

An Empirical Assessment of Information Systems in Agriculture in the Southern Province of Sri Lanka

K.H.N.H. WIMALAWANSHA¹, K.S. WEERASINGHE² and W.J.S.K. WEERAKKODY¹

¹Department of Plantation Management, Faculty of Agriculture and Plantation Management, ²Information and Communication Technology Center, Wayamba University of Sri Lanka, Makandura, Gonawila (NWP), 60170, Sri Lanka

ABSTRACT

Agricultural productivity can arguably be improved by relevant, reliable and useful information and knowledge. Hence, the creation of Information Systems in agriculture to disseminate information to the people can make better decisions and manage continuous changes in their production systems. As agriculture contributes to Sri Lankan economy greatly, it is useful to integrate agriculture with new technologies, like Information Systems. Some people in Sri Lanka have already applied this technology in agriculture, however, others do not accept leading to a gap among them. Therefore, it is a need to understand the functions and use of particular Agricultural Information Systems for better management and improvements. The purpose of this study was to examine empirically the current status of adoption of Information Systems and factors affecting them. A questionnaire based survey was conducted to collect data from 80 agriculture related organizations in Southern Province of Sri Lanka covering all three districts *viz.* Galle, Matara and Hambantota. According to the digital divide index of Information Systems, these organizations did not become innovators, early-adopters or early-majority of adoption of Information Systems. Most organizations were adopted by management level information systems, though strategic level Information Systems were zero. Most of the organizations had a trend to use off the shelf software rather than bespoke. The results from the regression analysis highlighted that the age and education level of manager have a positive relationship with the adoption of Information Systems.

KEYWORDS: Adoption, Digital divide, Information systems

INTRODUCTION

Agriculture is concerned as the engine of development in the most developing countries (Mokotjo and Kalusopa, 2010). As a developing country, agriculture in Sri Lanka is considered as a pillar of economy accounting for 11.1% GDP in year 2012 (Central Bank Report, 2014). Therefore, it plays a dominant role of the country's economy in terms of foreign exchange earnings, employment generation, government revenue earnings and land utilization.

An Information System (IS) is an organized system and it consists of collection of technical and human resources that provide the storage, computing, distribution and communication for the information required by all or some part of an enterprise (Martinez, 2015). Moreover, IS, for example, transaction processing systems, knowledge management systems, database management systems, office information systems, and decision support systems that are used by the organizations interact in support of business processes. Gradually, companies are incorporating computer-based IS into their products and services. Electronic business (E-Business) is expanding into e-commerce using IS. It is also used in enterprise systems such as transaction processing systems and enterprise resource planning. Apart from that, it is used in decision

support systems and in specialized business information systems such as knowledge management, artificial intelligent, expert systems and virtual reality (Stair and Reynolds, 2014). Management Information Systems (MIS) is a special form of IS (Martinez, 2015).

Today, IS of Sri Lanka have been ranked at the 86th position in the global IS ratings. Although, it has reported that adoption of Information Communication Technology (ICT) is at infant stage amongst different economic sectors in the country (Malalasekara, 2008). Therefore, there is a need to understand the functioning of particular agricultural information systems for better management and improvement (Demiryurek *et al.*, 2008).

In several countries researches regarding IS in agriculture sector were conducted based on open source solutions which clearly demonstrated that effectiveness of the tasks in the agriculture related organization is increased by the agricultural management information systems (Oliveira *et al.*, 2014).

Southern Province of Sri Lanka is constituted by Galle, Matara and Hambantota districts. Paddy, tea, rubber, coconut and cinnamon are the major agriculture crops grown in southern province. Apart from that coffee, clove, pepper and citronella are also grown well in Galle and Hambantota areas. Furthermore, milk production and poultry are popular

(Abeyasinghe, 1990). The southern province of Sri Lanka is characterized by large-scale agricultural activities done with huge labor force, time consuming and inefficiency. If they have systematic systems with better management and appropriate IS, they can have more profit and compete with others. However, some agriculture organizations have already implemented this technology, though others do not apply.

Few researches were conducted to evaluate IS adoption in agriculture field in Sri Lanka. This article provides the key results of an empirical study conducted to evaluate IS usage in agriculture sector in southern province of Sri Lanka.

METHODOLOGY

This study was carried out in southern province of Sri Lanka as a survey using a semi structured questionnaire with sample of 80 agriculture related organizations from February to May 2016.

Data Collection and Data Analysis

The 80 agriculture organizations comprises of 30 from Galle district, 30 from Matara district and 20 from Hambantota district. In depth face to face interviews were conducted to collect data with the managers and owners of the organization. Primary data were used in this study. First the information collected was used for a descriptive analysis.

Then Digital Divide Index of Information Systems (DDIIS) which reflects the state of the i^{th} organization with respect to adoption of IS was calculated. To obtain a valid and reliable estimation reflecting this phenomenon, first, based on the ICT literature, there were 15 distinct types of IS ($s=1, 2, 3...15$) available for agriculture in the southern province to adopt to increase its overall efficiency considered.

The overall level of adoption of certain IS (e.g. payroll) may be rated high in the agriculture sector whilst that of others (e.g. decision support system) may be at the lower rate. To resolve this problem, a "weighted" digital divide index was calculated for each organization where the relative frequency of adoption of an individual IS by the entire province was taken into account. The steps used in this regard were explained below. For this, following formula was used.

$$DDIIS = \sum_{i=1}^n ai / X$$

Where the term ai denotes the inter score taken from the statements (i.e. the sectors in which IS used such as financial, marketing, manufacturing and so on). And X represents the

total number of sectors in which IS can be incorporated with DDIIS values for that formula were calculated for each organization of this study.

Then the 'theory of diffusion of innovation' suggested by Rogers (1995) was applied for generalizing the spread of new idea within a social system using the 'adoption-diffusion model'. This theory describes the variation in adoption of a new technology by a set of people with the time. This particular model classifies those organizations into five categories based on degree of innovativeness towards the adoption of the new technology. They are innovators, early adapters, early majority adopters, late majority adopters and laggards.

Therefore, the values of DDIIS in this study were grouped in to five as 0.0-0.2, 0.2-0.4, 0.4-0.6, 0.6-0.8, and 0.8-1.0 according to the theory of diffusion of innovation. Then the percentage for those five groups was calculated. After that, the graph was plotted between frequency of organizations and DDIIS.

Then the analysis was performed to explore the possible relationship between educational levels and age of senior managers and owners on IS usage in southern province. Subsequently, simple linear regression was carried out for each relationship using Minitab 15 computer software.

RESULTS AND DISCUSSION

The present states of usage of IS in agriculture related organizations are depicted in Figure 1. Out of the sample, 37.5% companies used IS while 62.5% companies were not using IS because of lack of facilities and unaware of IS. Figure 2 shows the percentage of IS used in different districts Galle, Matara and Hambantota as 40, 40 and 20% respectively. Hambantota district had less percentage of IS due to some difficulties such as lack of infrastructure facilities, however, Galle and Matara districts had been invaded by new technologies, infrastructure facilities and so on. Hence, both districts had the same percentage of IS usage.

The percentages of organizations that adopted the 15 types of IS are illustrated in Figure 3. The highest percentage of companies used IS for financial (35%) and the second highest for marketing (30%). The systems used as personal database, office automation and sales are relatively low. The systems for manufacturing and budgeting were 4 and 1% respectively. No organizations were found those who used order processing, stock control, human resource, inventory, knowledge management, Decision Support Systems (DSS),

Management Information Systems (MIS), Executive Information Systems (EIS) and expert systems (Figure 3).

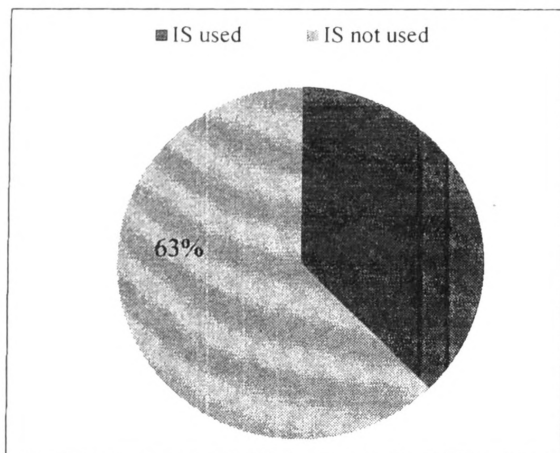


Figure 1. Availability of information systems in Southern Province. IS- information systems

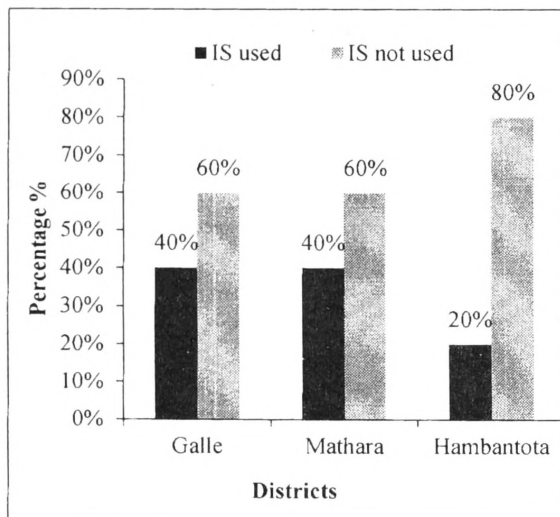


Figure 2. Availability of information systems in three districts. IS- information systems

The percentage of organizations belong to the five adopter categories suggested by Rogers (1995) are depicted in Figure 4. It shows that the percentage of organizations belong to each of the five categories were deviated substantially from the values of the theoretical model. There were no any innovators, early adopters and early majority with regard to adoption of IS as the percentages of both. This tells us that most of the firms did not adopt management and strategic IS sufficiently, although majority have confined to the operational level IS.

The results of simple linear regression depicted that there was a positive relationship between educational level and age of the managers or owners of the organizations and using Information Systems (Table 1 and 2). People who have higher education have a trend to incorporate IS in their organizations. It shows when owners experience is higher; they accept

advanced technology almost immediately and try to make innovativeness for their business.

Table 3 illustrates the types of software (Off the shelf and Bespoke) used as IS which were installed in different organizations. Out of them, 60% of the organizations used off the shelf IS and rest of them (40%) used bespoke IS. They used off the shelf IS because those software are available immediately and sometimes staff of the organizations are familiar to use them.

According to the survey, most of the organizations were working with Microsoft office Excel and Microsoft office Access programs to store data due to their user-friendliness. Further, survey found that 66.7% had spent less than one million rupees for purchasing or creating the IS software (Table 3). Still the owners of the organizations in southern province are afraid of introducing new technologies for their business activities. Time duration of using the Information Systems were less than one year (46.7%) and one to two years (50%). It shows that most of the organizations are at infant stage of introducing the new systems.

Table 1. Results of regression of education of managers and Information Systems

Source	DF	SS	MS	F	P
Regression	3	3.727	1.242	6.28	0.001
Residual error	76	15.023	0.198		
Total	79	18.75			

DF-Degrees of Freedom, SS-Sums of Square, MS-Mean Sums of Square

Table 2. Results of regression of age of managers and Information Systems

Source	F	SS	MS	F	P
Regression	5	2.789	0.558	2.57	0.034
Residual error	73	15.819	0.217		
Total	78	18.608			

DF-Degrees of Freedom, SS-Sums of Square, MS-Mean Sums of Square

It was very useful to find the reason of using IS in agriculture organizations (Figure 5). Highest percentage of organizations agreed that IS provided easiness, quickness and high accuracy for their works.

The factors affecting for not using IS are represented in Figure 6. Lack of facilities and lack of knowledge of the systems became the most critical problems of those organizations which affect on unutilized IS. Twenty four percent of organizations did not know about the system. Some organizations (18%) did not need an IS because they were able to carry out their works without application of this technology.

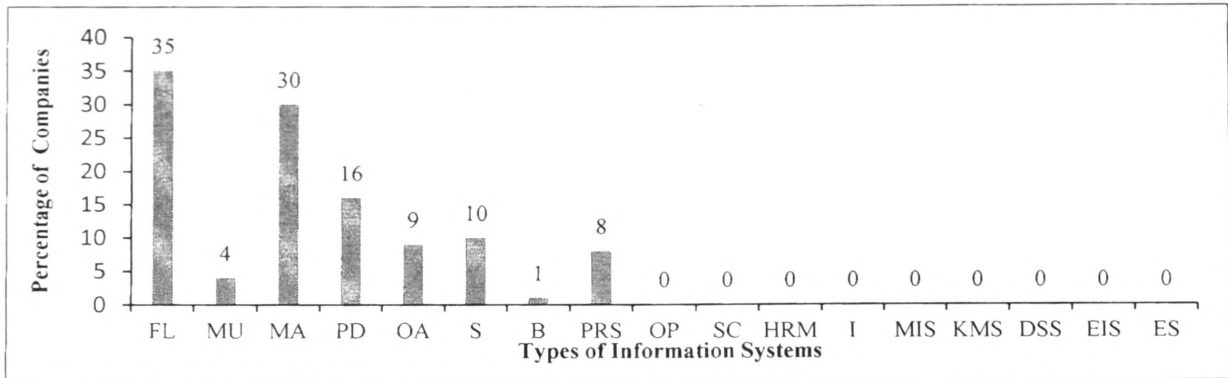


Figure 3. Types of Information Systems used in agriculture related organizations of Southern Province. FL- Financial, MU- Manufacturing, MA- Marketing, PD- Personal database, OA- Office automation, S- Sales, B- Budgeting, PRS- Pay roll systems, OP- Order processing, SC- Stock control, HRM- Human resource management, I- Inventory, MIS- Management information systems, KMS- Knowledge management systems, DSS- Decision support systems, EIS- Executive information systems, ES- Expert systems

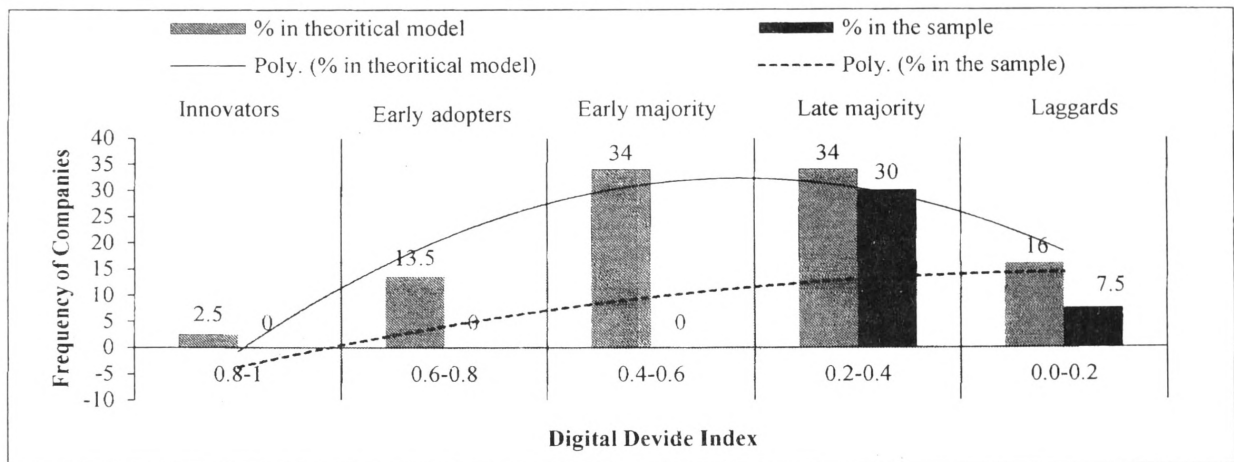


Figure 4. Percentage of organizations (observed and theoretical) in five adopter categories

Table 3. Types of software used

Districts	What kind of IS		Amount of investment for package		Time period for using package bought IS		
	Off the Shelf	Bespoke	<1 million	1-2 million	<1 year	1-2 years	2-5 years
Galle	9	3	2	1	4	7	1
Matara	12	8	5	3	5	7	
Hambantota	6	1	1		5	1	
Total	27	12	8	4	14	15	1
Grand total	45		12		30		
Percentage (%)	60.0	40.0	66.7	33.3	46.7	50.0	3.3

IS- Information systems

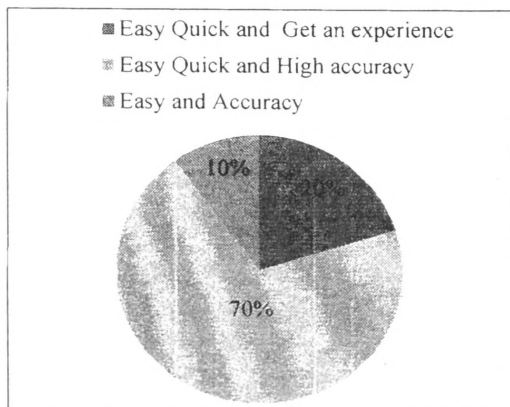


Figure 5. Reasons for using Information Systems

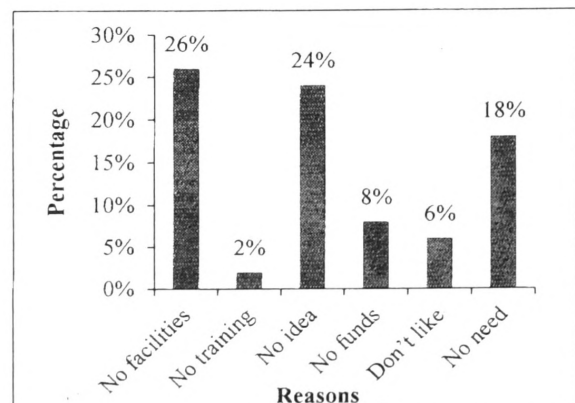


Figure 6. Reasons for not using Information Systems

CONCLUSIONS

The outcomes of the analysis suggest that only 37% agriculture related organizations use IS for their work in southern province. The organizations in Galle and Matara districts use same percentage of IS while organizations in Hambantota district use low percentage of IS.

The survey concludes that more than half of the organizations have been using off the shelf IS including MS Excel and MS Access because they are easy to handle and can purchase for lower price. All the organizations agreed that IS make works easy and enhance the productivity of the company.

The majority of agriculture related organizations in southern province do not use IS because of lack of facilities and unaware of the system. Then it is very important to be aware of IS to the public and emphasize the benefits of it. The survey suggests that an awareness program regarding IS are a good solution for that issue.

There are no any innovators, early adopters and early majority in southern province. Therefore, there are no people who are willing to accept the new technologies in southern province. Higher percentage of late majority than the laggards determines there are more skeptic people who use new ideas only when the majority is using it. In the present study, we could identify the gap of adoption of Information Systems in agricultural organizations in southern province of Sri Lanka. Public and private policies can promote to close the gap by supporting to conduct some awareness program and investing in information communication technology.

ACKNOWLEDGEMENTS

The authors like to extend their profound gratitude to all agriculture organizations in southern province for providing the data and

other information in responding to the questionnaires.

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