Digital Divide in the Corporate Tea Sector in Sri Lanka: An Empirical Investigation

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ABSTRACT

The rapid developments in the field of Information and Communication Technology (ICT) in an economy can at the same time create a "gap" between those businesses that adopt such technologies "in a flash" (innovators) and "at a snail's pace" (laggards), which is commonly referred to as Digital Divide. The purpose of this study was to examine empirically the current status of adoption of ICT and in turn the digital divide resulting from which in the corporate tea production sector in Sri Lanka and the factors affecting this behavior.

A questionnaire based survey (n = 121) was carried out to collect the data from the managers responsible for ICT of the tea estates located in the Low, Mid and Up country. An empirical model was developed to show the relationship between the level of adoption of 12 Basic, Intermediate and Advanced ICT facilities and a number of factors to reflect the managerial, production and financial aspects of tea estates. Based on the Innovation – Diffusion Theory the status of Digital Divide of an estate was specified by means of an Index. An Ordered Logistic Regression technique was employed to estimate the coefficients of the model.

The results show that these estates did not become innovators or early-adopters of ICT by adopting Advanced or intermediate type of technologies, but were mostly confined to the Basic facilities. The results from the OLR highlight that the turnover of tea estate, ICT literacy, attitudes of managers and IT training of the staff have a significant impact on the adoption of ICT.

INTRODUCTION

The convergence of telecommunication and computer technology that include, amongst the others, telephone, television, video, fax, personal computers, internet and its associated services such as electronic mail, electronic bulletin boards and the World Wide Web, is generally called Information and Communication Technology (ICT). It covers any product that will store, retrieve, manipulate, transmit or exchange information electronically in a digital form over the networks to many destinations in the world and helps individuals, businesses and organizations to use all types of information (i.e. data, audio and video) with digital technology. Today, ICT is used extensively as a "diffusion tool" to reach and share information, knowledge and resources efficiently and effectively in any field (Bouman *et al*., 2004; Warren, 2002).

Even though there are numerous opportunities in using ICT in various fields, a widespread inequality in its usage is reported, which, in turn, delays the substantial amount of efficiency and productivity loss at many of these sectors. In the ICT literature, this inequality is referred to as "Digital Divide". Quibria *et al.*, (2002), for example, define digital divide as the "division of the world between those who have access to new information and communication technology and those who have not access" (see, Song *et al*., 2006; Barrantes, 2007; Chinn and Fairlie, 2004 for details). Although Sri Lanka has been ranked at the 86th position in the global IT ratings (Malalasekera, 2007), it has been reported that adoption of ICT is at an infant stage amongst different economic sectors in the country. Not surprisingly, the level of awareness and knowledge about as well as access and use of ICT facilities in the rural communities, like in many other developing countries, are very low.

Tea sector in Sri Lanka has been playing a dominant role in the economy of Sri Lanka in terms of foreign exchange earnings (Rs. 880 million), employment generation and utilization of lands (222,000 hectares) etc. Its contribution to the Gross Domestic Product (GDP) of the country

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was about 1.1 percent in 2006 (Central Bank of Sri Lanka, 2007). The Corporate Tea Sector in Sri Lanka (i.e. estates with over 20 hectares), unlike the smallholding sector, is characterized by large-scale estates that undertake a number of activities unique to the sector which should be carried out consistently and systematically (e.g. plucking, handling, storage and on-site processing) with a participation of huge labor force and much organized structure of management (Table 1).

Consequently, it has a greater potential to increase its overall efficiency at the estate level so that it can be competitive with the current global and regional trends taking place in this industry, if individual estates adopt advanced and appropriate information and communication technologies. In light of this, although some of the estates managed by the Corporate Sector have already gone into adoption of various types of ICT to a various degree and obtained a "first mover advantage", some others did not pay much attention to this phenomenon. For that reason, there exists a "gap" with respect to the level of utilization of ICT by individual estates (i.e. digital divide) in the Corporate Tea Sector in Sri Lanka.

Only a few articles to date have studied the issues related to the adoption of ICT in agricultural sectors of a country from the empirical point of view. Sticker *et al.*, (2003), for example, investigated the relationship of which in the context of agriculture sector in Germany. It uses a three-stage questionnaire-based survey to examine the issues such as access and usage of computers, Internet and e-commerce by farm managers. The results show that the majority of farm managers have a personal computer and those managers, in general, utilize that to connect into the Internet. It found that young and educated managers were more likely to use the Internet than older and less-educated peers and also with respect to large and small-scale farms. The outcome of analysis revealed that a clear division of technology adoption can be seen in the agriculture sector in Germany.

Warren (2002) examined this phenomenon in the context of agriculture sector in the United Kingdom. It shows that there exists a significant difference with regard to use of personal computers between small and large-scale arable production. The differences in Internet use were even more extreme. It reveals that older farmers and those without formal education beyond the secondary school were more unlikely to adopt ICT. In another study, Dasgupta *et al.*, (2007), investigated the digital divide across the African, Latin American and Asian regions especially with regard to the "internet intensity" and "telecommunication access". The outcome of this study based on a model explains the relationship between diffusion of internet via mainline telephone systems and the income, government policy and urbanization suggests that the rapid growth of internet use in high income economies has raised the presence of digital divide. This has marginalized developing countries because they cannot afford internet access or use effectively even it is available.

This article provides the key results of an empirical study conducted to assess the digital divide in the Corporate Tea Sector in Sri Lanka and to investigate the factors affecting such a behavior. Although there is a great deal of literature available that reviews or provides statistics on the performance of plantation sector with respect to several other issues, for example effect of subsidies, credits and tariffs and quality assurance on production and trade etc., to the best knowledge of authors, there is first hand information available about the real situation with respect to adoption of ICT in the plantation sector in Sri Lanka. This article contributes to the literature by providing that vital information.

METHODS

The empirical model used to examine the relationship between the level of adoption of ICT in a tea estate and associated factors and the methods used to collect and analyze data are discussed below.

Empirical Model

The following empirical model was specified, in which the term DDI_i (dependent variable) describes the level of ICT adopted by the i^{th} estate (DDI refers to "Digital Divide Index" of the i^{th} estate – see below).

$$DDI_i = \beta_0 + \beta_1 * EMP + \beta_2 * LER + \beta_3 * PRD + \beta_4 * TVR + \beta_5 * AGE + \beta_6 * EXP + \beta_7 * ITT + \beta_8 * ITL + \beta_9 * ATI + \beta_{10} * HCP + \beta_{11} * OQS + \beta_{12} * ELE + \beta_{13} * INS + \varepsilon_i$$

The terms β_0 and β_i denote the intercept and the coefficients of the explanatory variables, and ε_i is the random error term. The methods used to derive the DDI are explained next followed by the description of explanatory variables used in this model.

Erivation of Digital Divide Index (DDI_i)

The following steps were used to derive the DDI_i, which reflects the state of the i^{th} tea estate with respect to adoption of ICT facilities. To obtain a valid and reliable estimate reflecting this phenomenon, first, based on the ICT literature, there were 12 distinct ICT facilities (s = 1, 2, 3…12) available for a tea estate in the Corporate Sector to adopt to increase its overall efficiency considered (Table 2).

Following Halavatau (2003); Nakamura (2003) and Barrantes (2007), those 12 ICT facilities were, in turn, classified into three categories, namely: (1) "*Basic ICT*" (B_{ICT}), (2) "*Intermediate ICT*" (I_{ICT}), and (3) "*Advanced ICT*" (A_{ICT}). As reported in Table 2, the Basic ICT facilities include: Land line phone, Computer, Fax and e-Mail. The Intermediate ICT facilities include: Mobile phones, Information systems, Internet and IT Department. Finally, possession of a Network, Company website, Digital conferencing and ERP were considered as having Advanced ICT facilities. The equations (i), (ii) and (iii) shown below were used to determine the level of adoption of ICT facility included in each category (i.e. B_{ICT}, I_{ICT} and A_{ICT}) by an individual estate:

One can simply derive an "un-weighted index" for DDI by considering that each ICT facility listed above (s = 12) as having an equal weight[1]. However, the value obtained through that may not reflect the real situation of a tea estate in relation to the whole industry (i.e. Corporate Sector in this case), because the benefits and costs as well as the effort of adoption of a particular ICT facility in a tea estate may be largely different from another ICT facility (e.g. use of personal computer versus establishment of Information Systems).

$$\textit{Level of Adoption of Basic ICT } (B_{ICT}) = \frac{\textit{Basic ICT Facilities}}{4} \quad \text{(i)}$$

$$\textit{Level of Adoption of Intermediate ICT } (I_{ICT}) = \frac{\textit{Intermediate ICT Facilities}}{4} \quad \text{(ii)}$$

$$\textit{Level of Adoption of Advanced ICT } (A_{ICT}) = \frac{\textit{Advanced ICT Facilities}}{4} \quad \text{(iii)}$$

Thus, the overall of level of adoption of certain ICT facilities (e.g. land line phone) may be rated high in the Corporate Sector whilst that of others (e.g. video conferencing) may be a at the lower rate. To resolve this problem, a "weighted" Digital Divide Index was calculated for each estate where the relative frequency of adoption of an individual ICT facility by the entire Corporate Sector was taken into account. The steps used in this regard were explained below, in turn.

First, a database explaining the status of adoption of each ICT facility by the corporate estates was prepared (i.e. adoption = 1; non-adoption = 0). Then, the

1 For example, if a given estate adopts 3 out of 4 ICT facilities listed under the Basic category, its B_{ICT} would be ¾ = 0.75. Similarly, if the same estate adopts 2 Intermediate and 1 Advanced ICT facility, its I_{ICT} and A_{ICT} would be 2/4 = ½ = 0.5 and ¼ = 0.25, respectively.

frequency of adoption of individual ICT facilities (F_{si}) by this sector was obtained using the equation (iv):

$$F_{si} = \sum_{i=1}^{n} T_{si}/n \qquad \text{(iv)}$$

As specified earlier, *s* and *i* of the term T_{si} of equation (iv) denotes the ICT facilities (*s* = 1, 2, 3…12) and the tea estates (*i* = 1, 2, 3…n), respectively. The value of T_{si} for a given ICT facility of a tea estate would be "1" if the said estate adopts it and "0" otherwise. The frequency of adoption of any ICT facility (F_{si}) will be ranging from "0" if nobody in the corporate sector adopts it to "1", if all in the estates adopt it.

Once the frequencies of adoption of individual ICT facilities in the whole sector were obtained, the "1" given to the adopters of those ICT facilities under the un-weighted criterion were replaced with the corresponding frequency and the "0" given to the non-adopters were retained, i.e. the frequency was considered the weight. For a given estate, the sum of weights belongs to the 12 ICT facilities were calculated and the resulting value was divided by S = 12 (i.e. no. of ICT facilities) for the purpose of normalization[2] as shown in equations (v) and (vi) below:

$$T_{ICTi} = \sum_{s=1}^{m} F_{si} \qquad \text{(v)}$$

$$DDI_{Wi} = \frac{T_{ICTi}}{S} \qquad \text{(vi)}$$

Accordingly, any estate that obtained a value for DDI_W that is close to "1" indicates that the said estate has adopted a higher number of ICT listed above, and on the same argument, the value of DDI_W close to "0" tells that it has not adopted the ICT facilities considered in the study to a satisfactory level.

2 With the normalization, the value of weighted DDI for a given estate should, theoretically, be range from minimum of "0" (i.e. none of the ICT facilities were adopted) to maximum of "1" (i.e. all the ICT facilities were adopted).

Classifying of Tea Estates Using the Value of DDI_W

Once the DDI_W (Weighted Digital Divide Index) of each estate was derived, it was used to classify those estates to reflect their "degree of innovativeness" towards adoption of ICT. For that purpose, the "Adoption – Diffusion Model" explored in the "Theory of Diffusion of Innovation" by Rogers (1995) that exemplify the spread of a new idea within a social system was used (Figure 1)

To obtain the cut-off points of DDI_w for each category, the value of DDI_w of all the estates included in the analysis were ordered in "descending order" (i.e. from "1" to "0") [i.e. degree of innovativeness increases as the value of DDI_w increases) and a Frequency Chart was derived, where the values of DDI_w were used in the "*X-axis*" and the corresponding frequencies of occurring each value were used in the "*Y-Axis*".

Factors Affecting the Level of Adoption of ICT

It was hypothesized that the following factors can have a positive and significant impact on the degree of innovativeness of tea estates towards adoption of ICT facilities (i.e. higher value of DDI_w) classified under the three types of categories (i.e. B_{ICT}, I_{ICT} and A_{ICT}) (Chinn and Fairlie, 2004; Quibria *et al.*, 2002):

(1) "*Scale of Operation*" – number of employees, land extent, volume of production and annual income.

(2) "*Managerial Aspects*" – age of the managers, years of working experience, IT literacy, and attitudes of the management towards ICT.

(3) "*Internal Systems*" – prevalence of enhanced food and environmental quality management/assurance systems (e.g. GMP, HACCP, ISO 14000).

(4) "*Infrastructure*" – connection to the national grid of electricity.

(5) "*Institutional Support*" – financial and/or any other type of support provided to the estate by public (government) or private (corporate) sector.

The explanatory variables developed to explain the effect of each aspect were described in the Table 3.

Data Collection and Analysis

The sampling framework to collect data includes the tea estates located in the Up Country, Mid Country and Low Country regions in Sri Lanka. To select the respondents to the sample, a telephone conversation was carried out with the manager of the estate, especially to get the consent and date for an interview/direct observation. A structured questionnaire was developed to collect first hand information related to many areas, including the profile of management, general information about the estate (e.g. infrastructure, production, quality assurance), types of ICT facilities adopted and attitudes of managers towards ICT. The questionnaire was pre-tested using a small representative sample (n=10) and certain modifications to the questionnaire and to the interview process were made, as necessary.

Based on the profile of estates developed through the telephone conversation, a series of "face to face interviews" (n=121) was carried out from March to July 2008 to collect the data with the managers responsible for making decisions with respect to the adoption of ICT in the estate. Once the data were coded, a Factor Analysis was carried out with the information pertaining to adoption of 12 ICT facilities listed using the techniques of Categorical Principal Component Analysis (CATPCA) using the Statistical Package for Social Sciences (SPSS 16.0), which displays the results in a low-dimensional map that makes it easy to understand the relationships. Based on the results from this analysis, the data pertaining to 84 estates were selected by removing the biased and non-representative responses (outliers) (Table 4).

Having obtained the value of DDI_w for each estate, there were five ordered-dependent variables were derived as shown in Table 5 to represent the five types of adopters of a technology explained in the Adoption-Diffusion curve. (Table 5)

To develop the explanatory variable explaining "Attitudinal Index" (ATI), there were 12 statements explaining the relationship between managerial attitudes and adoption of ICT were included in the questionnaire. The respondents were asked to rate these statements on a five-point Likert scale of: (1) strongly agree; (2) agree; (3) neither agree nor disagree (4) disagree, and (5) strongly disagree (Oppenheim, 1992). The ATI for each estate was then calculated using the equation (vii), where the value 60 in the numerator shows the maximum value can be obtained if the respondent strongly agree with 12 statements (i.e. 5 x 12).

$$Attiude\ Index = \frac{Summation\ of\ 12\ statements\ of\ each\ estate}{60} \quad \text{(vii)}$$

The coefficients of variables of the model were estimated using the Ordered Logistics Regression techniques available in STATA 9.2. Both the estimate of coefficient (logits) and Marginal Probabilities were used to interpret the results.

RESULTS AND DISCUSSION

Descriptive Statistics of the Sample

The general information of managers (age, work experience) and the tea estates (land extent, no. of employees, production, turnover) are reported in Table 6.

According to Table 6, the managers responsible for adoption of ICT in the

corporate sector were, in general, young with the minimum and maximum ages of 26 and 59. A relatively high mean value for work experience indicates that these managers, in general, work in the tea sector for long time; thus, knowledgeable about needs of the industry with respect to ICT. Also, the mean of these two characteristics were subjected to less variation, for example the Coefficient of Variation (CV) of age and work experience were 20.0 and 42.1 percent, respectively. In contrary, the mean of characteristics of the estate was subjected to high variation, for example the CV of land extent, number of employees, production of tea and turnover were 51.4, 58.9, 56.2 and 79.5 percent, respectively.

Current Status of Adoption of ICT Facilities

The percentage of estates that adopted the 12 types of ICT facilities is illustrated in Figure 2.

It clearly shows that land line telephone was used by all the tea estates (100%), while there were large number of other estates use personal computers (92.1%) and Information Systems (88.2%). Further, nearly 83 percent of estates use e-mail for their business activities. Conversely, the use of Internet (32.9%) and mobile phone technology (21.1%) and maintenance of company website (14.5%) was relatively low. It demonstrates that Digital Conferencing (2.6%) was the lowest adopted ICT facility in this particular sector. Surprisingly, the results indicate that the fax has not been utilized as a common ICT facility in this sector (18.4%). The results also reveal that the most widely used Information System was the Transaction Processing System (TPS) (88.2%) followed by Accounting System (77.6%) and Management Information System (56.6%) (Figure 3).

Classifying the Estates Based on the Value of DDI

The percentage of estates belong the five adopter categories suggested by Rogers (1995) were depicted in Figure 4.

It shows that the percentage of estates belong to each of the five categories were deviated substantially from the values of the theoretical model. There were no any innovators and early-adopters with regard to adoption of ICT as the percentages of both were zero. This tells us that these firms did not adopt the advanced and intermediate types of ICT facilities sufficiently, and as a result, the value of the DDI_w was less than 0.6. The percentage of early majority in the sample (9.2%) was also less than the theoretical value (34%). A vast majority of estates (85.5%) were having the DDI_w between 0.2 and 0.4, which was much higher than the theoretical value of 34 percent. The results show that the majority of estates were confined to adopt only the basic ICT facilities listed above (i.e. land line telephones and personal computers), but rarely and indiscriminately adopt other ICT facilities. A relatively lower value (5.3%) for the laggards in compared to the theorized value of 16 percent proves this, i.e. almost all adopts Basic ICT facilities and the estates' action towards Intermediate and Advanced ICT facilities were minimal.

Estimates from the Ordered Logistic Regression

The descriptive statistics of the 13 explanatory variables used in the model are reported in Table 7.

It shows that the value of most of these variables, including "Work Experience Ratio of Manager" and "ICT Literacy", were subjected to very high variability (i.e. CV = 200% and 191%, respectively). Several other variables, namely "Certified HACCP", "IT Support", "Other Quality Assurance" and "IT Training for Staff" were also showed somewhat higher variability. With regard to the attitudes of managers towards importance of ICT in tea estates, a majority of managers 53.9 percent indicated that it is highly important.

The results from OLR analysis suggest that the empirical model was significant at $\rho = 0.01$. The relatively high pseudo R-square value ($R^2 = 0.65$) too

indicates that the model performed well. Table 8 summarizes the estimates of coefficients (logits) from the OLR.
(Table 8)

It highlights that the turnover of estates ($\rho = 0.01$), ICT literacy ($\rho = 0.05$) and positive attitudes of manager towards ICT and IT training obtained by the staff ($\rho = 0.10$) have a significant impact on adoption of ICT in tea estates. The Marginal Probabilities obtained for these variables indicate that turnover (TVR), ICT literacy of the managers (ITL), attitudes of the managers (ATI) and IT training (ITT) have a substantial effect in this respect.

The outcome of analysis highlights that estates with higher turnover can channel a large amount of capital for ICT. Also, the estates with a higher number of employees in its office did possess a low propensity to adopt ICT. These results are a clear indication that the level of adoption of ICT, more specially the intermediate and advanced types, can be further improved if the knowledge of managers involved with ICT is increased by providing proper training. Also, it would become a good practice that new employers to the industry are having a good ICT literacy as it minimize the digital divide.

CONCLUSIONS AND POLICY IMPLICATIONS

The outcome of analysis confirms that tea estates, at present, mostly adopt only the basic ICT facilities such as land line telephones and personnel computers. Although a majority of estates possess Information Systems, the use of which were confined to Transaction Processing Systems in order to maintain the information of production details, inventory particulars and salary of the employees. In fact, the usage of Internet was unsatisfactory in the corporate estates at the moment, which from one hand, does not allow these estates to setting up the applications like Customer Relationship Management, Database Management System and Electronic Data Interchange through Intranet, Extranet and Internet effectively and expose into the current world trends in production, quality assurance and marketing of tea, on the other. Moreover, the lack of adoption of intermediate facilities, for example networking, affects the level of use of advanced and effective ICT facilities such as digital conferencing.

Lack of Innovators and Early-adopters of ICT in the corporate sector means that nearly 90 percent of estates were not motivated to adopt such technologies voluntarily. It proves that the levels of adoption of individual ICT facilities considered in this analysis were highly inconsistent across the estates, and as a result, there exists a digital divide among the tea estates. The outcome suggests that both the public (government) and private (corporate) sector should get together to increase the levels of ICT adoption. This can be done by capacity development of managers in terms of training and injection of right attitudes towards importance of ICT and financing the sector to develop necessary infrastructure.

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Table 1 : Comparison of Corporate and Small Holding Tea

	Corporate Tea Sector	**Small Holding Sector**
1. Land size	> = 20 hectares	< 20 hectares
2. Land coverage	58% of total tea land	42% of total tea land
3. Productivity in 2006	1,400 kg/ha	1,867 kg/ha
4. Made tea production	40% of the total	60% of the total
5. Management	By 20 Regional Plantation Companies (RPC)	By private owners
6. Number of estates/ Small Holdings	RPC manages 304 tea estates	397,223 in 2005

Source: *Report on census in tea small holdings in Sri Lanka (Anon, 2005), Feasibility study on potentials for community participation in tea production on tea plantations and adjacent villages (Anon, 2002), Performance 2006 and activities (Anon, 2007), Agricultural profile of the corporate tea sector (Anon, 2003).*

Table 2 : Types of ICT Facilities

	Variable	**Notation**	**Type**
1.	Use of Land Line Phone	T_1TEL	B_{ICT}
2.	Use of Facsimile	T_2FAX	B_{ICT}
3.	Use of Personal Computers	T_3COM	B_{ICT}
4.	Use of E-mail	T_4EML	B_{ICT}
5.	Access and use of Internet	T_5INT	I_{ICT}
6.	Establishment of Information Systems i. Transaction Processing System (TPS) ii. Office Automation System (OAS) iii. Accounting System (ACS) iv. Management Information System(MIS) v. Decision Support System (DSS) vi. Executive Support System (ESS)	T_6IFS	I_{ICT}
7.	Network Facilities	T_7NET	I_{ICT}
8.	Establishment of a separate IT Department/Section	T_8ITD	I_{ICT}
9.	Development of Website	T_9WEB	A_{ICT}
10.	Enterprise Resource Planning	T_{10}ERP	A_{ICT}
11.	Digital Conferencing	T_{11}DCF	A_{ICT}
12.	Mobile Phones given by the Company	T_{12}MOB	A_{ICT}

Table 3 : Explanatory Variables Used for the Empirical Model

Variable	Notation	Description
Scale of Operation		
"Employee Ratio"	EMP	No of employees in the estate / Average no of employees in the sample
"Land Extent Ratio"	LER	Land Extent / Average land extent
"Production Ratio"	PRD	Annual production of the estate / Average annual production of the sample
"Turnover Ratio"	TVR	Annual turnover of the estate / Average annual turnover of the sample
Managerial Aspects		
"Age of the Manager"	AGE	No of years
"Work Experience"	EXP	No of years worked / Age of the manager
"IT Literacy"	ITL	Qualifications on ICT (Yes = 1; No = 0)
"Attitude Index"	ATI	The score given on 12 attitudinal statements explaining "use of ICT in office management" use to develop an Attitude Index.
QA Systems		
"Certified HACCP"	HCP	System of certified HACCP (Yes = 1; No = 0)
"Other Systems"	OQS	No of other internal operational systems (GMP, ISO Series of Standards etc.)
Infrastructure		
"IT Training"	ITT	Formal training on ICT (Yes = 1; No = 0)
"Electricity"	ELE	Supply from the national grid of electricity (Yes = 1; No = 0)
Institutional Support		
"Private or Public"	INS	Dummy variable (Yes = 1; No = 0)

Table 4 : The Sampling Framework

Zone	Administrative District	Number of Estates
Up Country	Badulla	18
	Nuwara-Eliya	24
Mid Country	Kandy	10
Low Country	Galle	12
	Ratnapura	20
Total		**84**

Table 5 : Dependent Variables Used in the Empirical Model

Type of the Estate	Dependent Variable	Range of the Digital Divide Index
1. ICT Innovators	DDI_1	$0.8 < DDI \leq 1.0$
2. Early ICT Adopters	DDI_2	$0.6 < DDI \leq 0.8$
3. Early Majority ICT Adopters	DDI_3	$0.4 < DDI \leq 0.6$
4. Late Majority ICT Adopters	DDI_4	$0.2 < DDI \leq 0.4$
5. Laggards in Adopting ICT	DDI_5	$0.0 < DDI \leq 0.2$

Table 6 : General Statistics of the Estates

Variables	Mean	Standard Deviation	Minimum	Maximum
About Managers				
Age of Manager(years)	40	8	26	59
Work Experience (years)	19	8	3	39
About the Estate				
Land Extent (Ha)	276.6	142.4	26.5	707.1
Number of Employee	577	340	113	1805
Black Tea Production per Year(Mt)	457.5	257.2	45.6	1571.7
Turnover (Millions/year)	80.8	63.9	4.6	342.9

Table 7 : Descriptive Statistics of the Explanatory Variables

Variables		Mean	Standard Deviation	Coefficient of Variance (CV)
Age of the Manager	AGE	40	8	20
Work Experience Ratio of Manager	EXP	0.03	0.06	200
ICT Literacy	ITL	0.22	0.42	191
Attitude Index	ATI	0.79	0.12	15
Land Extent Ratio	LER	0.79	0.49	62
Production Ratio	PRD	0.47	0.26	55
Turnover Ratio	TVR	0.91	0.63	69
Employee Ratio	EMP	0.85	0.43	51
IT Training for Staff	ITT	0.52	0.50	96
Electricity	ELE	1	0	0
IT Support	INS	0.35	0.48	137
Certified HACCP	HCP	0.33	0.47	142
Other Quality Assurance	OQS	0.45	0.50	111

Note: *CV = (Standard Deviation / Mean) * 100*

Table 8 : Estimates of the Logits

Variables		Estimates of Logits	Standard Error	Marginal Probability
Age of the Manager	AGE	-0.069	0.058	0.05
Work Experience Ratio of Manager	EXP	-5.788	10.07	0.46
ICT Literacy	ITL	2.678**	1.073	0.17
Attitude Index	ATI	5.345*	3.815	0.43
Land Extent Ratio	LER	-0.678	1.699	0.10
Production Ratio	PRD	-2.123	1.918	0.20
Turnover Ratio	TVR	7.730***	1.788	0.60
Employee Ratio	EMP	-0.511	1.723	0.08
IT Training for Staff	ITT	1.113*	0.833	0.13
IT Support	INS	0.226	1.217	0.07
Certified HACCP	HCP	1.301	1.278	0.16
Other Quality Assurance	OQS	-1.139	0.957	0.13

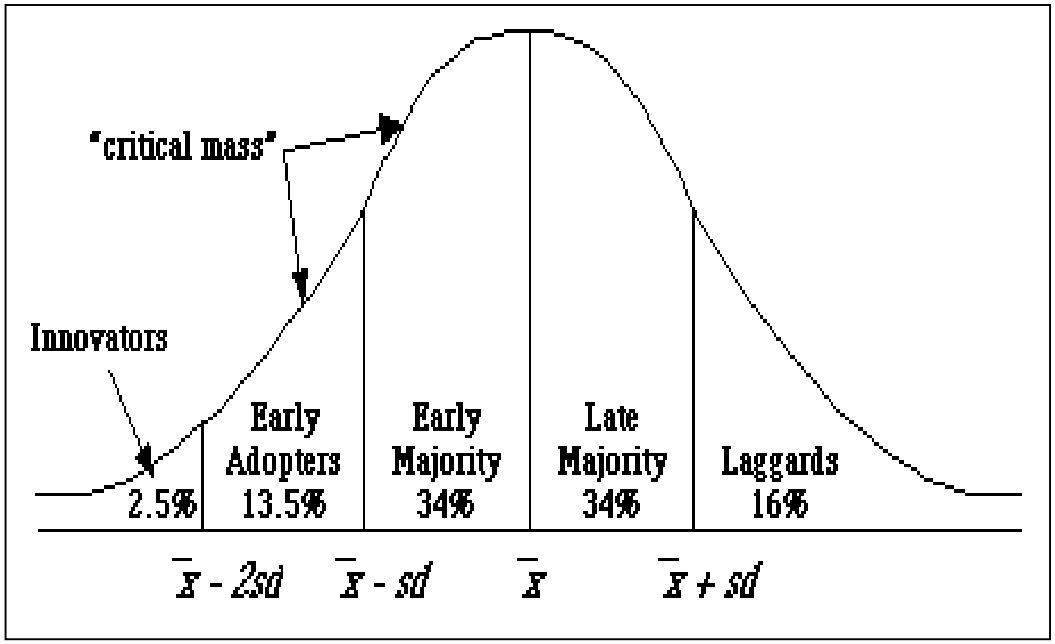

Figure 1 : The "Innovation – Adoption Curve"
Source: *Diffusion of Innovations (Rogers, 1995)*

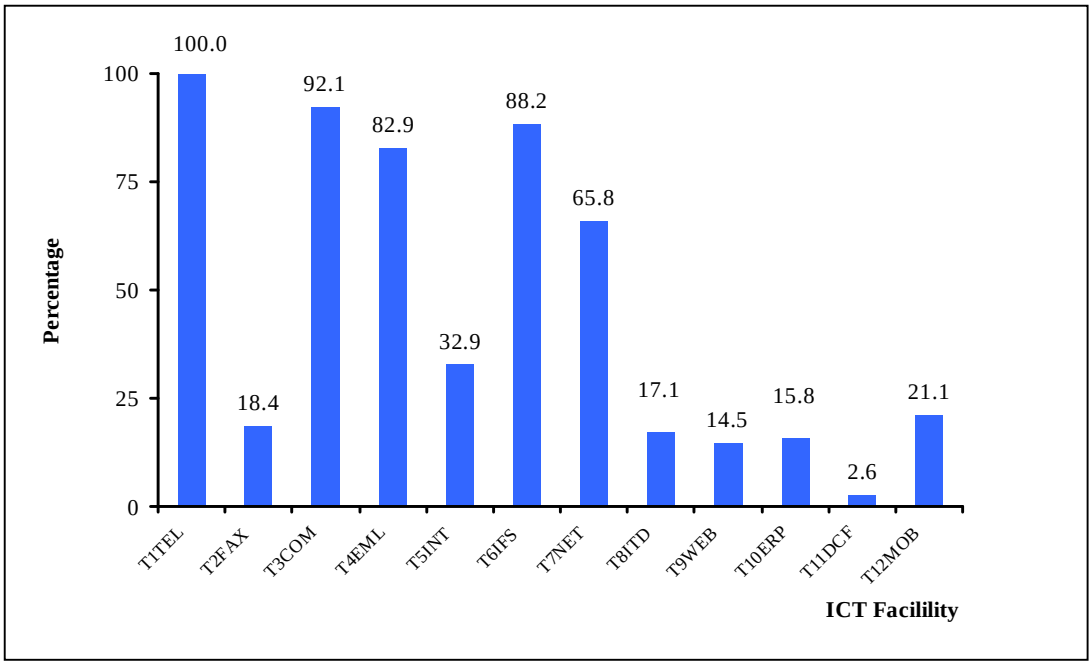

Figure 2 : Current status of ICT facilities

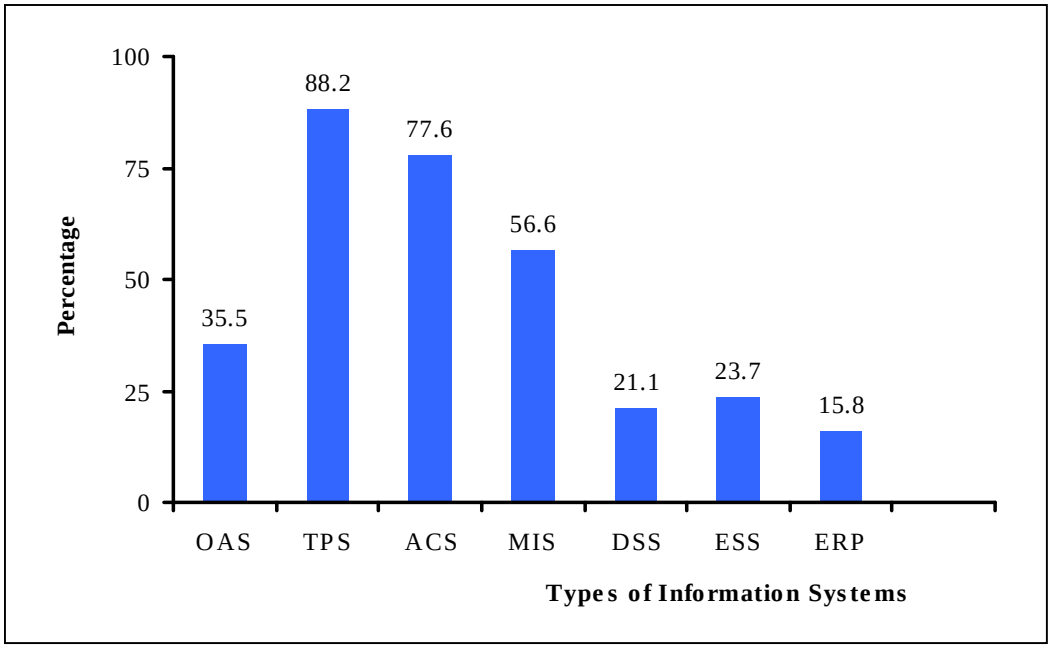

Figure 3 : Levels of Information Systems

Note:
****** OAS – Office Automated System, TPS – Transaction Processing System, ACS – Accounting System, MIS – Management Information System, DSS – Decision Support System, ESS – Executive Support System , ERP – Enterprise Resource Planning*

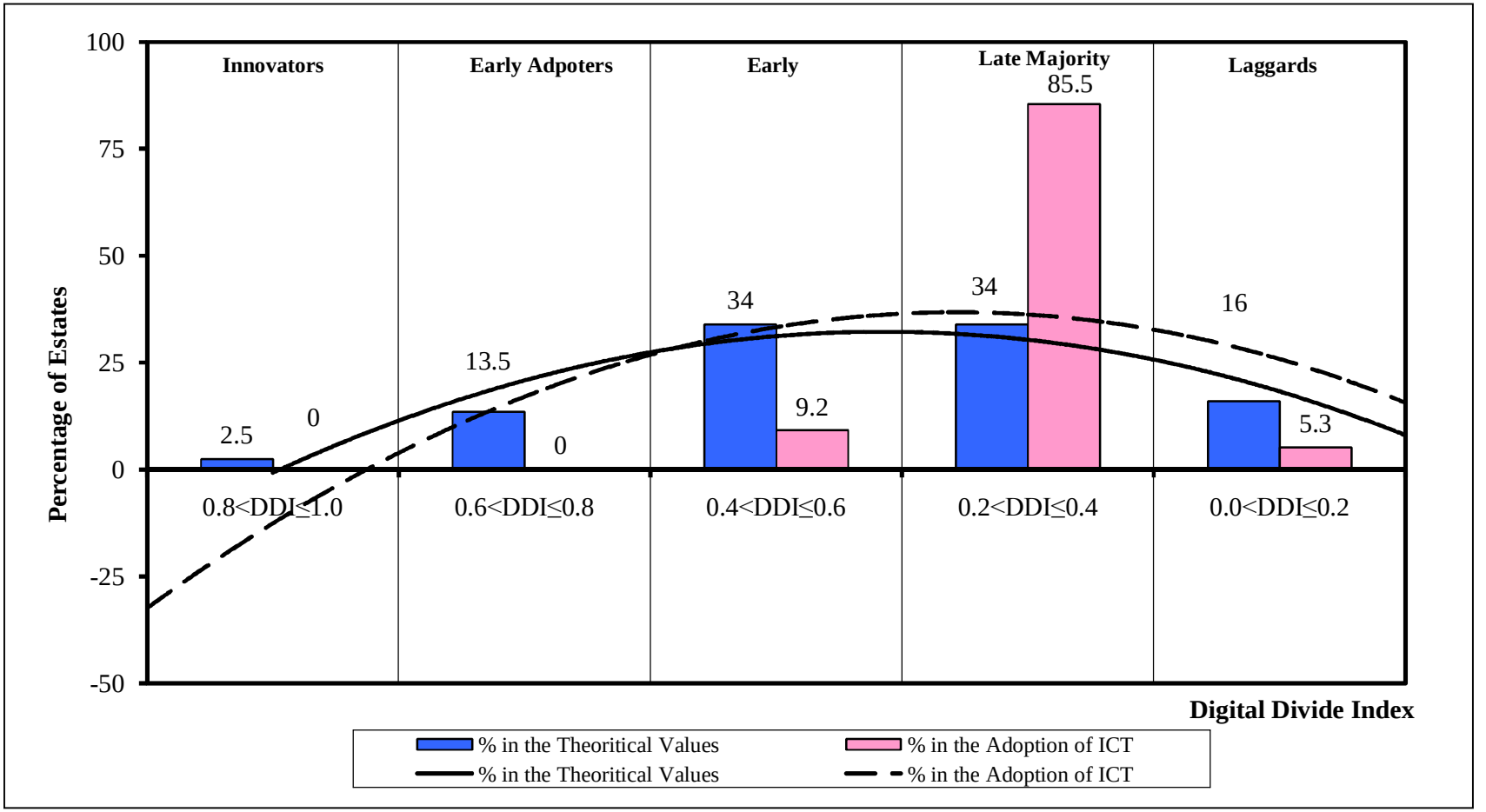

Figure 4 : Percentage of Estates (observed and theorized) in five adopter categories

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