and the rest is either underutilised or used as a home garden.

Currently, the farmers’ decisions on crop selection and production purely depend on past experiences and speculations on the market conditions. A farmer with an assumption of a bumper crop, purchases the seeds, equipment, fertilisers and other required material through interest bearing bank loans. The majority of these farmers face significant losses due to changes in market conditions and other external and environmental factors related to agricultural produce. Also, the production decision only considers the marketing conditions and prices in the capital city (Colombo) market without considering the transportation and other relevant logistical costs involved and hence the farmer ends up with very limited or no profits compared to the original estimation.

To overcome the problems mentioned above, information technology can be used as a solution to provide vital information and training to the farmers. However, due to very low literacy rates and knowledge of ICT, the biggest challenge was to motivate the farmers in effective use of modern agricultural methods and the use of information technology as a solution to the issues identified above.

## Phase Two - Action planning

Alternative courses of action for solving identified problems were considered in this phase.

An innovative “out grower supply chain model” was designed by Green Lanka. Under this model, smallholder farmers would be provided training, and technical assistance to acquire organic certification. With the seed capital provided by Green Lanka, the participating farmers would use their under-utilized land mass to produce organic crops. The produce of the organic farmers was to be collected and purchased at a preferred rate by Green Lanka, and after performing further value additions (i.e. Packaging etc.), the produce would then be marketed both locally and internationally by Green Lanka.

The International Centre for Research in Agro Forestry (ICRAF)<sup>4</sup>, the Gates Foundation, the Fulbright Commission and the Michigan State University were involved in the project to provide technical and educational support towards organic training and education.

To provide a sustainable solution to the problems mentioned in phase one, Green Lanka identified ICT as an important part of its strategy. As a result, the main aims and objectives of the Green Lanka project were defined as follows;

1. Building a network of farmers who will be certified organic producers.
2. Giving rural farmers the opportunity to share knowledge with other farmers (locally and internationally) through digital media.
3. Give farmers timely and accurate information with the use of mobile technology.
4. Providing farmers the opportunity to enhance their knowledge through the use of a Digital Video Library.
5. Provide ICT and Language training to farmer families.
6. Transform rural farmers into self-reliant and professional individuals.

To design the software architecture for the proposed application, a similar system study was conducted. eSagu (Reddy & Ramaraju, 2006) and Tradenet (Dialog, 2009) projects were studied to understand the basic requirements. Initially a fully customised software system was proposed to implement the project. The original approach was to use PHP<sup>5</sup> as the base programming language together with free “Frontline SMS Gateway<sup>6</sup>” to maintain the costs within the budget. However, as a result of the recommendations provided by the Price Waterhouse Coopers (PWC) consultants appointed by the ICTA to support the project, the strategy was changed to a mixed approach of using bespoke open source systems<sup>7</sup> integrated with the customised farmer database management system and SMS Agri-Information Systems. The development team was advised to choose Joomla as the base Content Management System with integration of open source video management plugins. The core farmer management system and SMS enabled agriculture information distribution system was developed using a PHP and MySQL<sup>8</sup> database. The Frontline SMS gateway was replaced with the standard SMS gateway system provided by a local telecommunications service provider at a reduced cost to the farmers.

The project team was aware that community involvement and the spirit of entrepreneurship were essential yet difficult antecedents for success. The Green Movement of Sri Lanka, an NGO organisation whose commercial wing “Echonia<sup>9</sup> (Pvt) Ltd.” and a group of young people from the same area who were to play the role of “entrepreneurship catalysts (ECs)” among the farming communities, were set up to address this challenge. Echonia designed and developed the social mobilizing programmes to promote organic farming, conducted awareness seminars and collected data on demographic and agricultural practices used by the farming community. The ECs were assigned as change agents to create and maintain an interface between Green Lanka

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<sup>4</sup> See (<http://www.worldagroforestrycentre.org/>) for further details.

<sup>5</sup> PHP (acronym for PHP: Hypertext Preprocessor) is a widely-used open source general-purpose scripting language that is especially suited for web development and can be embedded into HTML.

<sup>6</sup> FrontlineSMS is a free service that helps organizations across the world to overcome communication. (<http://www.frontlinesms.com/>).

<sup>7</sup> Open-source software (OSS) is computer software that is available in source code form under an open-source license (GNU or General Public License) that permits users to study, change, improve and also to distribute the software.

<sup>8</sup> MySQL, is the most popular Open Source SQL database management system, is developed, distributed, and supported by Oracle Corporation.

<sup>9</sup> The original name has been kept anonymous to protect the identity of the organization.

and the farmer community. ECs were also used to facilitate technical assistance and train farmers on mobile and digital media usage.

An Agri-Business Entrepreneurial Centre was also established in Wilgamuwa to provide the required skills, knowledge, and access to technology, to be used as a base to attract the farmer communities not only from Wilgamuwa but from the surrounding communities. Figure 1 exhibits the overall resulting business model of Green Lanka Project.

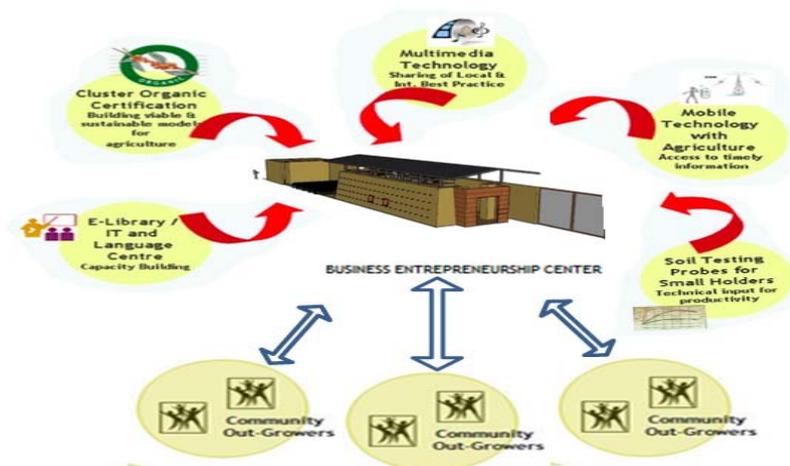


Figure 1: Green Lanka Business Model and Interfaces

The Centre was used as a hub and a communication point to reach the farmers whereby the farmer units around the area would be able to benefit the opportunity to enhance their knowledge, share their best practices and learn new ways of increasing their productivity. Farmer families too would be able to benefit through the centre with IT and language training being provided with opportunities for scholarships for higher education. The soil samples for organic certification would be collected at the Centre.

### Phase Three - Action taking

The Green Lanka Project was designed to develop the entrepreneurial skills and mind-set of the farming communities by providing the power of technology, knowledge, and contemporary skills in agriculture to help them make better decisions and sustainable farming and agriculture practices. The following section describes the activities undertaken to implement the project.

### The Concept

With a vision to provide farmer communities the appropriate knowledge, technology, and skills to define and establish micro enterprises using their smallholder lands, the project commenced with the selection of a cluster of 300 out-grower<sup>10</sup> families identified from the neighbouring areas. The selected farmers were provided with the necessary skills and competencies to develop their livelihoods by converting themselves into organically certified agriculture producers. The Agri-Business Entrepreneur Centre was constructed at the project site together with a 10 acre model farm to cultivate dragon fruit using organic agricultural practices. The organic crop produced by these farmers was to be acquired by Green Lanka who will market this produce both locally as well as internationally after making value additions i.e. packaging, branding etc. The decision to focus on producing organic crops was based on the global demand for organic food; initially, organic crops were marketed in luxury holiday resorts and hotels in Maldives and UAE by Green Lanka.

### Training in Organic Farming

Using the Agri-Entrepreneurial Centre, a number of training and development programmes were organised by Green Lanka. These programmes involved knowledge sharing sessions on organic farming, financial management, use of Information and Communication Technology, and training in the English language to the youth in the area. Green Lanka partnered with Control Union<sup>11</sup> to educate farmers in organic certification. Furthermore, the project approached the Information Communication and Technology Agency of Sri Lanka to provide funds for the project under the Institutional Capacity Building Programme (ICBP). The project was

<sup>10</sup> A term often used to refer to contract farming operations is 'out-grower schemes', whereby farmers are linked with a large farm or processing plant which supports production planning, input supply, extension advice and transport.

<sup>11</sup> Control Union is a global body for organic food and agriculture certifications (<http://www.controlunion.com>).

successful in securing a total grant of 6.1 million Sri Lankan Rupees to set-up the entrepreneurial centre, and to develop a mobile based farmer management system that would provide the farmers the required information using SMS and web technologies.

### **Involvement of Farmer Communities**

As a project requirement by Information Communication Technology Agency (ICTA), the farmer communities had to be actively involved in the use of ICT. Green Lanka had used an innovative approach to improve its penetration into the farming communities by training selected youth from the areas in ICT, English, and Management skills. These youth had the titles of “entrepreneurship catalysts”, as explained earlier, and their main role was to increase communication and knowledge transfer between the project and the farmers. The entrepreneurship catalysts were instrumental in the collection of demographic data and farming practices and knowledge.

### **Design and Implementation of the Agriculture Information and Farmer Management System**

The Information Communication Technology Agency (ICTA) required a fully functional mobile based farmer management system with the following functionalities.

- A fully functional farmer Management System including farmer’s demographic and agricultural details, market prices, transportation options, and data reports
- A mobile SMS module to provide the farmers suitable information related to current market prices, transportation costs, market demand, and historical costs of various products
- A video management system to record the best farming practices to be used as a knowledge bank which in turn can be used by the communities to self-learn new farming practices and methods for better productivity and efficiency.

In order to design and implement the required system, Green Lanka partnered with Intellicube Systems which is a small software development house in Sri Lanka. Intellicube Systems had the required expertise in mobile and web technologies. The development of the system commenced in January 2009; a five member team was assigned to design and develop the system in consultation with Green Lanka Staff. The development team visited the project site in Wilgamuwa to understand the requirements and nature and type of the end-users of the proposed system. The information needs were systematically analysed by the project team. A selected sample of farmers representing different age groups was interviewed to understand their competence, literacy and behavioural aspects towards an ICT solution. As discussed by Holden & Karsh (2010), the key to increase the technology usage depends on the acceptance of that technology; user-friendliness and perceived usefulness (Venkatesh and Davis, 2000; Venkatesh et al. 2003) would be the key challenges the development team must address. Considering these issues, three prototype applications were designed and tested with the sample farmers using IVR (*Interactive voice response*), Unstructured Supplementary Service Data (USSD), and a simpler SMS Port method. The feedback received from the farmers mentioned the lack of understanding of the IVR and USSD methods as both were in English. The Sinhala<sup>12</sup> character set was not available with the main stream telecom service providers at the time the project was developed. Hence, a “reference card” method was introduced to improve the useability aspects of the SMS application. The reference card was designed to provide the translations of key messages and options for easy understanding of the farmers. The project was successfully developed and tested in September 2009. Upon completion of the system, the application was handed over to the Green Lanka management to implement the system in Wilgamuwa and start entering the farmer data, market information and transportation options information.

While the technical project was in the development stage, Echonia initiated the social awareness campaigns including seminars, demographic and agricultural data collection, and door to door awareness programmes. Farmer communities were informed about the benefits of the Green Lanka initiatives to motivate the farmers to change their existing farming practices and to adopt the latest technologies and methods. It was a difficult task since these local communities were following their ancestral and arcane agricultural practices and were not very positive about moving into green and organic practices.

As a usual practice by ICTA, the project was monitored by PriceWaterhouseCoopers (PWC). The funding for the project was tied to the achievement of milestone objectives agreed between Green Lanka and ICTA. On

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<sup>12</sup> Sinhala is Sri Lanka’s national language, the language most popular amongst the rural communities – especially in the target areas of this project.

behalf of the ICTA, PWC appointed two consultants. The key role of the consultants was to audit the project activities and ensure that the deliverables met the project objectives.

## Phase Four – Evaluation

The evaluation was conducted following the guidelines of Stillman (2005) and Susman & Evered (1978). The overall evaluation occurred at three core different stages of the project; at the very *early stages*, where structured up front planning methods were used for determining the feasibility of further stages of the project, *during the life of a project* as a means of ongoing accountability and clarification (formative evaluations in alignment to project milestones and funding reviews took place here), and evaluations *after the first action research cycle*, aimed at determining final impacts and recommendations (summative evaluations). A summary of these efforts is presented below. All evaluation activities were done through direct collaboration with the management of Green Lanka, and review of the project progress reports.

The demographic and agricultural data was collected in the initial stage of the project to understand the project environment. Data was collected from 600 families by directly visiting the farmer families in Wilgamuwa using a structured questionnaire. Two Grama Niladhari<sup>13</sup> (GS) divisions were selected in Wilgamuwa to collect the required data. The Green Lanka staff and the Entrepreneur Catalysts were used for this purpose. The data collected was analysed to determine the existing agricultural practices, family unit compositions, education, literacy rates, and age profiles and income profiles of the selected farmer families. The farmer communities in Wilgamuwa were predominantly “Paddy” producers. On average a farmer owns a 3 to 4 acres of land of which only 60% of the area is normally suitable for paddy cultivation. The remaining land is used as home garden or in very few cases farmers use it for some alternative crop cultivation. Youth in the area had poor ICT literacy and there was a general lack of suitable education services and support which resulted in the lowest examinations results in the Island (Department of Examination, 2012). Dependency on a single crop had severely impacted the earning capacity of the farmers. An average farmer family’s monthly income was ranging between 6500 to 15,280 rupees (Wickramasinghe, 2009; Hettiarachchi, 2012).

To understand the software usability requirements (Pressman, 2009) requirement data was collected from users of the proposed system together with a requirements document developed by Green Lanka. Requirements were measured based on the Usability, Mobile and Web usage experience, and the age of the users. A stratified convenience sampling method (Sekaran, 2010; McBurney & White, 2004) was used to cover the various age groups; three users between the age group of 15 to 25, four from 31 to 45, and three from the age group 45 and above were selected to understand the user requirements. Two different mobile screen designs were provided to the end users depicting USSD<sup>14</sup> and SMS Port Solution. Due to poor literacy in English and the unavailability of “Sinhala” fonts for the mobile device, the USSD option was not considered as a suitable option as it depended on the farmers' ability to read and select the menu option. A simpler SMS Port Solution was chosen together with a pre-printed “reference card” for farmers. The card was designed to provide the Crop Code, Market Code, and Area Code in the Sinhalese language (the national language of Sri Lanka) to improve the farmers’ ability to select the correct option for their information requirements.

The software development and social awareness activities were under the direct purview of ICTA and hence were closely monitored by using project milestone plans linked to the project progress with the disbursement of the approved funding by ICTA. The total project was divided into 8 milestones. The first milestone was linked with submission of the detailed work plans and list of selected farmer clusters. The objective was achieved by providing the project detailed activity plans together with a list of farmer clusters. Under the 2<sup>nd</sup> milestone, a detailed specification document and software design for a mobile-enabled farmer database system and digital video content management system were successfully completed. The 3<sup>rd</sup> milestone was achieved by developing and demonstrating a functional prototype of the system. The awareness campaign design and implementation plan was submitted by Echonia as the deliverable required for the 4<sup>th</sup> milestone. The project successfully met the 5<sup>th</sup> milestone by a formal demonstration of the mobile-enabled farmer database system and digital video content management system to ICTA appointed reviewers (ICTA, 2009). The 6<sup>th</sup> milestone was linked with the approval of media release for project completion and public launch of the Mobile Agri-Information System for the targeted farmer communities. The target was not achieved since the mobile network coverage was not available in Wilgamuwa and no private telecom operator has shown interest to set-up the required infrastructure to provide the communication services to the residents of Wilgamuwa. The results highlight the existence of a digital divide and accessibility to mobile services (Wijerathna, 2011) and its impacts on projects depending on

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<sup>13</sup> Grama Niladhari is the Sinhalese term used for “Local Administrative Authority”.

<sup>14</sup> Unstructured Supplementary Service Data (USSD) is a capability of all GSM phones. USSD is a menu driven form of SMS where a customer would receive a text menu on their phone as opposed to a string of words.

mobile networks. Milestone 7 and 8 were related to the achievement of post-project analysis and further sustainability of the project beneficiaries are described in the following sections.

The outcomes of the project activities were further analysed towards the end of the project; the data made available for the research team was originally collected from 2009 to 2011 by Green Lanka staff through direct discussion and observations with the participants. Furthermore, direct interviews were conducted by a member of the research team with the CEO and the senior management of Green Lanka together with direct observation methods deployed by the research team (following Sekaran, 2010).

Project activities were monitored at various stages using the Green Lanka staff and Entrepreneurial Catalysts. At the inception stage, 600 farmers were provided training on organic agricultural methods and practices. Only 70 farmers were converted into organic farmers by 2011. It was identified that most of the farmers were more interested in the “aid” rather than using the training to improve their agricultural and trade practices. Scepticism towards modern agricultural practices was another inhibition factor contributing to the resistance to change.

Under the Soil Sampling program, 25 farmers were provided training on the importance of the soil and crop combination to improve the yield. The general issues amongst the participants were related to disbelief at the importance and relevance of the selection of correct soil and accessibility to technology.

To improve the technology utilisation and improve literacy, a total of 275 farmers were given training in the English language and 6 teachers selected from the schools in Wilgamuwa were trained by ESOL qualified foreign trainers. During the middle stages of the project, a GigaPan<sup>15</sup> device was introduced to the youth participating in the project. 30 local youth were trained in the use of the GigaPan, to share knowledge and ideas with the outside world by the documentation and exhibition of best practices in agriculture in real time. Use of the GigaPan has improved the communication and confidence of the youth involved in cultural exchanges between the US and Sri Lankan participants.

The outcomes of the project activities are still under progress. However, the initial data showed significant improvements in the economic aspects of the farmers who participated in the project. According to Hettiarachchi (2012), the income of the farmers who participated in the project has shown significant improvement and increased to an average 30,000 rupees per month. The farmers’ agricultural land utilisation has improved. As mentioned above, the project was primarily focused towards productive use of the land used for the home garden by introducing alternative crops. The increase in income was identified as a direct result of the changes in the farmers’ mindset and the introduction of the out-grower model for alternative crop production). The youth trained under various educational and capacity building programmes gained confidence and entrepreneurial skills to change their views towards farming as a profession.

These evaluation results have pointed to a range of learnings, which are presented in further detail below.

## **Phase Five – Specifying learning outcomes**

The Green Lanka project provides some key lessons in order to implement a social sustainability project which involves technology implementation. A comprehensive environmental stakeholder analysis should be conducted. The control and level of dependency on service providers is a key factor for the success of these process improvement projects. Formal agreements should be in place with the service providers to ensure that projects run smoothly. The importance of policies to select the project partners is also confirmed as one of the critical success factors by Bridges.org (2006).

Selection of the right partners and maintenance of relationships with key players is another key success factor for these projects. Green Lanka faced considerable financial losses due to misguided information provided by the social catalysts. The initial strategy of involving the local youth was a more suitable approach as suggested by Batchelor and Sugden (2003) than depending on a partner who does not understand ground realities.

The project auditors should not recommend frequent changes in the system architecture. The focus should be on following the project charter without interfering in the technical decisions of the project implementation team. The approach by Green Lanka of doing everything alone resulted in the loss of the project’s focus in achieving its main objectives and that resulted in reduced financial support by the donor organisation. Being very idealistic in nature, Green Lanka tried to do too many things simultaneously that resulted in quite a few issues due to the sheer size of the project activities.

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<sup>15</sup> GigaPan was developed by Carnegie Mellon University in collaboration with NASA Ames Intelligent Robotics Group, with support from Google. The GigaPan EPIC series is based on the same technology employed by the Mars Rovers, Spirit and Opportunity, to capture the incredible images of the red planet.

Talyarkhan (2004) emphasised on selection of an appropriate technology as an important factor for the success of sustainability projects. Changes requested by the PWC consultants in the original software design resulted in a number of issues related to the inflexibility of the CMS and integration with the mobile information management system. Joomla CMS was not very compatible with the Frontline SMS Gateway which was originally proposed by Intellicube Systems. This caused the search for a proprietary SMS Gateway to route the information between farmers and the system. Green Lanka had a number of discussions with key telecom service providers in Sri Lanka. Though a lot of enthusiasm was shown by every telecom operator, none took a practical step to provide GSM services in Wilgamuwa. Finally, although the system was fully functional and tested using a test SMS Gateway provided by Dialog<sup>16</sup> Telecom, the final demonstration of the system was not considered successful by the ICTA audit team, the reason being that it was not used by the key project stakeholders i.e. the farmer community in the project implementation area.

Conflicts arose between the technology partner and the social catalyst partners about the type and nature of information. Intellicube Systems was more focused on achieving the ICTA requirements whereas the social catalysts (Echonia) were more inclined towards psychographic details of the farmers and to implement a system geared towards business intelligence. The conflict between the two partners resulted in a complete communication failure and it hence resulted in a total loss of track in maintaining the project's technical progress. Due to the ever changing requirements from Echonia, Intellicube Systems had taken a stance to only provide the functionality which was stated in the project charter signed between Green Lanka and ICTA. That resulted in a number of deadlines being missed which caused delays in funding from ICTA for the project.

The issue faced by the project also brings about the digital divide problem and accessibility to the basic communication services to the rural communities in Sri Lanka. It is evident that the project would have achieved all its goals related to the use of ICT by farmers, provided a mobile network service was available in the area. From the strategic planning and project management perspective (Cleland, 1986), it can be stated that a comprehensive project environmental analysis would have identified this issue during the initiation stages and hence, a better solution could have been identified to ensure successful implementation and sustainability of the project.

The Green Lanka Project was successful in achieving its primary goals of building entrepreneurial attitude and skills for the selected communities in Wilgamuwa. The newly designed supply chain and information availability did motivate the farmer to adopt sustainable organic farming practices. An information system to record farmer demographic details, their socio-economic profile, agricultural information data and profile was designed and successfully developed.

## CONCLUSION

This paper reports on the outcomes of an ICT enabled social sustainability project named "Green Lanka" trialled in Sri Lanka for agricultural enhancement and improved livelihood of rural farmer communities. Agriculture is a fundamental economic sector for human survival, and ICT can play a significant role in sustaining and developing this sector. The project was conceived as an action research project, and the paper systematically summarises each phase; (i) diagnosing (ii) action planning (iii) action taking (iv) evaluating and (v) specifying learning, as it unfolds.

The experience of Green Lanka addresses a number of fundamental issues faced by ICT for social sustainability projects. The cluster of out grower farming communities was an innovative approach designed by Green Lanka. The challenges faced by the project also highlight the digital divide and accessibility to basic communication services to the rural communities in Sri Lanka. It is evident that the project would have achieved its goals towards the use of ICT by farmers if a reasonable network service had been available in the area. From the strategic planning and project management perspective (Cleland, 1986), it can be stated that a comprehensive project environmental analysis would have identified this issue during the initiation stages and hence, a better solution could have been identified to ensure successful implementation and sustainability of the project. The information provided in this paper only focuses on the project implemented by Green Lanka and does not sufficiently cover the technical details of the software development process used in the project.

### Planned next steps for the future

The information provided in this paper is limited to observations made within one action research cycle, yet many lessons were learnt from this. Based on the lessons learned in the first implementation of the project, the following can be recommended to improve future endeavours.

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<sup>16</sup> Dialog Telecom is a subsidiary of Axiata Group and the largest mobile operator in Sri Lanka (see [www.dialog.lk](http://www.dialog.lk) for further details)

1. Understand the environment in a more clearer and systematic manner to ensure the risks involved in the project are adequately identified and remedial actions are planned.
2. Project sponsors should have implemented a change management process to address the frequent changes to the project requirements.
3. A suitable project management methodology i.e. Logical Framework Analysis, should be considered to ensure that a more regressive system is in place for effective monitoring and control of the project activities.
4. The project leadership should have taken a hands-on approach and should have been directly involved with the project partners to ensure better communication and handling of conflicts.
5. A more sustainable and efficient supply chain process should be developed to reduce the financial and logistical burden from Green Lanka.
6. Selection of the right project partners is a key aspect which needs attention. The practical experience and knowledge of the partners should be carefully analysed before getting them involved in the project activities.
7. The Management of Green Lanka should have maintained its focus on developing the information management system, marketing and supply chain management of the out grower model as originally planned. The social awareness and integration with the farming communities could have been outsourced to key NGOs (Oxfam, CARE etc.). Using this Management by Objective approach Green Lanka Management would have been more focused toward achieving its objectives.

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