

Summary of Thesis **Alahakoon Mudalige Uthpala Indeelinie**

Thesis Title:

(English) A Post-Implementation Analysis of Digital Transformation Regime for E-Governance in Sri Lanka

(日本語) スリランカ電子ガバナンスのためのデジタル変革レジーム

1. Summary of the Thesis

The thesis is about analyzing the state of affairs related to the digitalization of government functions in Sri Lanka. The process of digitalization was started in sync with the introduction of ICT in the country. ICTA designed and promoted the architecture, infrastructure, and digitalization of government functions in the country. In the following section, I have laid down the list of important research questions that need to be investigated and answered to form an informed opinion about the state of affairs in the country in the post ICT implementation scenario.

2. Research Questions

I have formulated three crucial research questions for this thesis as follows:

- To what extent the operational efficiency has been achieved with ICT deployment in 20 D&Ms of the government of Sri Lanka?
- To what extent informational efficiency increased with the ICT deployment in the D&Ms?
- To what extent has PSD efficiency increased in a post ICT deployment scenario in the country?

These are essential questions that are central to the analysis and inquiry carried out in this thesis. In order to carry out a meaningful analysis to answer these questions, we needed some relevant data. The nature of the data and data collection method is briefly explained in the next section of this chapter.

3. The Data

The data was collected through a field survey conducted from February through March of 2020. In total, we surveyed 20 representative departments and ministries (D&M) of the government of Sri Lanka. It was a bifocal survey; on the one hand, I

questioned the ICT regime implementors (officers and employees) about the ICT implementation. Ten questionnaires were distributed and collected from each of the entities. On the other hand, a similar number of questionnaires were distributed and collected from the general public who availed services from these D&Ms. In total, 400 responses were collected. We collected 200 each from both sides of the service spectrum. The questionnaire comprised 20 questions divided into input and outcomes questions (input for D&Ms and outcomes for the public). The responses were sought on a Likert scale: 5 standing for a strong agreement, 4 for agreement, 3 as neutral, 2 as disagreement, and 1 as strong disagreement. Input questions have been coded as ICT, whereas the outcomes have been coded to reflect the degree of satisfaction users of the ICT-based PSD had from the regime implementation. Originally the questionnaires were designed in English and then translated into Sinhala language, one of the major official languages of Sri Lanka, in order to assure ease of understandability and response to the questions. The data thus collected was recorded into a separate excel sheet and tabulated for further treatment and analysis. Keeping in view the ordinal nature of the data, a transformed binary variable agree/disagree (AD) was created from the variable "satisfaction" to allow better analysis and understanding of the data outcome without dropping other variables from the final analysis.

4. The Analysis

In this thesis, I have applied a two-way analysis to cover multiple dimensions of the analysis and reach comprehensive results. **First**, I applied data envelopment analysis (DEA) to estimate the overall and relative efficiencies of various D&Ms studied in this thesis. **Secondly**, I carried out a regression analysis to understand the relationships between various ICT input measures and the outcomes of the implementation of the ICT regime.

i. Data Envelopment Analysis

First, I have applied a nonparametric-multistage data envelopment analysis (DEA) to understand how the ICT regime performed. The three outputs factors (OP1, OP2, and Op3) were used in the analysis, and the technical efficiency (TE) has been measured on a variable return to scale (VRTS) from an output orientation. Using standard VRTS and DEA models, we assumed output orientation as the magnitude and the direction of input

has already been defined and is not alterable in the short run (Fare et al. 1994). Thus, only outputs, i.e., services, information, and operations, can be adjusted to allow our entities to perform at optimum scale to achieve maximum efficiency. Farell originally developed these efficiency measures; however, the DEA has evolved as a body of knowledge and technique over time.

CCR model defines the efficiency of a decision-making unit (DMU) as the maximum of a ratio of weighted outputs to weighted inputs, subject to the condition that the similar ratios for every DMU can be less than or equal to unity (Fare 2005).

ii. Regression Analysis

For the regression analysis, the response data was categorized as inputs and outcomes based on the nature of the response data. IT has been used as the independent variable. The independent variable is satisfaction. Another dependent variable, i.e., AD, has been used in the data; it is a transformed binary variable for which satisfaction and ICT are independent variables. We established a limit of 4 to convert outcomes (satisfaction) into a binary dependent variable AD of 1 (overall agreement) and 0 (overall disagreement). It may be noted that our response data is ordinal on a 5-point Likert scale where 5 stands for strongly agreed, 4 agreed, 3 neutral, 2 disagreed, and 1 for strongly disagreed. To achieve this transformation for all client responses ≥ 4 , we allocated a value of 1 to this additional variable, and for all responses < 4 , we assigned 0. In this way, we assumed a careful approach in handling and analyzing the response data. The robustness of the data was checked via Cronbach's alpha. I calculated Cronbach's alpha to assess the reliability and internal consistency of data's test items.

Additionally, I produced multivariate ordinal logistic (logit) regression results to deepen our understanding of the relationships between various variables used in the analysis. Ologit regression model is a generalization of a binary logistic regression model when the outcome variable has more than two ordinal levels, which in our case is 5. Ologit estimates the probability of being at or below a specific outcome level, conditional on a collection of explanatory variables. Our survey's observed ICT satisfaction level is the ordinal outcome, y , ranging from 0 to 5, as described in the data section. As the response categories in our data are limited up to 5, using a nonparametric ordered logistic regression model seems most appropriate for our analytical purpose.

5. Results

The results thus obtained through a rigorous statistical analysis show that there is a reasonable and understandable basis for continuing to invest in the ICT infrastructure as it has positive bearings upon the PSD in Sri Lanka. The results of our study indicate disparate performance across the entities of the Sri Lankan government. One can identify benchmarks as well as slackers in the whole PSD structure through this study. It can suggest that apparent incongruity of results across various PSD entities should be minimized to allow a smoother ICT continuum ending in a complete transformation of the PSD structure in the country. We have, however, taken a 3-output factors (OP1, OP2, and OP3) approach towards performance assessment in this study; those three factors correspond to the first three factors of the ICTT continuum.

Consequently, I mapped out the performance of the public services in the wake of the ICT regime in three areas, i.e., services (OP1), information (OP2), and operations (OP3). Our findings suggest that OP1, i.e., technical efficiency score regarding public service delivery, is not consistent across all entities. With a TE score of 0.957 (CRTS) and 0.976 (VRTS), service delivery at the Department of Imports and Exports (E3) has been the least inefficient area as compared to others. That suggests that while departments and ministries have benefited from implementing the ICT regime, the same cannot be said for the public service delivery efficiency across all of them. There are few exceptions like E6, E10, E11, and E12 (the corresponding names of the departments or the ministries can be cross-checked in Table 1). Department of Labor (E11) has come out as a star performer in a comparative analysis with $TE = 1$ and a constant returns-to-scale situation. It can serve as a peer to the highest number of other departments and ministries, which is 8 in total. This result suggests that other entities should at least replicate the Department of Labor's *performance*. Also, from a scalar perspective, the Department of Pensions (E8) has plenty of unused capacity; and, at the same time, is facing a decreasing returns-to-scale situation. This situation may indicate a structural issue of the department, and the situation requires more in-depth insight to pinpoint the exact cause of the problem with the department.

In regression analysis, I have analyzed the effectiveness and acceptability of the ICT regime in Sri Lanka, and results have shown that inputs of the regime are positively contributing towards the program's success. However, the contribution has not reached

very significant levels so far. After explaining the summary statistics of the data collected and various correlations, we use ordinal logistics analysis to understand the interrelations amongst various ICT inputs and their impact upon the outcomes. Cronbach alpha has been calculated to test the robustness of the data. Finally, we conducted specificity, sensitivity, and predictive values analysis in order to assess the accuracy of the model applied. Lastly, the findings suggest a positive, though a weak correlation between the inputs and outcomes of the ICT regime put into place to digitalize the PSD in the country. Also, sensitivity and specificity tests have been carried out for the AD, and the results show sensitivity and specificity results for our model.