DEVELOPMENT OF AN ACTIVITY ALLOCATION MODEL FOR SRI LANKA USING PECAS FRAMEWORK

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Degree of Master of Science

Department of Civil Engineering

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Sri Lanka

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Thesis submitted in partial fulfilment of the requirements for the degree
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DECLARATION

I declare that this is my own work and this thesis does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or institute of higher learning and to the best of my knowledge and believe it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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G.L.D.I. De Silva

ABSTRACT

Traditional Transport Models can under or overestimate the benefits when they try to model a rapidly changing economic surrounding. While looking in to transport aspects, they cannot account the changes, the transportation causes on other systems, which ultimately act upon transportation itself. With expanding economic activities, the rapid urbanization, urban sprawl, planned developments, government policies, the traditional transportation modelling efforts in Sri Lanka is now challenged. Even though some efforts were taken for a better approach, a complete model is yet to be developed, which can grasp the integrated nature of land use and transportation.

Even though the land use transport integration is a complex process to model, PECAS (Production, Exchange, Consumption Allocation System), a generalized theoretical framework for representing spatial economic systems, is capable of modelling it efficiently due to its intrinsic capabilities of modelling all economic subsystems with acceptable accuracy levels. It generates the demand for land, products and services. While the use of PECAS is widely tested in developed countries, only limited studies have been carried out to identify the importance of having a model for developing countries.

Thus, the study focused on developing one of the major components of the framework, an Activity Allocation Module. First, study checked the possibility of adopting the PECAS framework for Sri Lanka, identified data to be derived and did necessary processing.

Data gathered from national accounts of Sri Lanka, input output tables, supply and use tables, other surveys conducted by Department of Census and Statistics and data from other sources were assessed, to check the suitability of available data to prepare economic and land use inputs to the model. Development of key elements of an Activity Allocation Model were completed with available and synthesized data. As the basic output of the study, an Aggregate Economic Flow Table was developed with 42 commodity categories (17 good categories, 11 service commodities, 11 labour categories, 3 space categories and 8 financial and adjusting categories), 12 manufacturing activities and 11 service activities. It includes government and 3 categories of households. Import and export markets are also accounted.

Keywords: Activity Allocation, Spatial Economic Model, PECAS, Aggregate Economic Flow Tables, Sri Lanka Setup Model

DEDICATION

To most loving persons I know,

Amma, Thaththa, Nangi and Shara…

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LIST OF ABBREVIATIONS

ABBREVIATION	DESCRIPTION
AA Model	Activity Allocation Model
ADB	Asian Development Bank
AEF Table	Aggregate Economic Flow Table
ASC	Annual Survey of Construction
ASI	Annual Survey of Industries
ASMI	Annual Survey of Manufacturing Industries
CIF/FOB	Cost, Insurance, and Freight (CIF) / Free on Board (FOB)
CPC	Central Product Classification
DCS	Department of Census and Statistics
EC	Economic Census
ED Model	Economic and Demographic Model
ES	Economic Survey
GDP	Gross Domestic Product
HIES	Household Income and Expenditure Survey
I/O	Input output
IPS	Institute of Policy Studies
ISCO88	International Standard Classification of Occupations 1998
ISIC	International Standard of Industry Classification
JICA	Japan International Cooperation Agency
LFS	Labour Force Survey
LLRC	Lessons Learnt and Reconciliation Committee
LPW	Lanka Property Web
LUPPD	Land Use Policy Planning Department
LUZ	Land Use Zone
PECAS	Production, Exchange, and Consumption Allocation System

PUMS	Public Use Microdata Samples
RDA	Road Development Authority
SAM	Social Accounting Matrix
SD Model	Space Development Model
SL	Sri Lanka
STRADA	System for Traffic Demand Analysis
SUT	Supply and Use Tables
TR Model	Transport Model
UDA	Urban Development Authority
USA	United States of America
WRMPP	Western Region Megapolis Planning Project

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1 INTRODUCTION

1.1 Problem Statement

Sri Lanka, a strategically located island nation on Indian ocean, is experiencing a fast-economic growth. With the end of 30-year long war ending in 2009, lots of investing opportunities have emerged. Many large-scale projects, like new expressways, seaports, offshore financial cities, skyscrapers etc. have come to light. This infrastructure developments causes changes on spatial usage of land (Residential, Commercial, Industrial, Institutional, Mixed, etc.). As changes in land use patterns influence the transportation trends, the full impacts of investments cannot be realized without land use impacts. This requires a combined investigation of land use and transportation modelling to analyse the true effects of an urban development. While, some efforts have been taken to account most of the effects of these projects, the current transport models in Sri Lanka are not capable of representing the integrated impact they are having on land use and transportation. This leads to assumption-based forecasting, sometimes causing under estimating of benefits, and in some cases erratic over estimating of benefits, which can ultimately make an infeasible project feasible.

Due to these reasons, the importance of having a tool to properly analyse and identify the impact on both land use and transport networks have been identified. While most of the developed countries have developed models to identify the combined effect, the concept is new to developing countries. Only few studies have been carried out to identify the importance of having such an integrated Land Use-Transport model for developing countries, and challenges of developing one in a developing country like Sri Lanka is yet to identify. Thus, this study mainly checks the possibility of adopting the PECAS framework for Sri Lanka, by trying to develop one of the major components of the framework, Activity Allocation Module.

PECAS (Production, Exchange, and Consumption Allocation System) is a generalized theoretical framework for representing spatial economic systems. PECAS has a conceptually believable and behaviourally valid method for representing location choices for employment, households and land or floor space development. Moreover, PECAS generates the demand for land, products, and services. This spatial accounting

of economic activity enables the model to consider a broad array of urban economic policies in addition to traditional land use regulatory policies and transportation infrastructure alternatives. The importance of PECAS in Sri Lanka is that it places the transportation system within the context of the whole economy by considering the fundamental root of transport demand, which is the exchange of goods, services, and labour among various activities. Thus, underestimating and more importantly overestimating the benefits are avoided when extreme land-use changes are to occur.

The PECAS model is composed of two separate models: Activity Allocation Model (AA) and Space Development Model (SD). The SD module represents actions of developers in the study area. On the demand side, the AA module represents how activities are distributed within the space provided by developers and how the activities interact with each other at a particular point in time.

In this study, data gathered from national accounts of Sri Lanka, input output tables, supply and use tables, and other surveys conducted by Department of Census and Statistics was analysed, derived and synthesized to prepare the economic and land used inputs to the Activity Allocation Module.

1.2 Objectives of the Study

- Establishing an Activity Allocation Model on Sri Lankan environment as a part of PECAS modelling framework (establishing major components of an Activity Allocation Module)
- Understanding the applicability of the theoretical framework in different conditions (Sri Lankan) from those in already tested areas (Identifying the elements of similar and different behaviour).
- Development of key elements of a PECAS model to help developing an integrated transport model for Sri Lanka

1.3 Scope of Work

Most of the data sources available are aggregated data at national level. Especially the Supply and Use Tables used, which play a major role in developing inputs to the AA module, were developed covering all Sri Lanka. Because of the on-going war at the time of 2006, for the year data were developed, data for Northern Province was not available. In Eastern Province data is available only for Ampara district, which too is not reliable.

Therefore, the scope of the study was limited to entire Sri Lanka excluding Northern and Eastern Provinces.

1.4 Methodology

- Understanding and familiarizing with the theoretical framework of PECAS Activity Allocation models and the theoretical background
- Carrying out a literature survey to find out the similar scenarios and previous studies.
- Collecting and processing data and information to produce the inputs for developing the PECAS Activity Allocation model
- Designing and setting up an initial version of PECAS Activity Allocation Model.
- Drawing conclusions: special considerations, changes, and suggestions to develop PECAS models (AA Module) within the context of Sri Lanka

2 LITERATURE SURVEY

2.1 Land Use Transport Integrated Modelling and Place of PECAS

Spatial development (regional development) is the reason behind peoples' need to travel. The need to travel cause transport systems to be built. The accessibility provided by transport systems also determines the spatial development. Therefore, it is hard to isolate two systems from each other making predicting the impacts each having on other hard. Since the 1950s, starting from USA, people have been trying to systematically study the inter-relationship (Wegener, 2004). Since then, many modelling systems have emerged, to mathematically resolve the dilemma.

PECAS, the Production, Exchange, and Consumption Allocation System, is a tool developed by Douglas Hunt and John Abraham of University of Calgary, Canada. It's capable of modelling urban and regional changes to support better economic, transportation and development planning. Framework was first developed as a part of the state-wide modelling project by Oregon Department of Transportation. Since then the framework has been implemented in California, Ohio, Sacramento, Calgary, Edmonton, Baltimore and etc. (Waddel & Reilly, 2011)

According to a study conducted comparing land use transport models, PECAS was identified as one of few modelling frameworks which can model (represent) all urban change processes (Wegener, 2004). It is capable of modelling very slow changes, (networks or land use changes), slow changes (work places or houses), fast changes (employment, population) and immediate changes like good transport or travel. The theoretical development of PECAS rely on random utility discrete choice theory. It is identified to have a unified model structure, which implies PECAS searches for a unifying principal, while linking all economic subsystems.

PECAS framework consists of two basic modules with two supporting modules. The two basic modules are Activity Allocation Module and Space Development Module. Activity Allocation Module represents how activities are allocated within the study area and their interaction at a given instant. Space Development Module represents the actions on developed space. These actions can vary from developments, re-developments to demolitions. Other than two basic modules, another two supporting

modules are used by PECAS framework. One is the Transport Module, which represents the transport network and systems. Other is the Economic Demographic Aggregate Forecasting Model.

The interactions (information flows) among these flows are represented by the Figure 2.1. The figure assumes 1-year time steps, which is the recommended time step for running the Activity Allocation Module (Abraham & Hunt, 2005).

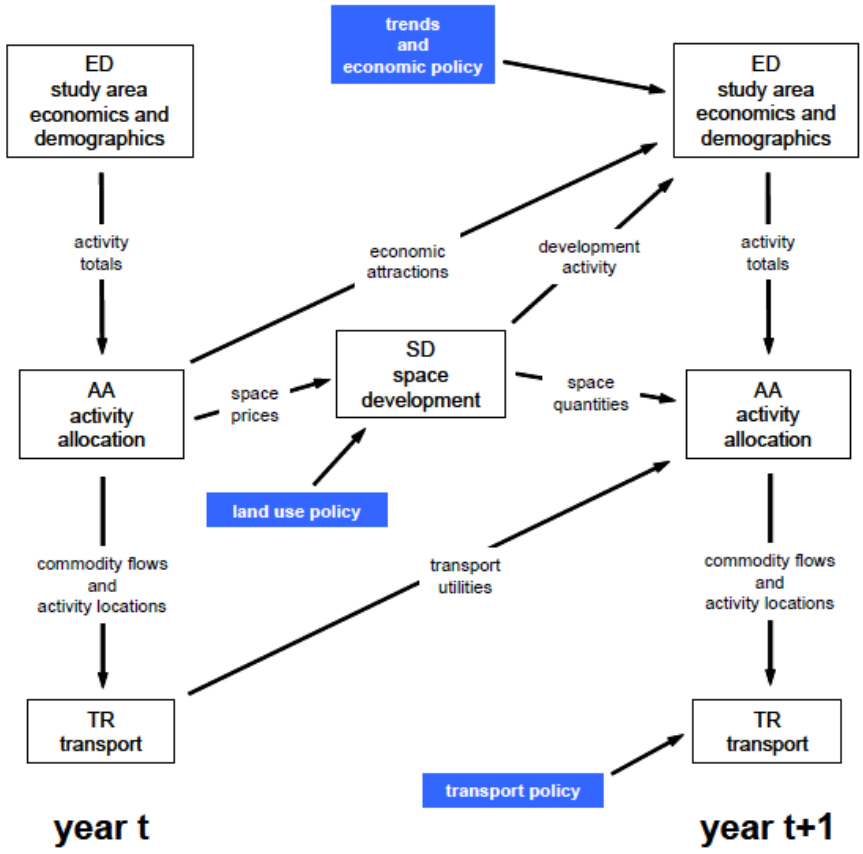

Figure 2.1 - Modules and information flows (HBA Specto Incorporated, 2009)

Researcher could identify 03 types of PECAS Models. The most basic type model is called a Setup Model, which is constructed just to show the model functionality. With more data, an advanced model called a Demonstration Model can be built, using which, limited policy analysis can be done. A production Model, more powerful than a Demonstration Model is the best model for policy analysis (HBA Specto Incorporated, 2007).

2.2 Activity Allocation Module in PECAS Framework

PECAS Activity Allocation Module is an aggregate representation. It uses spatially disaggregated forms of social accounting tables. The module allocates the total activities provided between zones. AA module identifies 4 kinds of basic commodities, they are goods, services, labour, and space. All the other commodities, but space flow from produced location to the consuming location via the exchanged zone, where they are sold or purchased. Allocation process accounts for all those processes.

Rate of commodities produced by an activity is based on technology being used by the activity. Therefore, AA module defines one or more technology options for a given activity. And when the allocation process is taking place, AA module consider the technology option also for the allocation process. With Technology option being the middle one, PECAS uses 3 allocation processes. First Allocation is the allocating the model wide total quantities among land use zones. Third allocation process is the buying and selling allocations, two logit allocations. While selling allocation accounts for the allocation of produced commodities between various markets, buying allocation allocate purchased commodities among various markets (Hunt J. D.).

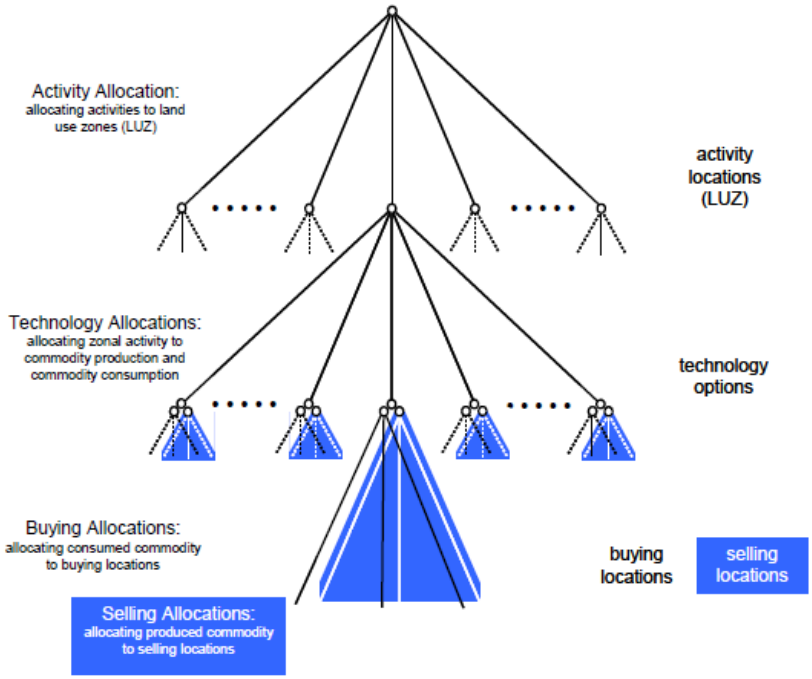

Figure 2.2 - Three-level nesting allocation process (HBA Specto Incorporated, 2009)

Markets, or exchanged locations are where sellers cell commodities to buyers. Prices are established at exchanged locations in a manner a short-rum market equilibrium is established. This implies that all commodity quantities bought were sold. Imports and exports also enter the model via markets.

As a practice, standard industrial categories following an international classification system, are used when representing the economic activities in the study area. Industrial categories are further divided in to white-collar and blue-collar components where possible, due to the different characteristics they bear even at a same activity. Households are typically categorized according to the income levels, or the sector (rural, urban, estate, etc.) or using some other demographic properties. Following Figure 2.3 shows the commodity production and consumption and associate interactions. Top most part is for supply, or commodity production while bottom part is for use, or consumption of commodities.

	commodities								
	goods	internal management services	services	education services	retail services	domestic services	labour	non-residential space	residential space
producing activities (making)									
industry	goods production by industry	internal management services production by industry	services production by industry	education services production by industry	retail services production by industry				
government	goods produced by government		services production by government	education services production by government					
households						domestic services production by households	labour production by households		
exports	yes		yes		yes		yes		
exchange locations	at production	at consumption	at production	at production	at production	at consumption	at consumption	non-transportable	non-transportable
imports	yes	yes	yes		yes		yes		
consuming activities (using)									
industries	goods consumption by industry	internal management services consumption by industry	services consumption by industry	education services consumption by industry			labour consumption by industry	space consumption by industry	
government	goods consumption by government		services consumption by government	education services consumption by government			labour consumption by government	space consumption by government	
households	goods consumption by households - direct		services consumption by households	education services consumption by households	goods consumption by households - via retail	domestic services consumption by households			space consumption by households

Figure 2.3 - Categories of activities and commodities in make and use tables (HBA Specto Incorporated, 2009)

2.3 Importance of a PECAS Model in Sri Lankan Contest

2.3.1 A solution for emerging traffic problems of the urban centres

The Traffic Conditions of almost all the urban centres in the country is changing bad to worse. The national average speed is predicted to drop to 19km/h in 2031 with respect to 26km/h it has at 2012. Colombo average speeds are predicted to drop to a recording 15 km/h from 22 km/h by 2031 (Kumarage, 2012). This suggests that, against the best efforts of the planning agencies, traffic conditions are deteriorating. Sri Lankan government agencies planning transportation have identified one of the major inherent weaknesses of their planning processes is not trying to incorporate land use managing with transport modelling (Mawilmada, 2015)

2.3.2 Western region megapolis planning project

Sri Lanka is expected to be on an accelerated path to development. Industries, quality of life, tourism and everything is boosting up in a rapid pace. Western province being the majority shareholder on this endeavour (nearly 42% of contribution to Sri Lankan GDP), it's appealed for largest scale planning of the country to secure the future performance of the economic giant. It's the Ministry of Megapolis and Western Development has taken the initiative of this. It implements Western Region Megapolis Planning Project (WRMPP) for Urban planning of the Western Province.

There are many forecasted traffic related problems of the region like continual degradation of traffic condition, deterioration of quality of public transportation, increasing number of private vehicles, decreasing environmental quality and liveability and traffic due to coming up new developments. Under many solutions that have been planned to implement by WRMPP, Transport Demand Management also has come into presence. A PECAS Model is identified as a perfect solution for addressing some of those problems (Hunt, Gregor, Weidner, & Abraham, 2005)

As a latecomer to major scale urbanization, Sri Lanka is still in cross roads on what should be implemented and what shouldn't. Whether it is an infrastructure project or change of policy, a carefully built PECAS Model can help in scientifically forecasting the short term and long-term impacts. The reason for that is among many available integrated modelling frameworks PECAS is a rare one which can model all types of

urban subsystems. A study carried out at Montgomery region suggests that PECAS can be successfully implemented for small to medium sized regions too (Clay, Andersen, Abraham, Hunt, & White, 2010), which makes the western region of Sri Lanka a best candidate.

2.3.3 Economic and demographic forecasting and policy evaluation

PECAS can represent all economic activities of all considered regions. As a basic function, through a transport model, it can forecast about future transport requirement and trends. But that is not the only use that can be gain from PECAS. With necessary alterations, PECAS Model can be used to forecast future economic and demographic trends and analysing policies (Abraham, Hunt, & Fuenmayor, 2013)

Many major infrastructure projects and changes of regulations are taking place around the country while attracting many local and foreign investors and changing the direction of the economy. Many government bodies which take the initiative for these projects don't have a proper method/way of evaluating the complete set of major and minor outputs/impacts their projects are going to cause for the economic environment of the country. Therefore, with a developed PECAS models, not only the transport planners, but infrastructure planners, economists, policy makers, investors and all Sri Lankans would be benefited.

Beneficiaries of developing a PECAS Model was identified as.

- Ministry of Mahaweli Development and Environment
- Ministry of National Policies and Economic Affairs
- Ministry of Higher Education and Highways
- Ministry of Lands
- Ministry of Transport and Civil Aviation
- Ministry of City Planning and Water Supply
- Ministry of Industry and Commerce
- Ministry of Public Enterprises Development
- Ministry of Housing and Construction
- Ministry of Ports and Shipping
- Ministry of Regional Development

2.4 Challenges of Developing an AA Module Using PECAS Framework for SL

2.4.1 Data requirement

Data requirement for developing an Activity Allocation Module depends on the level/comprehensiveness of the model. In the case of PECAS, it has three levels of Models (HBA Specto Incorporated, 2007). The basic level model, called Setup Model can be developed using commonly available data. But the model can be hardly used more than as a proof of concept. When the believability of the model increases, through Demonstration Model to Production Model the data requirements and the necessity of completeness of them go up. Same is true for the Activity Allocation Module also, which is a major component on PECAS framework. The Production model is the ultimate model, which can be used for policy analysis.

2.4.1.1 Unavailability of data

A Land Use Transport Integrated models try to model the economic activity of all regions. Estimating the total number of variables and acquiring data for each is quite impossible. Therefore, some data of variables of lesser importance can be omitted, but the most basic data that commonly used in the model building is necessary to have. The major challenge of developing a Land Use Transport Integrated models using PECAS for Sri Lanka is the unavailability of necessary data. While some data are virtually unavailable some available data are also not in the correct format for using. In the case of PECAS AA module finding the data requirement for the basic Setup Model even has been troublesome.

But in most of the developed countries, and especially where PECAS has been already implemented, most of the data are readily available. Therefore, in those countries, developing a PECAS model is basically doing the due processing of data to have them in the model. But in Sri Lanka most of these data are not available, so developing required data becomes a major challenge.

While developing a PECAS Model for Sri Lanka a major ease would have been the availability of a Social Accounting Matrix. But a SAM is yet to come in Sri Lanka (Naranpanawa & Jayathilake, 2006). There is some research done on how to develop a SAM for Sri Lanka, but their output hasn't gone far more than developing a

Framework for Developing SAMs (Naranpanawa & Jayathilake, 2006). The next closest thing would be an Input-Output table. Institute of Policy Studies of Sri Lanka and Asian Development Bank has developed two comprehensive Input-Output tables for Sri Lanka for years 1999 and 2006 (Amarasinghe & Bandara, 2005). Irregular nature of developing I/O tables is quite distressing. Considering the year 1999 as the base year because of the availability of I/O tables and developing the PECAS model according to that is obviously impractical because of the outdated nature of data and the drastic changes Sri Lanka has undergone since 2009. So, a major challenge was identified to be developing a SAM for a recent year or developing data given by a SAM for a recent year.

The I-O table developed by DCS for the year 2006, was converted to a Supply and Use Table, which shows the production and intermediate consumption of industries and households (Department of Census and Statistics, 2011) This was identified as a starting point.

2.4.1.2 Inefficiency of available data

Department of Census and Statistics of Sri Lanka publishes reports (Sri Lanka Labour Force annual and quarterly survey, Annual Report on Industry, Income and Expenditure Survey, Census of Population and Housing, Annual National Accounts, etc.) which are quite helpful in developing an Activity Allocation Module for Sri Lanka. But for most of the time, only them are not enough because they are not comprehensive enough. This can be witnessed especially on data categorization. Therefore, corrections, modifications, and adjustments had to be done to data to achieve the desired input data types. These processes are always time taking and always raise a question whether these synthesized data are accurate enough.

Land Use data available in Sri Lanka covers only a few aspects of Land Use (District Statistical Handbook published by DCS). Apart from some administrative areas of western part of the country, the Land Use data available in Sri Lanka only covers the physical differences of the land usage. For an example, while identifying and categorizing land usage for all major and minor plantations, all industrial land usage is identified without any sub divisions. The reasons for not having vivid data was

identified as the difficulties of identifying proper land usage due to mix developments. The report "National Land Use Policy for Sri Lanka" clearly states that numerous interferences were made against the natural development of land use changes with time without considering the physical suitability of land utilization. The widespread nature of these uncountable small-scale land use zones makes it very hard allocating activities within zones.

As a conclusion, data requirement which represents the social aspects of Sri Lanka can be made available after certain pre-processing. But the data requirement which represents the economic aspects of Sri Lanka is fairly lagging. So, a major challenge lies here on acquiring or developing those data.

2.4.1.3 Unavailability of public use microdata samples

Sri Lanka currently doesn't have a PUMS which represents the whole country. With the help of JICA, a microdata sample was collected covering nearly 30,000 households from Nov 2012 to Feb 2013 under project "Colombo Metropolitan Transport Master Plan". This is primarily a household travel survey. But this data covers only the western region (Western Province) of the country. So, this data set also can't be used to generate already non-tabulated data.

2.4.1.4 Availability of data for AAM: Demonstration model

Table 2.1 - Availability of data for an AA demonstration model

	Name	Availability		
		Yes	No	Part
1	Disaggregate transport cost data to determine transport size, variable and non-variable costs with distances- Goods			x
2	Disaggregate data on firm-to-firm (establishment-to-establishment) service trips		x	
3	Disaggregate data on mode choice by occupation		x	
4	Data on price variation between cities for consumer goods	x		
5	Disaggregate Salary survey data			x
6	Disaggregate data on commercial rent			x
7	National and international comparative price data for import and exports	x		
8	Data on quantity of residential space by zone, is used to compare against the quantities of activity, to determine use rates and variation in use rates	x		
9	Data on quantity of non-residential space by zone, is used to compare against the quantities of activity, to determine use rates and variation in use rates	x		
10	Nation-wide information on production and consumption of commodities			x
11	Data on what type of household make what type of labour (occupation-by-place-of-residence information and occupation-by-place-of-work		x	
12	Data on what types of structures are used by different types of households (A basic partial indicator is number of rooms)			x
13	Disaggregate data on consumption of goods and services by households		x	
14	Data on households invests in business, investment returns, taxes to the government, receiving government benefits, and other financial flows		x	
15	Data on Production of goods and services by industry	x		
16	Data on Production and consumption of financial flows by industry	x		
17	Data on Consumption of goods services labour and space by industry			x
18	Data on government collection of taxes	x		
19	Household locations for a base year	x		
20	Housing inventory and residential space inventory data for determining the size term for the location choice model.			x
21	The employment in each industry in each zone (to be divided into blue and white-collar components)		x	
22	Minimum observed prices of land for each zone for determining short term floor space supply			x

2.4.2 Not having other types of integrated models

Only recently, Sri Lanka identified the importance of Land Use Transport Integrated modelling. While RDA has developed a basic model using STRADA (System for Traffic Demand Analysis), developed by Japan, for demand forecasting, model building, project evaluation and identification of development projects. It is not popular due to the limitations of it. Up to now most of the transport modelling that has been done in Sri Lanka have been predominantly based on Four Step Modelling. Available small number of disaggregate models don't model the entire nation. There lies a major challenge of not having other types of integrated models to compare and draw from. So, the development of PECAS Model under current conditions becomes an isolated project where all the data and theoretical formulation must be done from sketch to end.

2.4.3 Cost of developing a PECAS model

According to the report "Executive Summary, Technical Memo 2, Data requirements and estimated costs for the full zonal demonstration model, California PECAS Model Development" to develop a state-wide PECAS production model in 2009 following costs have been estimated.

1. Cost for data - $500,000
2. Human hrs. for data development - 4480
3. Overheads for developing data $265,000
4. Calibration $4,000,000
5. Annual Operating and Maintenance - $1,000,000

When developing the above estimation, a labour rate of $125/hr. is assumed. All the data were considered to be acquired by purchasing. Data preparation along for a Setup model was estimated to be $11,000 with 700 working hours. Even though it can use a low labour rate in Sri Lanka and most of the data can be acquired through government institutions free of cost, developing data for a PECAS model along is going to cost a lot.

3 MODEL DEVELOPMENT

3.1 Overview

With the literature survey carried out, it was understood that the data availability for constructing a PECAS activity allocation module is much limited. The need of deriving data to various components in AA module was identified as the major task ahead. Activity allocation module allocates activities among zones when the complete PECAS model is run. Before the model run, AA module is an aggregate representation of economy on the whole study area, with a set of data which accounts for the zonal properties. Therefore, developing the AA module was principally identified as developing necessary data to build the aggregate representation of economy, which is called an Aggregate Economic Flow Table (AEF Table). The structure of an AEF table gives the relationships in an economy in monetary figures.

Table 3.1 - Structure of AEF table

Activities		**Commodities**			
		Goods	**Services**	**Labour**	**Space**
Producing Activities	Manufacturing Activities				
	Service Activities				
	Households				
	Imports				
Consuming Activities	Manufacturing Activities				
	Service Activities				
	Households				
	Government				
	Exports				

To develop the AEF Table, 4 basic data requirements were identified:

1. Use/Production of goods and services by manufacturing and service activities
2. Production of space commodity and consumption of it by activities
3. Production of labour commodity and use of it by activities
4. Household and government consumption
5. Production of exports and consumption of imports

Data were collected and analysed on these fields to build the AEF Table for an AA module setup model.

3.2 Consumption and Production of Goods and Services by Manufacturing and Service Activities

3.2.1 Data availability

The Supply and Use Tables (SUT) developed by National Accounts Division of Department of Census and Statistics for 2006 were identified as the best data source to derive data for determining commodity production and Consumption of Manufacturing and Service Activities. This was identified as the only SUT available for Sri Lanka. It was carried out as Asian Development Bank Funded Project. SUT 2006 was primarily developed with the data from Household Income and Expenditure Survey 2006/2007, Annual Survey of Industries 2007, Annual Survey of Construction 2007, Labour Force Survey 2006 with annual agricultural and Price Statistics.

Following ISIC Rev. 3.1 classification for Industries and CPC Ver. 1.1 for products, it identifies 32 SUT industries and 51 SUT product groups. It includes 8 types of agriculture products, 23 industry products, and with construction products 20 services sector products.

3.2.2 Process of data derivation

SUT 2006 data, was reshaped to develop the Aggregate Economic Flow (AEF) using PECAS framework, Appendix I. It could identify 12 manufacturing activities and 11 service activities producing commodities or consuming intermediate production, and 17 goods commodities could be identified along with 11 service commodities.

Apart from identified activities and commodities, data about imports and exports, government and household consumption, capital formation, taxes, CIF/FOB adjustments, direct purchases in abroad by residents and compensation for employees could be identified.

None of the activities or commodities were curtailed or aggregated together considering those possibilities are available if needed at later stages too.

Table 3.2 - Activities used in AEF

Index	Index	Activity Type
Manufacturing Activities	1	Agriculture, Hunting, Forestry, and Related Service Activities
	2	Fishing, Aquaculture, and Service Activities Incidental to Fishing
	3	Mining and Quarrying
	4	Manufacture of Food Products, Beverages, and Tobacco
	5	Manufacture of Textiles, Wearing Apparel, and Footwear
	6	Manufacturing of Wood, Wood Products, Paper, and Paper Products
	7	Manufacture of Rubber and Plastic Products
	8	Manufacture of Basic Metals
	9	Manufacture of Fabricated Metal Products; and Office and Computing Machinery
	10	Manufacture of Motor Vehicles and Other Transport Equipment
	11	Other Manufacturing
	12	Electricity, Gas, and Water Supply
Service Activities	13	Construction
	14	Wholesale and Retail Trade; and Repair of Motor Vehicles
	15	Hotels and Restaurants
	16	Transport Services and Storage
	17	Post and Telecommunications
	18	Financial Intermediation and Insurance
	19	Real Estate, Renting, and Business Services
	20	Public Administration and Defence
	21	Education
	22	Health and Social Work
	23	Other Community Service Activities

Table 3.3 - Commodities used in AEF

	Index	Commodity Type
Goods	1	Agriculture, Forestry, and Logging Products
	2	Fish and Other Fishing Products
	3	Coal and Lignite; Peat, Crude Petroleum, and Natural Gas
	4	Other Minerals, n.e.c.
	5	Electricity, Gas, and Water
	6	Food, Beverages, and Tobacco
	7	Clothing and Wearing Apparel; and Leather and Leather Products
	8	Products of Wood, Paper, and Paper Products
	9	Basic Chemicals and Other Chemicals
	10	Rubber and Plastics Products
	11	Furniture and Other Transportable Goods, n.e.c.
	12	Basic Metals
	13	Fabricated Metal Products, Except Machinery and Equipment
	14	General and Special Purpose Machinery
	15	Office, Accounting, and Computing Machinery
	16	Transport Equipment
	17	Other Manufacturing
Services	18	Construction Services
	19	Wholesale and Retail Trade Services
	20	Lodging, Food, and Beverage Serving Services
	21	Transport Services, and Supporting and Auxiliary Transport Services
	22	Postal, and Courier and Telecommunications Services
	23	Financial Intermediation, Insurance, and Auxiliary Services
	24	Real Estate, Leasing Services, and Other Business Services
	25	Public Administration and Compulsory Social Security Services
	26	Education Services
	27	Health and Social Services
	28	Other Services, n.e.c.

3.3 Production of Labour by Households

3.3.1 Data availability

Households produce the labour, which is considered as a commodity in the PECAS framework, then sold to labour consuming activities. When the labour is purchased a price is paid to households and that's basically the total of salaries and wages paid to employees of each households. Therefore, the household income is a measurement of amount and quality of labour produced.

When determining the production of labour by Households, the expected practise by the framework is to categorize the households by income wise, sector wise and household size wise. The produced labour is categorized in to a suitable number of labour categories, which covers all labour produced. Then the labour production by each household type in each labour type is determined as White-Collar component and Blue-Collar component. Those figures are expressed as monetary values.

Data availability of household income was checked. The Department of Census of Statistics was identified as the only body to provide comprehensive data on income of households. In the report Household Income and Expenditure Survey 2006 (HIES 2006) published by DCS, the only type of aggregate income data regarding households that could be found was the median and mean income of household by districts. No income classification of households by household size was identified. No categorization was found on the type of labour produced by households and how people are paid. In the report of Labour Force Survey 2007 (LFS 2007), number of people producing different kinds of labour are recorded but sector wise distribution or any reference to household size couldn't be found. Therefore, the need to follow a process of data derivation was identified, to fill and bridge the gaps between available data and required data.

Data compiled in report of LFS 2006 does not contain the data for Northern and Eastern Provinces of Sri Lanka due to the internal conflicts which had been going on at the time.

3.3.1.1 Selection of nested model of households

At the beginning a nested classification of households was assumed as given in the Figure 3.1.

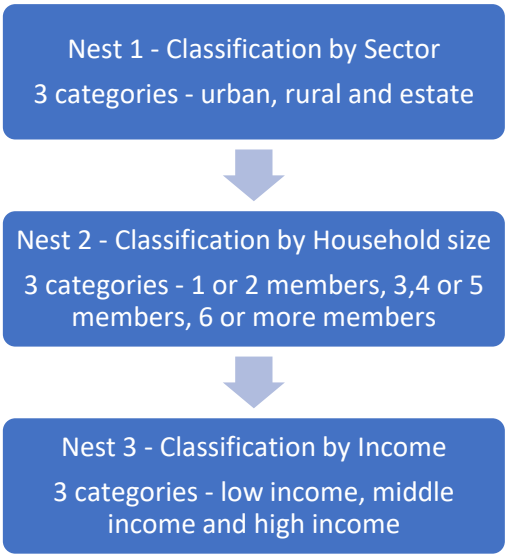

Figure 3.1 - Selection of household categories

With available data, it was understood that data was not available to follow the last two nests of the model. Data was not readily available for the 1st nest too; data deriving was needed. If the lower nests of households were selected for labour categories, the same classification should be used for commodity (Goods, Services, and Space) consumption. Availability of those data, and possibility of deriving those data were identified as impossible with available data. Therefore, only the classification of households by sector was picked.

3.3.1.2 Selection of labour force categories

Table 14 of Labour Force Survey Report – 2007 provides data on currently employed person by Occupation Group (Based on ISCO88) by province, Appendix II. This data is available as a total value at provincial level, or by sex category. Manufacturing and Service sector labour use also could be calculated for the occupation groups used in ISCO88. Therefore, the occupation categories given on ISCO88 was adopted for the AA module's labour production categories. This contains 10 defined labour categories and one to account all unidentified labour types.

- Senior Officials and Managers
- Professionals
- Technical and Associate Professionals
- Clerks
- Proprietors and Managers of Enterprises
- Sales and Service workers
- Skilled Agricultural and Fishery workers
- Craft and Related workers
- Plant and Machine operators and Assemblers
- Elementary occupations
- Unidentified

International Labour Organization website provides descriptive information about the labour categories adopted under ISCO.

3.3.2 Process of calculation

3.3.2.1 Assumptions – derivation of employment data

1. For each type of labour produced there's a sizable difference of contribution by male and female. The wages and salaries paid for the same task are lower for females with respect to what paid for males (LFS 2007). It's expected that male female ratio for each province is the same. If not, if a province has a significant high value of percentage for a certain gender, it's bound to have a significant impact of the value of labour produced.

2. Another assumption made was, whatever the province, each sector (urban, rural and estate) have same kind of attributes. Further simplified it says, the ratio between total amount of a certain labour type produced by urban sectors of Western and North Central provinces, is same as the ratio between the urban sector population of those two provinces. Such a relationship is considered valid between any pair of Provinces. In real case there is a possibility of slight deviations from the assumption made because of the irregularities of facilities and resource distribution, but due to limitations of the data and to reduce the complexity of calculations that assumption was considered valid.

3.3.2.2 Derivation of employment data

When the second assumption was made, a percentage distribution of employment could be found for each sector type. Once these percentages were multiplied by the respective sector employed population of the province, distribution of the employment in the respective sector of that respective province could be found. Following Table 3.4 provides the population distribution of each province by sector.

North Western and North Central provinces have predominantly a rural population, which consists roughly 95% of total employed population in them. Therefore, an average distribution among employment of those two provinces was taken as the representative distribution for rural sector neglecting the small contribution of urban sector. The Western Province has the minimum share of estate sector. Thus, urban, and rural sectors mainly govern it.

Table 3.4 - Sector wise employed population by province

Total	**7,105,322**	**Urban**	**Rural**	**Estate**	**Urban**	**Rural**	**Estate**
Western	2,263,368	691,348	1,552,835	19,184	30.55%	68.61%	0.85%
Central	929,841	90,209	651,089	188,542	9.70%	70.02%	20.28%
Southern	976,352	83,933	875,620	16,799	8.60%	89.68%	1.72%
North Western	1,023,567	47,164	972,244	4,159	4.61%	94.99%	0.41%
North Central	496,316	23,880	471,864	572	4.81%	95.07%	0.12%
Uva	603,769	26,429	489,947	87,393	4.38%	81.15%	14.47%
SB.Gamuwa	812,107	33,986	706,954	71,167	4.18%	87.05%	8.76%

Using the above derived distribution for the rural sector and the total distribution for Western Province, distribution for the urban sector was calculated. (This Assumption was used: Total employed persons in a sector was assumed to be proportionate to the total population in the sector). Using already calculated distributions for urban and rural sectors and the total distribution of the central province, which had the highest share of employed population in estate sector, the distribution for the estate sector was calculated.

Table 3.5 - Distribution of employment for rural sector

Occupation/Employment Category	North Central Province		North Western Province		Rural Sector
	Employed People	Distri-bution	Employed People	Distri-bution	Average Distribution
Total	496,316	100%	1,023,567	100%	100%
Senior Officials/Managers	5,080	1.02%	10,240	1.00%	1.01%
Professionals	22,424	4.52%	53,673	5.24%	4.88%
Technical and Associate Professionals	13,824	2.79%	33,222	3.25%	3.02%
Clerks	8,780	1.77%	24,815	2.42%	2.10%
Proprietors and Managers	21,916	4.42%	66,752	6.52%	5.47%
Sales and Service workers	38,797	7.82%	75,089	7.34%	7.58%
Skilled Agricultural and Fishery workers	246,769	49.72%	260,388	25.44%	37.58%
Craft and Related workers	53,509	10.78%	228,314	22.31%	16.54%
Plant and Machine operators and Assemblers	19,216	3.87%	73,884	7.22%	5.55%
Elementary occupations	61,704	12.43%	192,848	18.84%	15.64%
Unidentified	4,297	0.87%	4,343	0.42%	0.65%

Table 3.6 - Distribution of employment for urban sector

Occupation/Employment Category	Western Province (WP)Total	Total Rural Sector Employment of WP	Calculated Rural Sector Employment Distribution	Rural Sector Employment of WP	Urban Sector Employment of WP	Urban Sector Employment Distribution
Senior Officials/Managers	90,693	1,552,835	1.01%	15,714	74,979	5.85%
Professionals	158,220	1,552,835	4.88%	75,792	82,428	6.43%
Technical & A.Professionals	192,741	1,552,835	3.02%	46,826	145,915	11.39%
Clerks	150,113	1,552,835	2.10%	32,558	117,555	9.17%
Proprietors and Managers	227,921	1,552,835	5.47%	84,919	143,002	11.16%
Sales and Service workers	218,008	1,552,835	7.58%	117,651	100,357	7.83%
Skilled Agricultural and Fishery workers	125,433	1,552,835	37.58%	12,500	112,933	8.81%
Craft and Related workers	453,866	1,552,835	16.54%	256,893	196,973	15.37%
Plant and Machine operators and Assemblers	230,877	1,552,835	5.55%	86,105	144,772	11.30%
Elementary occupations	398,282	1,552,835	15.64%	242,810	155,472	12.13%
Unidentified	17,214	1,552,835	0.65%	10,016	7,198	0.56%

Table 3.7 - Distribution of employment for estate sector

Occupation/Employment Category	Central Province (CP) Total Employment	Urban Sector Employment of CP	Rural Sector Employment of CP	Estate Sector Employment of CP (col 01– col 02 – col 03)	Estate Sector Employment Distribution
Senior Officials and Managers	11,916	5,278	6,589	49	0.03%
Professionals	46,776	5,802	31,779	9,195	4.88%
Technical and Associate Professionals	39,527	10,271	19,634	9,623	5.10%
Clerks	26,949	8,275	13,651	5,023	2.66%
Proprietors and Managers of Enterprises	61,543	10,066	35,606	15,872	8.42%
Sales and Service workers	61,356	7,064	49,330	4,962	2.63%
Skilled Agricultural and Fishery workers	187,262	7,949	244,677	67,893	36.01%
Craft and Related workers	124,170	13,865	107,713	2,592	1.38%
Plant and Machine operators and Assemblers	53,409	10,190	36,103	7,116	3.77%
Elementary occupations	313,903	10,943	101,808	67,893	36.01%
Unidentified	3,031	507	4,200	-1,675	0.00%

The data derived gave a small negative figure for ‘Unidentified’ occupation category of estate sector. This was taken as zero based on the assumption that there were no unidentified labour categories in estate sector.

As per the second assumption made, a certain type of labour produced in a province was divided among sectors proportionately to the population by sectors. This gave a singly restrained distribution of sector wise employment in a province. Summation of the column totals match. But this arrangement of data wouldn’t fulfil the row totals. See Table 3.8 for the distribution obtained for the western province. Therefore, an iterative doubly restrained balancing method was carried out for each province to find out the doubly restrained distribution of employment for sectors.

Table 3.8 - Singly restrained employment matrix for western province

Western Province						
Occupation Category	**Urban Sector**	**Rural Sector**	**Estate Sector**	**Actual Total**	**Expected Total**	**Exp/ Act**
Senior Officials and Managers	40,447	15,714	5	56,167	90,693	1.61
Professionals	44,465	75,792	936	121,193	158,220	1.30
Technical and Associate Professionals	78,714	46,826	979	126,519	192,741	1.52
Clerks	63,415	32,558	511	96,484	150,113	1.55
Proprietors and Managers of Enterprises	77,142	84,919	1,615	163,676	227,921	1.39
Sales and Service workers	54,138	117,651	505	172,293	218,008	1.26
Skilled Agricultural and Fishery workers	60,922	583,551	6,908	651,381	125,433	0.19
Craft and Related workers	106,257	256,893	264	363,414	453,866	1.24
Plant and Machine operators and Assemblers	78,097	86,105	724	164,926	230,877	1.39
Elementary occupations	83,869	242,810	6,734	333,413	398,282	1.19
Unidentified	3,883	10,016	0	13,899	17,214	1.23
Actual Total	691,348	1,552,836	19,180			
Expected Total	691,348	1,552,835	19,184			
Exp/Act	1.00	1.00	1.04			

15 iterations were carried out to get the final distributions with an accuracy level of 6 decimal points. Final distribution for Western Province is given in Table 3.9

Table 3.9 - Doubly restrained employment matrix for western province

Western Province						
Occupation Category	**Urban Sector**	**Rural Sector**	**Estate Sector**	**Actual Total**	**Expected Total**	**Exp/ Act**
Senior Officials and Managers	57,282	33,401	11	90693	90,693	1.00
Professionals	44,080	112,765	1,376	158220	158,220	1.00
Technical and Associate Professionals	100,844	90,037	1,861	192741	192,741	1.00
Clerks	84,214	64,892	1,007	150113	150,113	1.00
Proprietors and Managers of Enterprises	84,944	140,339	2,638	227,921	227,921	1.00
Sales and Service workers	50,991	166,312	705	218,008	218,008	1.00
Skilled Agricultural and Fishery workers	8,069	116,006	1,357	125,433	125,433	1.00
Craft and Related workers	97,981	355,524	361	453,866	453,866	1.00
Plant and Machine operators and Assemblers	86,520	143,167	1,190	230,877	230,877	1.00
Elementary occupations	72,890	316,712	8,680	398,282	398,282	1.00
Unidentified	3,533	13,681	0	17,214	17,214	1.00
Actual Total	691,348	1,552,835	19,184			
Expected Total	691,348	1,552,835	19,184			
Exp/Act	1.00	1.00	1.00			

The doubly restrained distributions for all provinces but North and East are given in Appendix III.

3.3.2.3 Assumptions - derivation of income data

- It is understood that even the people in the same employment category have different income levels based on different attributes of their employment. Ex. Sector they are working on, Province they are working on, Type of the industry they are working on, etc. But to reduce the complexity, it is assumed that the income of a certain type of an employment category is dependant only upon sector.
- The 10 employment categories were listed in the order of descending average income. Due to lack of data this order was decided based on general understanding. In the list, the category, Senior Officials and Managers hold first

position, second is Professionals and third is Proprietors and Managers of Enterprises. There is a possibility of some professionals having higher incomes than some Officials and Managers, in the same time there can be some professionals having lesser income than Proprietors or Mangers of Enterprises. The assumption simply means, the average income of professionals lies between average income of the two categories, Senior Officials and Managers, and Managers of Enterprises. List is as below,

- Senior Officials and Managers
- Professionals
- Proprietors and Managers of Enterprises
- Technical and Associate Professionals
- Plant and Machine operators and Assemblers
- Sales and Service workers
- Clerks
- Skilled Agricultural and Fishery workers
- Craft and Related workers
- Elementary occupations
- Unidentified

- Sector wise income data was needed on number of income receivers, not on the number of households. So, the data set on households was converted to a dataset on income receivers, by dividing the data set by average number of income receivers in a household in each sector. It was assumed that the income receivers in a household have approximately same income.

3.3.2.4 Derivation of income data

The process adopted to find the final production of labour assumes, sector wise total income of the employment categories was given by the multiplication of number of Employed Personnel by Employment category (Sector wise) and median annual income for employment category (sector wise).

Number of sector wise employed personnel by employment category was estimated before. Data on average income was needed for finishing calculations. But neither

Household Income and Expenditure Survey or Labour Force Survey provide direct data about the mean, median or any others statistical data of income for the employment categories adopted. But they contain data about sector wise income decile (average monthly income). Income deciles are income groups whose borders are defined to get 10% of the total number of households tumbled into each group. A simple derivation process was carried out to find the median monthly income for the employment categories by sector wise.

Using monthly household income data points, regression equations were developed for household income. A 6^{th} order polynomial is selected as the regression line to a perfect match. This gives coefficient of determination, R^2 an almost 1. Equations obtained from regression analysis are as below.

Urban sector

$$y = 1{,}125{,}740.74x^6 - 2{,}630{,}299.15x^5 + 2{,}484{,}347.58x^4 - 1{,}147{,}919.19x^3 + 270{,}271.08x^2 + 3{,}420.27x + 7{,}229.22$$

Rural sector

$$y = 405{,}370.37x^6 - 708{,}739.31x^5 + 365{,}526.35x^4 + 48{,}554.68x^3 - 89{,}362.73x^2 + 46{,}600.64x + 2{,}319.11$$

Estate sector

$$Y = 57399.83x^3 - 68{,}461.98x^2 + 38{,}027.42x + 1{,}212.40$$

Where y is the average monthly household income and, x is the cumulative percentage. Coefficients are rounded to the nearest second decimal.

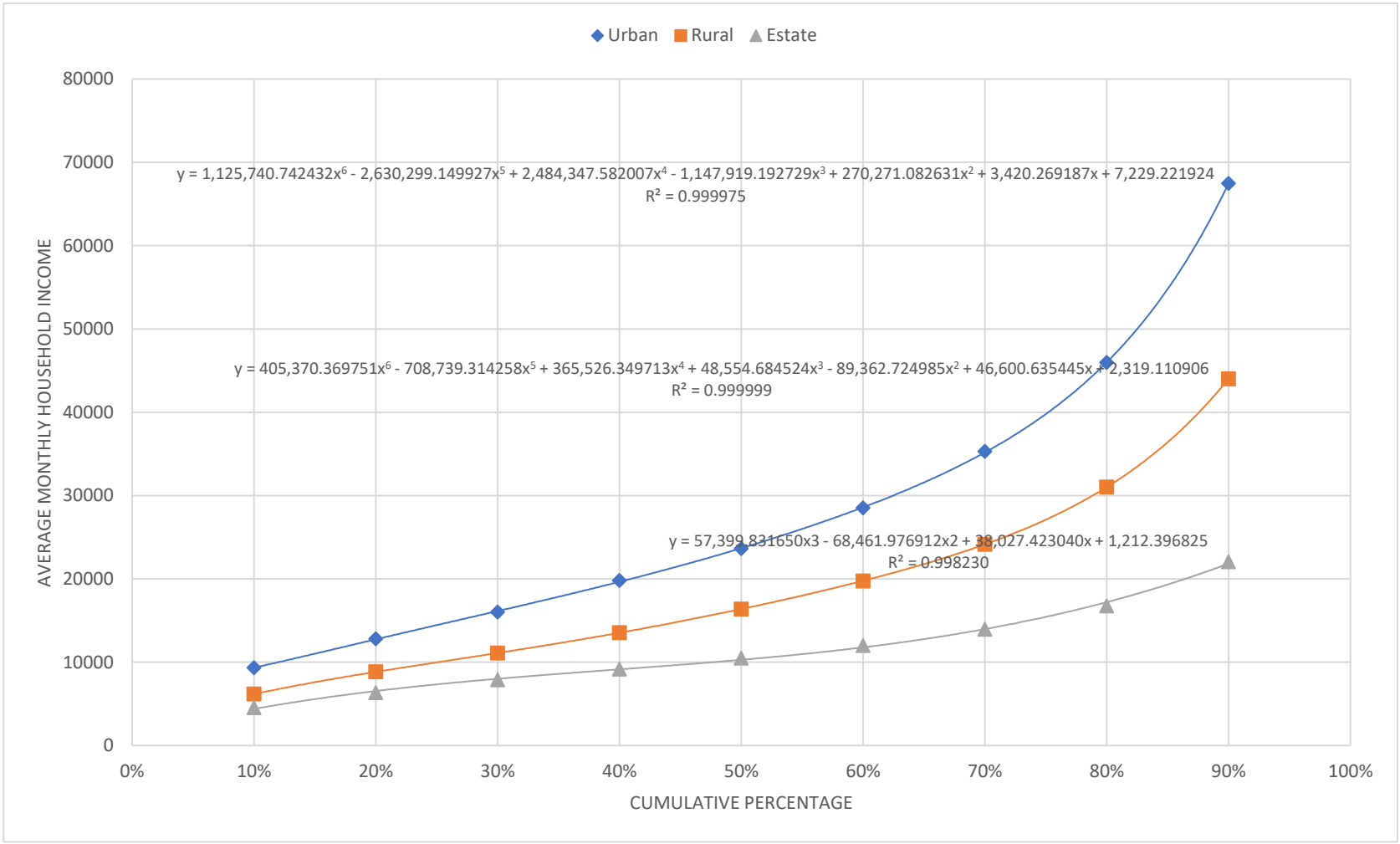

Figure 3.2 - Sector wise monthly household income

Regression equations developed to represent the distribution of sector wise household income were divided by average number of income receivers for respective sector (1.9 for urban sector, 1.8 for rural sector and 2 for estate sector) and multiplied by share of monetary income (84% for urban sector, 86% for rural sector and 92% for estate sector – Table 2.14 of HIES 2006) to develop the distribution of sector wise income receiver's income.

As for the second assumption made on deriving income data, employment categories were listed on order of descending average income, as given in the list. Then the cumulative percentage of each employment category was calculated (to the mid of the category). It was expected to give average income of an employee based on the occupational category, sector, and province once the calculated percentage was plugged in to the modified regression equation. Table 3.11 summarizes the process for the Western Province.

Employed number was multiplied by respective income and disaggregate data at provincial level was aggregated to develop the final matrix, Table 3.10.

Table 3.10 - Total annual production of labour

Occupation Categories	Rs Millions		
	Urban Sector Households	Rural Sector Households	Estate Sector Households
Senior Officials and Managers	33,516	23,345	11
Professionals	22,460	99,225	2,193
Proprietors and Managers of Enterprises	30,270	95,559	3,717
Technical and Associate Professionals	24,165	43,101	1,783
Plant and Machine operators and Assemblers	16,627	65,060	1,223
Sales and Service workers	8,299	64,121	738
Clerks	10,985	19,901	831
Skilled Agricultural and Fishery workers	2,862	150,863	6,744
Craft and Related workers	9,993	71,951	254
Elementary occupations	5,877	48,797	7,886
Unidentified	184	483	0

Table 3.11 - Total labour production for western province

	Western Province														
	Total Employment			**Percentage Employment**			**Cumulative Percentage (to mid of the category)**			**Average Monthly Income per Person (Rs millions)**			**Province Wise Total Income - Monthly (Rs millions)**		
	Urban	Rural	Estate	Urban	Rural	Estate	Urban	Rural	Estate	Urban	Rural	Estate	Urban	Rural	Estate
Senior Officials and Managers	57,282	33,401	11	8.3%	2.2%	0.1%	95.9%	98.9%	100.0%	39,887	31,866	12,898	2,285	1,064	0
Professionals	44,080	112,765	1,376	6.4%	7.3%	7.2%	88.5%	94.2%	96.4%	28,056	25,357	11,747	1,237	2,859	16
Proprietors and Managers of Enterprises	84,944	140,339	2,638	12.3%	9.0%	13.7%	79.2%	86.1%	85.9%	19,905	18,123	9,044	1,691	2,543	24
Technical and Associate Professionals	100,844	90,037	1,861	14.6%	5.8%	9.7%	65.8%	78.7%	74.2%	14,233	14,299	6,952	1,435	1,287	13
Plant and Machine operators and Assemblers	86,520	143,167	1,190	12.5%	9.2%	6.2%	52.2%	71.1%	66.2%	10,949	11,864	5,974	947	1,699	7
Sales and Service workers	50,991	166,312	705	7.4%	10.7%	3.7%	42.3%	61.2%	61.3%	9,098	9,689	5,504	464	1,611	4
Clerks	84,214	64,892	1,007	12.2%	4.2%	5.2%	32.5%	53.7%	56.8%	7,536	8,421	5,152	635	546	5
Skilled Agricultural and Fishery workers	8,069	116,006	1,357	1.2%	7.5%	7.1%	25.8%	47.9%	50.7%	6,534	7,545	4,750	53	875	6
Craft and Related workers	97,981	355,524	361	14.2%	22.9%	1.9%	18.1%	32.7%	46.2%	5,371	5,622	4,501	526	1,999	2
Elementary occupations	72,890	316,712	8,680	10.5%	20.4%	45.2%	5.8%	11.1%	22.6%	3,610	3,113	3,195	263	986	28
Unidentified	3,533	13,681	0	0.5%	0.9%	0.0%	0.3%	0.4%	0.0%	3,212	1,209	555	11	17	0

3.4 Consumption of Labour by Manufacturing Activities

3.4.1 Data availability

The ‘Annual Survey on Industries 2007 (ASI 2007) report consists the data about the total sum of salaries and wages paid under each type of occupation, for each manufacturing industry of formal sector. The data is under 7 occupational categories, which have slight differences from the 11 categories used for developing the AA module. Manufacturing industries are according to ISIC 4-digit classification and should be matched with the manufacturing activities adopted for developing AA module. Data is available for the fiscal year for 2006/2007 therefore derivation of data across time was not needed.

Data for informal sector was not available for 2006. Economic Survey of 2013 (ES 2013) has carried out surveys and possibility of using the ratios and trends from it to develop 2006 data was explored.

3.4.2 Process of data derivation

Data obtained from the ASI 2006 report covers all the formal sector manufacturing activities under 49 main activity classifications and 109 sub classifications. As the selected 12 activities for the AA module were representative of all manufacturing activities, above mentioned 109 subclassifications each, were matched with one of aforementioned 12 activities. Then the cumulative salaries and wages paid for each occupational category was calculated, provided in Table 3.12.

Table 3.12 - Total salaries and wages paid for manufacturing activities - ASI labour categories

Industry	S_Skilled	S_Technical	S_Unskilled	S_Administrative	S_Clerical	S_Other
Fishing, Aquaculture, and Service Activities Incidental to Fishing	679	346	372	207	78	107
Mining and Quarrying	1,638	12	432	50	30	51
Manufacture of Food Products, Beverages, and Tobacco	9,165	2,343	6,387	3,955	2,730	1,302
Manufacture of Textiles, Wearing Apparel, and Footwear	34,774	5,879	8,732	10,657	2,722	1,908
Manufacturing of Wood, Wood Products, Paper, and Paper Products	5,326	738	765	304	876	347
Manufacture of Rubber and Plastic Products	3,009	368	1,605	1,566	478	281
Manufacture of Basic Metals	4,763	555	2,804	2,859	1,349	1,111
Manufacture of Fabricated Metal Products; and Office and Computing Machinery	4,325	143	1,426	4,057	1,984	60
Manufacture of Motor Vehicles and Other Transport Equipment	263	54	13	59	79	8
Other Manufacturing	8,280	1,821	3,401	8,218	2,284	1,260
Electricity, Gas, and Water Supply	5,233	2,797	1,726	1,703	1,999	977

The occupational categories used in ASI report (7 categories) did not exactly match with the categories used for developing the AA module. Therefore, those 07 categories were expanded in to 11 categories used, using secondary, outside parameters. Provisions were kept for evaluating and change those parameters if needed. Matching criteria were developed for all manufacturing activities based on limited data sources (Central Bank Data, Government data, Financial reports of companies, etc.) The matching criteria used for, Agriculture, Hunting, Forestry, and Related Service Activity is as follows. The term 'Share' refers to the share of salaries and wages from each ASI employment categories.

Table 3.13 – ASI/AA module matching criteria for agriculture, hunting, forestry and related service activity

AA Module Categories	Matched ASI Category	Share
Senior Officials and Managers	Administrative	50%
Professionals	S_Technical	40%
Technical and Associate Professionals	S_Technical	60%
Clerks	S_Clerical	100%
Proprietors and Managers of Enterprises	S_Administrative	50%
Sales and Service Workers	S_Skilled	20%
Skilled Agricultural and Fishery Workers	S_Skilled	70%
Craft and Related Workers	S_Skilled	5%
Plant and Machine operators and Assemblers	S_Skilled	5%
Elementary occupations	S_Unskilled	100%
Unidentified	S_Other	100%

Some of the labour categories were not present in some of the manufacturing categories. In those cases, those categories were omitted and distributed among others. For instance, the activity manufacturing of Mining and Quarrying products does not use any skilled agricultural and fishery workers or craft and related workers, which would leave 70% and 5 % of skilled labour free in comparison to agriculture activity given above. But Mining and Quarrying uses a lot of Plant and Machine Operators and Assemblers. Therefore, the majority of above mentioned free skilled labour was allocated to Plant and Machine Operators and Assemblers category. Thus, the matching criteria used for Mining and Quarrying is as Table 3.14. Accordingly, a customized matching criterion was developed for each activity type.

Table 3.14 – ASI/AA module matching criteria for mining and quarrying activity

AA Module Categories	Matched ASI Category	Share
Senior Officials and Managers	S_Administrative	50%
Professionals	S_Technical	40%
Technical and Associate Professionals	S_Technical	60%
Clerks	S_Clerical	100%
Proprietors and Managers of Enterprises	S_Administrative	50%
Sales and Service Workers	S_Skilled	10%
Skilled Agricultural and Fishery Workers		
Craft and Related Workers		
Plant and Machine operators and Assemblers	S_Skilled	90%
Elementary occupations	S_Unskilled	100%
Unidentified	S_Other	100%

Appendix IV shows how AA module activity criteria were matched with each ASI categories for each manufacturing activity. Cumulative salaries and wages paid for each AA module labour categories for all formal sector manufacturing activities were calculated, Table 3.15. LFS 2007 report gives the total employment in manufacturing sector for 2006 as 1,363,092 people. This does not include the employment in Electricity Gas and Water Supply, which too is identified by AA module as a manufacturing activity. Therefore, by dividing the salary totals for each occupational category by average salary for respective category (derived while determine total labour production), for Electricity, Gas and Water Supply sector, total number of formal sector employment of it was calculated. Figure is 109,235 employees. LFS 2007 report suggests that, informal sector share of this activity is 45%. That makes activity's total employment is 158,391 employees. Making all manufacturing employment 1,521,483 employees. Derived data suggests formal sector employment of all manufacturing activities is 1,392,651 employees, leaves 128,832 employees in informal sector. It was assumed that average salary for informal sector was same as formal sector when equilibrium between informal and formal sectors was established. So, values in Table 3.15 was multiplied by 1.09 (1,521,483/1,392,651) to account for informal sector too. Final table is given on Table 3.16.

Table 3.15 - Salaries and wages paid by AA module labour categories at activity level for formal sector only

	Senior Officials and Managers	Professionals	Technical and Associate Professionals	Clerks	Proprietors and Managers of Enterprises	Sales and Service Workers	Skilled Agricultural and Fishery Workers	Craft and Related Workers	Plant and Machine operators and Assemblers	Elementary occupations	Unidentified
Agriculture, Hunting, Forestry, and Related Service Activities	#N/A	#N/A	N/A	N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Fishing, Aquaculture, and Service Activities Incidental to Fishing	103	138	207	78	103	204	476	0	0	473	5
Mining and Quarrying	25	5	7	30	25	164	0	0	1,474	481	3
Manufacture of Food Products, Beverages, and Tobacco	1,978	937	1,406	2,730	1,978	916	0	0	8,248	7,624	65
Manufacture of Textiles, Wearing Apparel, and Footwear	5,328	2,352	3,528	2,722	5,328	3,477	0	8,767	24,342	8,732	95
Manufacturing of Wood, Wood Products, Paper, and Paper Products	152	295	443	876	152	533	0	1,395	3,728	765	17
Manufacture of Rubber and Plastic Products	783	147	221	478	783	301	0	0	2,708	1,872	14
Manufacture of Basic Metals	1,430	222	333	1,349	1,430	476	0	0	4,287	3,859	56
Manufacture of Fabricated Metal Products; and Office and Computing Machinery	2,029	57	86	1,984	2,029	432	0	490	3,460	1,426	3
Manufacture of Motor Vehicles and Other Transport Equipment	30	22	33	79	30	26	0	0	237	21	0
Other Manufacturing	4,109	728	1,093	2,284	4,109	828	0	2,025	6,624	3,401	63
Electricity, Gas, and Water Supply	851	1,119	1,678	1,999	851	523	0	0	4,710	2,655	49

Table 3.16 - Salaries and wages paid by AA module labour categories at activity level for both formal/informal sectors

	Senior Officials and Managers	Professionals	Technical and Associate Professionals	Clerks	Proprietors and Managers of Enterprises	Sales and Service Workers	Skilled Agricultural and Fishery Workers	Craft and Related Workers	Plant and Machine operators and Assemblers	Elementary occupations	Unidentified
Agriculture, Hunting, Forestry, and Related Service Activities	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A	#N/A
Fishing, Aquaculture, and Service Activities Incidental to Fishing	113	151	227	85	113	223	519	0	0	517	6
Mining and Quarrying	27	5	8	32	27	179	0	0	1,611	525	3
Manufacture of Food Products, Beverages, and Tobacco	2,161	1,024	1,536	2,982	2,161	1001	0	0	9,011	8,329	71
Manufacture of Textiles, Wearing Apparel, and Footwear	5,821	2,569	3,854	2,974	5821	3,799	0	9,578	26,594	9,540	104
Manufacturing of Wood, Wood Products, Paper, and Paper Products	166	322	484	957	166	582	0	1,524	4,073	836	19
Manufacture of Rubber and Plastic Products	855	161	241	523	855	329	0	0	2,959	2,045	15
Manufacture of Basic Metals	1,562	242	364	1,474	1,562	520	0	0	4,683	4,216	61
Manufacture of Fabricated Metal Products; and Office and Computing Machinery	2,216	63	94	2,167	2,216	472	0	535	3,780	1,558	3
Manufacture of Motor Vehicles and Other Transport Equipment	32	24	36	86	32	29	0	0	259	23	0
Other Manufacturing	4,489	796	1,194	2,495	4,489	905	0	2,213	7,236	3,716	69
Electricity, Gas, and Water Supply	930	1,222	1,833	2,184	930	572	0	0	5,146	2,900	53

3.5 Consumption of Labour by Agri And Service Activities

3.5.1 Data availability

Even though the service industries accounts for more than 60% of the gross domestic production, an extensive survey about the field is yet to carry out. Annual Survey of Industries covers only the Manufacturing Industries. Economic Survey is to cover both service and manufacturing industries, and with agriculture it is to cover the whole economy. No descriptive enough data about salaries and wages of service sector employees is available prior 2013. Even though the first Economic Survey was carried out in 2013, planned biennial survey was not carried out in 2015 or 2017.

Thus, it was identified that, there were no descriptive enough direct data sources to identify the number of employees who worked on service sector in 2006, not the salaries or wages paid to them. It was identified that; government sector maintains descriptive enough data about its involvement in service activities. Government records provide, total number of employees in each sector, salaries paid to them etc.

3.5.2 Process of data derivation – concise flow chart

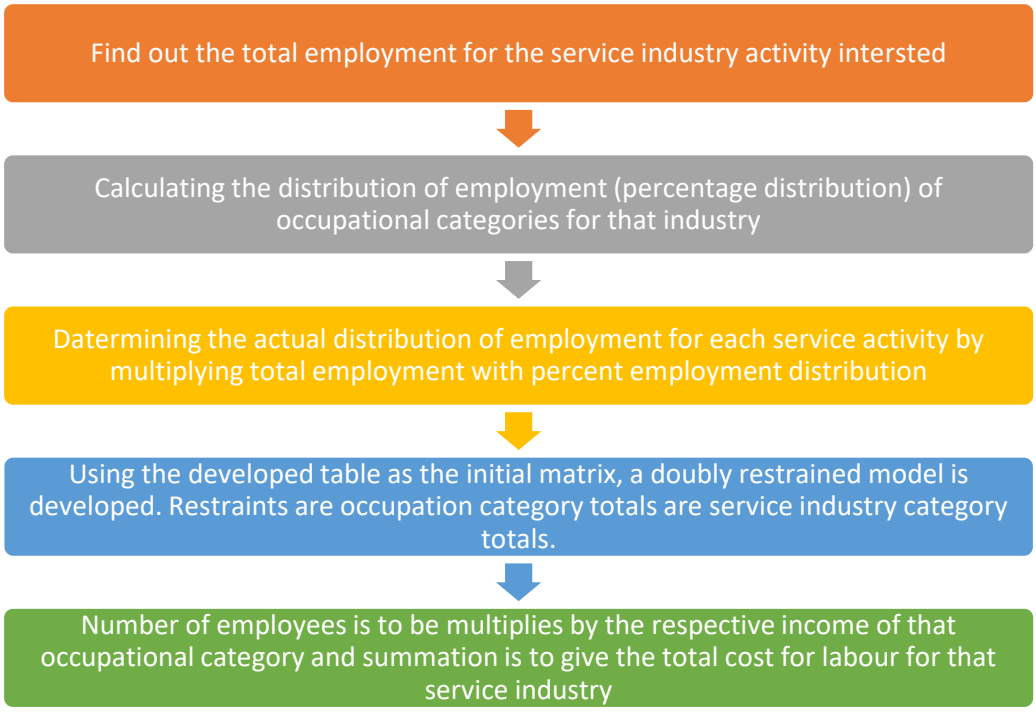

Figure 3.3 - Concise flow chart - Consumption of labour by service / agriculture activities

3.5.3 Process of data derivation

As the AA module was developed for the base year 2006, a data derivation is to be carried out to convert 2013 data to 2006.

In the Labour Force Survey Report of 2006, the industry category wise total employment is available. But the distribution of employment by occupational categories in a particular industry category is not available. Therefore, primary task of estimating the consumption of labour by service activities was identified as finding out the distribution of occupation categories within each industry category. Once that was calculated, number of employees in each occupational category were multiplied with the average salary for that occupational category and summation of all such will give the cost of labour for that service activity.

ES 2013 comes in 3 distinct reports. One covers the formal manufacturing establishments, another covers formal sector of service industries, while last covers the informal sector for both manufacturing and service sectors. These 03 reports neither cover the agriculture sector nor the public-sector employment. EC 2013 brings the first extensive survey about the informal sector of Sri Lanka. While conducting the EC surveys in 2013, data were collected for economical establishments covering following main 05 sections,

- Identification information
- Employment
- Expenditure
- Income/Receipts
- Fixed Assets
- Other data related to economic activities.

From those data, most of the data collected on employment, expenditure, income and fixed assets are not published due to their lesser reliability. Following their policies DCS won't share those unpublished data. If they were available, they could have been used as a base line to derive data for 2006, for the year AA module was developed. (If the second EC was carried out in 2018, data from that survey could have been used to derive data for 2006). Hence, a lengthier indirect approach was adopted to derive data.

As the government sector of Sri Lanka is having a thorough grip on the service industries, possibility of using public sector data for calculating the distribution of employment (percentage distribution) of occupational categories for service industry categories was checked. Share of employment of the public and semi government sector was calculated for 2013 with EC 2013 data and it was assumed that share of each service industry category in 2013 was true for same service industry category in 2006.

Table 3.17 - Share of Government employment

Service Activity	Gvt 2006	Pvt Formal (2013)	Pvt Informal (2013)	Gvt 2013 - Interpolated	Gvt Share	Informal sector share
Hotels and Restaurants		70,196	154,944		0%	69%
Transport Services and Storage	68,411	105,978	67,478	80,229	28%	28%
Post and Telecommunications	21,442	35,270	12,018	25,146	31%	17%
Financial Intermediation and Insurance	34,113	131,831	7,578	40,006	20%	4%
Real Estate, Renting, and Business Services	8,729	3,365	11,927	10,237	36%	50%
Public Administration and defence	322,467	92,457	18,173	378,172	74%	4%
Education	259,213	48,927	159,433	303,991	55%	34%
Health and Social Work	87,869	27,833	36,620	103,048	58%	24%
Other Community Service Activities	83,245	15,678	169,213	97,625	31%	63%

According to data derived, in Public Administration and Defence, Education and Health and Social Work service categories, public sector was the leading employer. Apart from the Hotels and Restaurant services, Trade services and Construction services, public sector participation was more than 20% in each service sector. Due to above mentioned reason and much more availability of data on public sector, the distribution of employment (percentage distribution) of occupational categories for a certain service industry is calculated using the public-sector data.

Public sector mainly consists employment at three levels, State Level, Provincial level, and Semi-government level. All these data were taken separately and combined before calculating the percentage distribution. Employment categories available on those were not exact matches of the labour categories used for model development. As all the government employees were suitably grouped in to government employment categories, no category as 'Unidentified' could be seen. Apart from that, as the government is the sole employer for the public sector, an occupational category named 'Proprietor's and Managers of Enterprises' also couldn't be seen. Therefore, when calculating the share of occupational category of 'Unidentified', a share of 'Elementary' occupations was assigned to it. The assigned share was calculated proportionately using the ratio between the total employments of 'Elementary' and 'Unidentified' categories as given in LFS 2006.

In LFS 2006, the percent share of informal sector contribution is given for the fields which have major informal sector influence. According to it 'Construction' industry was the leading among service industries with 83% share from informal sector followed by 'Hotels and Restaurants' industry with a 55% share (69% for 2013). To calculate the approximate share of the informal sector on other service activities, EC 2013 data was used. A brief analysis was done, and these data too are provided in the Table 3.17. Based on the assumption that informal sector share was not much changed from 2006 to 2013, apart from 'Construction' and 'Hotels and Restaurants' sector, 'Real Estate, Renting, and Business Services' service sector and 'Other Community Service Activities' sector could possibly have higher informal sector share. But as for LFS 2006, Real estate sector employed just 5504 people, which was 0.07% of the total employment. Hence, informal sector contribution was considered negligible in it. The informal sector on 'Other community Service Activities' category was identified as too complex to account due to diverse nature of its employees, so assumed that informal sector of it has same properties as formal sector.

Government sector does not have much of retail or wholesale activities, and according to EC 2013 the informal and formal private sector share of 'Wholesale and Retail Trade; and Repair of Motor Vehicles' was 19:81. (Derived omitting government sector contribution)

Based on all given above, it was assumed that the employment of all service industry sectors (formal informal both) except for 'Wholesale and Retail Trade; and Repair of Motor Vehicles', 'Construction' and 'Hotels and Restaurants', all other service sectors had percentage occupational distributions same as government sector distribution. This was considered valid due two reasons. First one was those sectors had lower share of informal sector component and second was most of the private sector formal institutions in each service category virtually had the same employment distributions as public sector (Ex. Government schools and Private Schools, Government universities and private universities, Government hospitals and Private hospitals, etc.)

Following Table 3.18 summarizes the percentage distribution of occupation categories for the all service sectors, which distribution was calculated using public sector data

Table 3.18 - Percentage distribution of occupation categories

Service Activity	Sum of Senior Officials and Managers	Sum of Professionals	Sum of Technicians and Associate	Sum of Clerks and Related Workers	Sum of Services and Sales Workers	Sum of Craft and Related Workers	Sum of Machine Operators and Related	Sum of Elementary Occupations
Transport Services and Storage	2%	1%	8%	18%	19%	14%	19%	18%
Post and Telecommunications	0%	0%	33%	4%	2%	0%	1%	59%
Financial Intermediation and Insurance	31 %	3%	14%	34%	8%	0%	2%	8%
Real Estate, Renting, and Business Services	1%	2%	11%	5%	1%	0%	1%	80%
Public Administration and Defence	1%	39%	9%	8%	29%	1%	1%	12%
Education	1%	82%	6%	3%	1%	0%	0%	7%
Health and Social Work	0%	36%	19%	5%	8%	0%	2%	29%
Other Community Service Activities	3%	3%	29%	39%	4%	2%	4%	16%
Agriculture, Hunting, Forestry and Related Service Activities	2%	5%	17%	9%	1%	1%	4%	62%
Construction	2%	11%	17%	19%	4%	9%	14%	24%
Wholesale and Retail Trade and repair of Motor Vehicles	5%	1%	51%	20%	3%	1%	3%	17%

The occupation category 'Proprietors and Managers of the Enterprises' was mainly from private sector. According to LFS 2006, 70.22% of Proprietors and Managers of Enterprises were from informal sector. To account for the informal sector of each service industry category, 75% of the occupational category of 'Senior Officials and Managers' was allocated as 'Proprietors and Managers of Enterprises' based on data.

When calculating these distributions, it was understood that two occupational categories, 'Sales and Service Workers' and 'Proprietors and Managers of Enterprises' were not reliably distributed on 'Construction', 'Wholesale and Retail Trade; and Repair of Motor Vehicles', and 'Hotel and Restaurant' activities as government sector does not employ sales workers or proprietors. Therefore, those two occupational categories were alternatively distributed as follows.

1. From the analysis done to find out the labour consumption by manufacturing activities, total number of 'Sales and Service Workers' and 'Proprietors and Managers of Enterprises' were extracted (Total for both formal and informal sectors)
2. By subtracting those numbers from the occupational category totals (LFS 2006), available number of 'Sales and Service Workers' and 'Proprietors and Managers of Enterprises' for service and agriculture sectors were calculated.
3. From previously distributed 8 service industries, total number of 'Sales and Service Workers' and 'Proprietors and Managers of Enterprises' were calculated.
4. Distributing for agriculture sector was carried out (explained later)
5. Once step 03 results and step 04 results were subtracted from step 01 results (Step 01 – Step 02 – Step 03) the total number of 'Sales and Service Workers' and 'Proprietors and Managers of Enterprises' available to distribute between, 'Wholesale and Retail Trade; and Repair of Motor Vehicles', 'Construction' and 'Hotels and Restaurants' sectors were identified.
6. Remaining total number of employments for both occupational categories, 'Sales and Service Workers' and 'Proprietors and Managers of Enterprises', were distributed among the above 03 service industry sectors proportionately to total employment from LFS 2006.

7. Remaining number of employments for, ‘Wholesale and Retail Trade; and Repair of Motor Vehicles’ and ‘Construction’ sectors were distributed among occupation categories according to a derived percentage distribution which accounts for both formal and informal sectors of each industry activity. Process of derivation is given in next paragraph.
8. As there were only a handful of institutions and just a limited number of people are involving in ‘Hotels and Restaurants’ activities representing Sri Lankan government, a reliable percentage distribution of employment among occupation categories couldn’t be established. Therefore, the percentage distribution for the sector is assumed to be same as the percentage distribution developed at step 02

Because of the higher share of informal sector contribution, ‘Wholesale and Retail Trade; and Repair of Motor Vehicles’, and ‘Construction’ sectors were assumed to have distinct occupational distributions for formal and informal sectors. Again, the formal sector distributions were calculated using the percentage employment distribution of occupational categories of public sector. LFS 2006 report provides data about the percentage formal sector employment and informal sector employment for each occupational category, Appendix V summarizes those data. Percentage distribution for the formal sectors of ‘Wholesale and Retail Trade; and Repair of Motor Vehicles’ and ‘Construction’ industries were calculated and associated informal sector share for each occupation group was calculated using data on Appendix V. This would give a total not 100%, therefore it is converted to a percentage distribution by taking the observed total as 100%. Then each distribution is weighted with informal or formal sector share and a combined final distribution was developed, which is used on step 07 above.

Table 3.19 – Percentage occupation distributions for construction and trade sectors

	Sum of Senior Officials and Managers	Sum of Professionals	Sum of Technicians and Associate Professionals	Sum of Clerks and Related Workers	Sum of Services and Sales Workers	Sum of Craft and Related Workers	Sum of Machine Operators and Related Workers	Sum of Elementary Occupations	Total
Construction - Formal sector 100%	2%	11%	17%	19%	4%	9%	14%	24%	100%
Construction - Calculated Distribution in Informal Sector Not 100%	0%	2%	3%	2%	5%	18%	19%	33%	82%
Construction - Calculated Distribution in Informal Sector 100%	0%	2%	3%	2%	6%	22%	23%	40%	100%
Construction - Formal and Informal Together 100% (Formal 17%, Informal 83%)	1%	4%	6%	5%	6%	20%	22%	37%	100%
Wholesale and Retail Trade; and Repair of Motor Vehicles - Formal Sector 100%	5%	1%	51%	20%	3%	1%	3%	17%	100%
Wholesale and Retail Trade; and Repair of Motor Vehicles - Informal Sector Not 100%	1%	0%	8%	2%	4%	1%	5%	24%	44%
Wholesale and Retail Trade; and Repair of Motor Vehicles - Informal Sector 100%	1%	0%	19%	4%	8%	3%	10%	54%	100%
Wholesale and Retail Trade; and Repair of Motor V. - Formal and Informal Together 100% (Formal 19%, Informal 81%)	2%	0%	25%	7%	7%	3%	9%	47%	100%

When determining the distribution for 'Agriculture.' service activity, the labour category, Skilled Agriculture and Fishery Workers were considered separately. Share of informal sector contribution for the sector is 84% based on LFS 2006. This share was basically consisting of agriculture field workers. Hence, all the remaining number

of employees, 1585084, in 'Skilled Agriculture and Fishery Workers' category was assigned to informal sector (5,066 was employed by manufacturing industries). That left 702,224 personnel working in the formal sector. Formal sector percentage employee distribution of occupation categories was done using government sector distribution, Table 3.18.

The developed occupation distribution table was a singly restrained model. Its row sum was an exact much to the expected row total. But the column sums vary from the expected column totals, which were the occupation category totals given in LFS 2006 subtracted manufacturing and agriculture sectors combined. Therefore, using the developed table as the initial matrix, a doubly restrained model was developed. This was expected to give balanced and much accurate distribution figures, Table 3.21. Once the occupation adjusted distributions were calculated, number of employees in each occupation category was multiplied by average (Sri Lankan average) annual income values for respective category. Average monthly income values for each occupation category were developed at the analysis done to find out production of labour by households.

Table 3.20 - Average monthly income for occupation categories

	SL - Average Monthly Income (Rs)			
Occupation Group	**Urban**	**Rural**	**Estate**	**Sri Lanka**
Senior Officials and Managers	40,601	32,380	12,903	36,755
Professionals	30,078	27,628	12,225	27,421
Proprietors and Managers of Enterprises	21,130	21,101	10,482	20,511
Technical and Associate Professionals	14,926	17,047	8,921	15,883
Plant and Machine operators and Assemblers	11,601	14,665	8,210	13,775
Sales and Service workers	9,711	12,309	7,786	11,879
Clerks	8,099	10,759	7,356	9,556
Skilled Agricultural and Fishery workers	7,806	8,605	5,704	8,410
Craft and Related workers	5,761	5,629	4,871	5,642
Elementary occupations	3,824	3,240	3,388	3,306
Unidentified	3,212	1,186	0	1,436

Table 3.21 - Total annual consumption of labour by service and agriculture sectors (Rs millions)

Service Activity	Senior Officials and Managers	Professionals	Technical and Associate Professionals	Clerks	Proprietors and Managers of Enterprises	Sales and Service Workers	Skilled Agricultural and Fishery Workers	Craft and Related Workers	Plant and Machine operators and Assemblers	Elementary occupations	Unidentified
Agriculture, Hunting, Forestry, and Related Service Activities	847	5,887	13,527	2,119	4,148	1,460	159958	4,064	3,077	19054	119
Construction	257	713	644	175	13,292	1,046	0	16,321	2,639	1,659	10
Wholesale and Retail Trade; and Repair of Motor Vehicles	3,743	290	12,295	1,125	73,274	23,886	0	9,269	4,924	9,359	59
Hotels and Restaurants	277	469	254	36	4,020	1,311	0	6,122	100	355	2
Transport Services and Storage	1,187	305	1,360	949	342	5,079	0	18,302	3,590	1,211	8
Post and Telecommunications	48	13	2,013	83	14	221	0	107	45	1,422	9
Financial Intermediation and Insurance	26,971	1,656	4,414	3,354	7,773	3,919	0	541	747	996	6
Real Estate, Renting, and Business Services	14	21	61	8	4	8	0	12	7	185	1
Public Administration and Defence	1,111	31,174	4,230	1,233	320	22,471	0	3,227	758	2,312	14
Education	796	65,629	3,149	502	229	571	0	972	255	1,321	8
Health and Social Work	139	8,852	2,868	239	40	1,935	0	357	342	1,730	11
Other Community Service Activities	4,666	2,393	14,522	6,188	1,345	2,777	0	9,274	2,114	3,231	20

3.6 Production of Space Commodity

3.6.1 Data availability

3.6.1.1 Data on land use

In Sri Lanka there are few institutions to collect and publish data about land consumptions and land use patterns. All of them are government institutions. Multi-agency cooperation could be observed when carrying out data collection, surveying, and publishing data. Identified main institutions are as below.

- Land Use Policy Planning Department (LUPPD)
- Urban Development Authority (UDA)
- Department of Survey
- Department of Census and Statistics
- Department of Irrigation

Among these, LUPPD and UDA are actively participating in land use planning. UDA is primarily responsible for land use planning in urban areas, basically understood as the area governed by a municipal council or an urban council. Therefore, the total area falls under UDA jurisdiction is lower than 5% of total amount of land of Sri Lanka. LUPPD is the body to cover entire nation but apart from the descriptive land use plans developed for Northern and Eastern provinces under the recommendations of The Lessons Learnt and Reconciliation Commission (LLRC) of 2011, they do not have a complete set of comprehensive data covering all districts. Department of Irrigation is collecting limited data on land use to help irrigation and agriculture planning, which not comprehensive and limited in scope.

With the help of Department of Survey, District Land Use Planning offices of LUPPD, annually collect data about land use in each district under a limited number of categories. Those collected data is published as maps by Department of Survey and as data with Department of Census and Statistics in their annual District Statistical Handbooks. LUPPD, earlier the Land Use Policy Planning Division, under the Ministry of Land Development and Mahaweli Development, upgraded to the status of a department and given more responsibilities in 2009-2010 period. Therefore, their data also starts from 2009.

Apart from the residential land use, LUPPD data categorizes all built up area in to a category called 'Buildings'. This is identified as one of the limiting factors of the data set. Due to the internal conflicts at the time, updated land use data for Northern and Eastern provinces are not available for 2009.

3.6.1.2 Data on land prices

As the production of land is measured in monetary figures, the data on land prices is also required to calculated total land values. Annual Survey of Industries report of 2006, ASI 2006, by the Department of Census and Statistics (DCS) consists data regarding the land values of manufacturing industries as an asset of them. Those figures are for formal manufacturing sector only. Informal sector data is not present. Economic Survey of 2013 conducted by DCS, the first survey carried out to collect comprehensive data about the service sector, has collected data about the land consumption (land values) of service industries but not published, due to the unreliability of the collected data. Reasons are given as, sample size not being adequate and unforeseen troubles on the adopted process which hindered steadfast data collection. Apart from those two sources, no other verified sources were identified to extract land prices. Wasantha et.al proposes a model for estimating the residential land value of a land lot, based on multiple parameters,

- Accessibility of the property
- Location of the Property
- Distance to the Main road

This is similar to the model used by Department of Valuations to determine land values, but this model can be used to determine the value of a piece of land only. It can't be used to determine the average land prices in the land use zones of interest.

Therefore, the researcher looked in to informal data sources, to be used after validating their reliability. The primary sources available was identified as the figures published by Real Estate Developers. Among many institutions, Lanka Property Web (LPW), was identified to have the most comprehensive data set published with historical records, developed using over 20000 property sales entries for each year. LPW data for 2018 was validated using different other real estate price sources. Those data

consist data about the province wise Residential, Non-Residential, and Agricultural land prices from 2012 to 2018. Using those data, data for 2006 was derived. Apart from above mentioned data, website provided access to current individual land plot sale entries, from which compiled data later mentioned were derived. Those individual entrees were also used to derive some of the missing figures.

3.6.2 Assumptions

- Earliest data availability with DCS for district wise different land uses was for the years 2009 and 2010. Even though data was available for all the years from 2010 onwards, it's not reasonable to assume that the same trends from 2009 upwards should have prevailed between 2006 to 2009. The reason for that is the internal conflicts of the country ceased to exist from 2009 changing the usual trends. But the assumption was made that land use distributions in 2006 was similar to 2009 distributions due to lack of data
- Acquired data set about land price variations did not contain data before 2012. Therefore, it was assumed that immediate trend of land price variations after 2011 (2012 onwards) was true for period between 2006 and 2011.
- When examining the data about the land prices, it was seen that there was a sudden price hike in 2015 – 2016. Apart from there, it was assumed that, land prices were gradually changing between 2006 to 2015 and 2015 to 2018. Trends were analysed, and 2018 data were converted to 2006 data.
- It was assumed that all the built-up area was shared only by manufacturing or service activities. Areas of forests, Mangroves and water bodies are assumed to be conserved lands, and area was assumed not to change. Therefore, not considered as a space commodity.
- Percentage price changes on Colombo district land prices was assumed to be matching with the urban sector land price changes.

3.6.3 Process of data derivation – concise flow chart

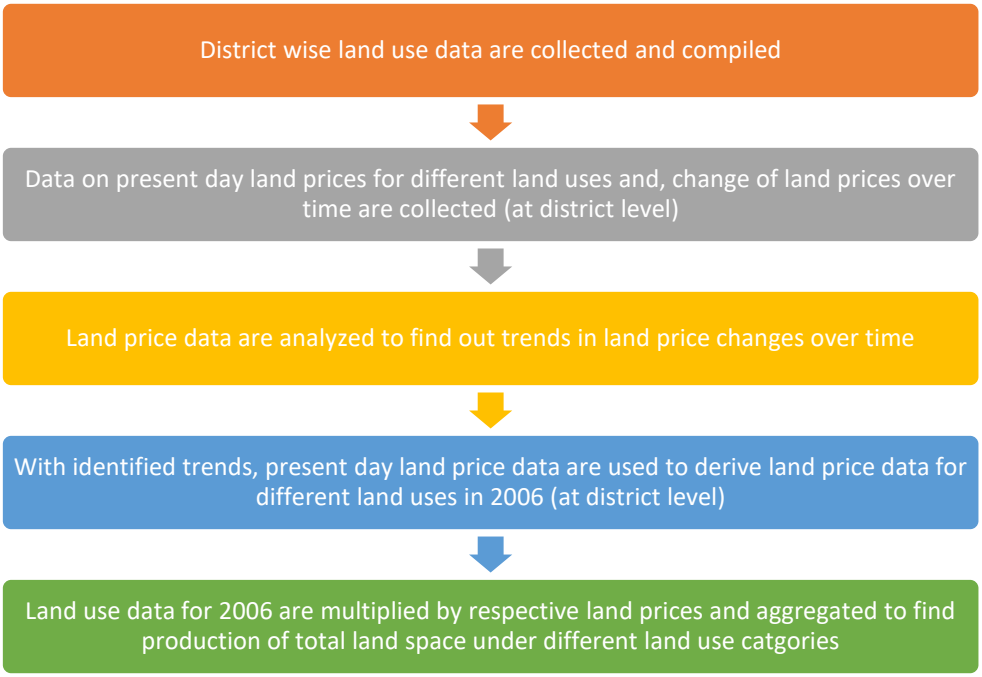

Figure 3.4 - Process of data derivation for production of space

3.6.4 Process of data derivation

The basic concept followed on the process of finding the production of space commodity, was finding the district wise space commodity production, and aggregating them to cover the entire study area. Northern and Eastern provinces were excluded.

The collected land use data for each district consisted data under 15 land use categories. 06 of them cover the agriculture sector covering all major crop types. 03 of them covered natural forests, grass lands and marshy lands, of which most were conserved lands. While another 04 covered water bodies and non-built up land, built up land was covered by only two categories, Home Gardens and Buildings.

Table 3.22 shows the nature of available raw data for Anuradhapura district. Table 3.23 summarizes derived combined data for all districts.

Table 3.22 - Composition of land consumption in Anuradhapura district

ඉඩම් ස්වභාවය **Nature of land**	භූමි ප්‍රමාණය (හෙක්ටයාර) **Area (Hec)**	ප්‍රතිශතය **Percentage (%)** **Percentage (%)**
01.අස්වද්දන ලද කුඹුරු` - Asweddumized paddy land		
1. වාරිමාර්ග - Irrigated	117,022	16%
11.අහස්දියෙන් - Rainfed	10,609	1%
02. තේ - Tea	0	0%
03. රබර් - Rubber	0	0%
04. පොල් - Coconut	17,800	2%
05. කුරුඳු- Cinnamon	0	0%
06. වෙනත් වගාවන් - Other crops	14,800	2%
07. වනාන්තර- Forests		
1. ඝන වනාන්තර - Dense forests	164,877	23%
11. විවෘත වනාන්තර - Open forests	120,398	17%
111. වගා කරන ලද වනාන්තර - Planted forests	5,974	1%
08.ලඳු කැළැ හා හේන - Grass lands/Chena	42,603	6%
09. වගුරු හා කඩොලාන කැළැ - Marshes and Mangroves	2,140	0%
10. ගෙවතු - Home gardens	86,254	12%
11. ජලාශ - Reservoirs	54,800	8%
12. ගොඩනැගිලි- Building	2,150	0%
13. වැලි හා ගල් පර - Sand and Mountain	3,020	0%
14. මුඩු බිම් හා අත්හරින ලද ඉඩම් - Abandoned land	13,356	2%
15. වෙනත් (පූජා භූමි, මාර්ග, සුසාන භූමි ආදිය) - Other (sacred places, roads, cemetery etc)	62,097	9%
එකතුව - Total	717,900	100%

Table 3.23 - District level composition of land consumption

දිස්ත්‍රිකය - District ඉඩම් ස්වභාවය Nature of land	අනුරාධපුර - Anuradhapura - 2009	පොළොන්නරුව - Polonnaruwa - 2009	බදුල්ල - Badulla - 2009	මොණරාගල - Monaragala - 2009	කොළඹ - Colombo - 2009	ගම්පහ - Gampaha - 2009	කළුතර - Kaluthara - 2009	ගාල්ල - Galle	මාතර - Matara - 2009	හම්බන්තොට - Hambantota - 2009	කෑගල්ල - Kegalle - 2009	රත්නපුර - Ratnapura - 2009	මහනුවර - Kandy - 2009	මාතලේ - Matale - 2009	නුවර එළිය - Nuwara Eliya - 2009	කුරුණෑගල - Kurunegala - 2010	පුත්තලම - Puttalam - 2009
01.අස්වද්දන ලද කුඹුරු` - Asweddumized paddy land																	
1. වාරිමාර්ග - Irrigated	117022	61099	23100	16774	1466	5521	2553	141	7685	36148	2952	14818	8701	0	6560	52075	18356
11.අහස්දියෙන් - Rainfed	10609	1650	6500	9296	4615	9594	13640	17168	10586	3575	6188	7800	7304	17985	274	30803	2090
02. තේ - Tea	0		34100	873	88	0	7170	27427	23704	394	11551	43585	27940	3212	50266	104	
03. රබර් - Rubber	0		400		17739	4614	29852	6679	3733	144	51976	40055	2162	3012	33	3445	
04. පොල් - Coconut	17800	7750	3600	12580	3149	19567	11276	12548	14398	15967	12507	4624	4729	4973	954	152358	48379
05. කුරුඳු- Cinnamon	0		200		149	52	4509	10969	7420	547	57	1242	318			27	
06. වෙනත් වගාවන් - Other crops	14800	1637	22700	22478	386	611	20316	1993	9101	3858	1887	7915	6308	14011	13500	3020	12033
07. වනාන්තර- Forests			0				0										
1. ඝන වනාන්තර - Dense forests	164877	129965	47800	116588	1237		7366	18442	14850	11441	4226	66752	23317	59274	33340	7991	
11. විවෘත වනාන්තර - Open forests	120398	34318	26700	89423	8	1374	5628	914	3275	22844	3432	11483	10759	859	12341	4131	
111. වගා කරන ලද වනාන්තර - Planted forests	5974	3126	7000	4861	618	905	2606	452	808	3693	3201	3006	7445	0	10846	9155	114294
08.ලදු කැළෑ හා හේන - Grass lands/Chena	42603	13610	47000	75575	584	972	4238	12216	1764	77906	4814	51531	21755	51401	16098	42340	59399
09. වගුරු හා කඩොලාන කැළෑ - Marshes and Mangroves	2140	5635	200	420	2226	49	1008	1085	225	3658	5	8	12	0	65	177	6298
10. ගෙවතු - Home gardens	86254	53676	23500	75245	19154	78022	45257	50222	10589	66793	55000	66000	49794	37000	15377	117540	25467
11. ජලාශ - Reservoirs	54800	14021	6100	13100	1706	4736	2653	3064	1310	10259	1017	3905	4227	4062	4965	23729	14653
12. ගොඩනැගිලි- Building	2150	1312	800	272	11199	7994	1898	612	3925	1512	4338	1186	1858	754	1538	18254	1137
13. වැලි හා ගල් පර - Sand and Mountain	3020	4039	4700	4	59	579	304	661	118	1095	1369	1045	2406	0	1450	3405	4240
14. මුඩු බිම් හා අත්හරින ලද ඉඩම් - Abandoned land	13356	1170	31700	8343	598	509	401	607	230	2652	1284	642	10095	0	3403	4313	
15. වෙනත් (පූජා භූමි, මාර්ග,සුසාන භූමි ආදිය) - Other (sacred places, roads,cemetery etc)	62097	782	0	120099	4918	3623	85		14528	49	3486	1943		2757	3091	8403	855
දෙන ලද එකතුව - Total Given	717900	333790	286100	565930	69900	138721	160760	165200	128250	262535	169280	327540	189130	199300	174100	481269	307200
සැබෑ එකතුව - Calculated Total	717900	333790	286100	565930	69900	138721	160760	165200	128250	262535	169290	327540	189130	199300	174100	481270	307200

This aggregate nature of the land use in built up land limits identifying different categories of space commodity being used by identified manufacturing or service industries. The possibility of sub-dividing the built-up area in to multiple space commodity types were checked to have a more descriptive model. But that was abandoned due to not having reliable data sources or other parameters to derive those data. Grass Lands/Chena abandoned lands and Sandy and Mountainous lands were categorized as non-conserved non-built up land. Therefore only 04 types of land space categories were selected on developing the model. They are,

- Agricultural space
- Residential space
- Built up non-residential and
- Non-conserved non-built up lands

The last category was not priced as they are used neither by activities nor households. The comprehensive compiled land prices available on Lanka Property Web was for current year only. But there was a set of data showing change of average Sri Lankan land prices and Colombo land prices between 2012 and 2018. Current year land prices were available at province level for residential land use and agricultural land use. Agriculture land prices for Tea, Rubber and Coconut cultivation were given as a figure for all provinces. Checking individual entries on the website also suggested that there was no major change of prices at district levels for these uses. Paddy field land prices were developed using individual entries from the website. Land values of the lands where other crops were cultivated, were assumed to be equal to the minimum per area land value of other cultivations, either coconut, rubber, or tea.

As the Lanka Property Development is a real estate developer, most of their developed residential spaces are closer to urban centres. Checking individual entries and other online sources also suggested that the given residential land prices were closely related to land prices in urban centres. As most of the residential lands are situated in rural sector, using those figures as residential land prices are misguiding. So, after checking and averaging multiple entries for each district, primarily based on rural sector, average residential land prices are developed. As for one of the assumptions made above, built up non-residential land spaces are basically used by manufacturing and

service industry activities. For most of times, these establishments are in urban centers (especially if it is a service sector activity) as they intend to interact with more people, or easily get their supplies and products delivered. Therefore, the residential land price data given in Lanka Property Web was considered as the built-up area land prices, which is basically the urban sector non-residential land prices.

Table 3.24 - Average land prices in Sri Lanka for 2018

		Land Prices in Rs millions per perch		
	Average Land prices by Region for mid-year 2018 (Rs million per perch)	**Non-residential land prices**	**Residential land prices**	**Paddy land prices**
Residential, non-residential and paddy land prices	Western Province Land price	1.1800		
	Colombo City	11.4000	0.0000	0.0000
	Colombo District	1.0200	0.4000	0.0313
	Gampaha District	0.5000	0.3000	0.0188
	Kaluthara District	0.2750	0.1500	0.0063
	Southern province Land price	0.4140		
	Galle District	0.4250	0.1400	0.0094
	Matara District	0.3750	0.1200	0.0063
	Hambantota District	0.2000	0.0600	0.0047
	Central province Land price	0.3710		
	Kandy District	0.4000	0.1500	0.0050
	Matale District	0.1750	0.0800	0.0050
	Nuwara Eliya District	0.2000	0.1200	0.0044
	North West province Land price	0.1890		
	Kurunegala District	0.2000	0.0800	0.0094
	Puttalam District	0.1500	0.0600	0.0094
	North Central province Land price	0.1250		
	Anuradhapura District	0.1300	0.0600	0.0047
	Polonnaruwa District	0.1200	0.0600	0.0047
	Uva province Residential Land price	0.1610		
	Badulla District	0.1750	0.0750	0.0050
	Monaragala District	0.1000	0.0500	0.0047
	Sabaragamuwa province Land price	0.1220		
	Ratnapura District	0.1250	0.0800	0.0050
	Kegalle District	0.1250	0.0750	0.0050
	Eastern province Land price	0.1440		
	Northern Province Land price	0.1540		
Other	Overall Tea Land price	0.0128		
	Overall Rubber Land price	0.0188		
	Overall Coconut Land price	0.0211		

Historical data provided by LPW about average Sri Lankan land prices and Colombo land prices were extracted and plotted to identify the trends in land price changes over time, to be used to convert 2018 data to 2006.

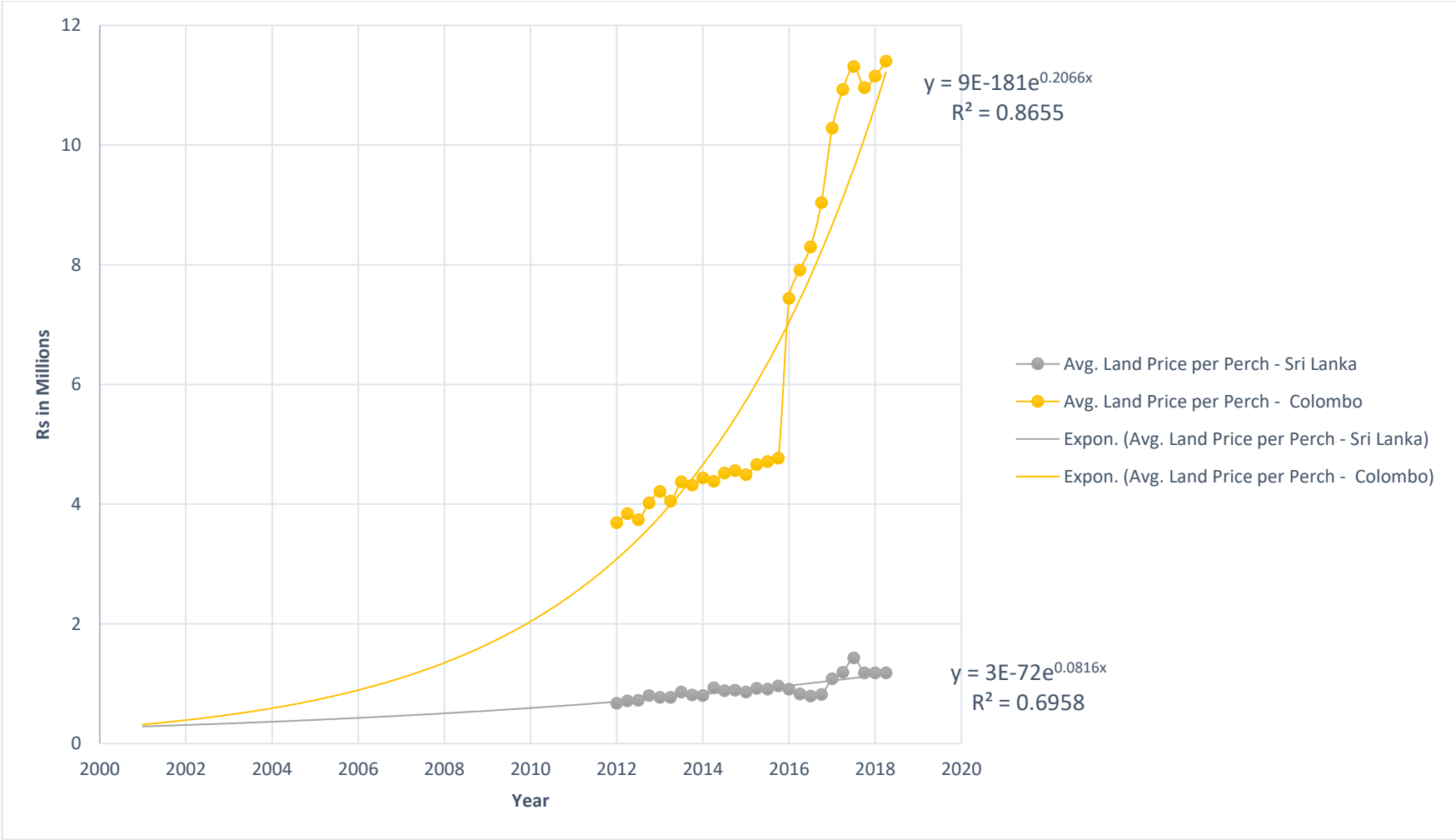

Figure 3.5 - Change of land prices in Sri Lanka from 2012 to 2018

A sudden hike in Colombo land prices was observed towards the end of 2015 (Figure 3.5). But the sudden hike was not visible on average Sri Lankan land prices. As for the assumptions made before, Colombo land price changes were to reflect urban centre land price changes. Therefore, event can be interpreted as there was a sudden price hike for urban centre land prices while other land prices remained same. Two exponential trendlines were developed for the two distributions, and their equations were established. Once those two equations were solved simultaneously, the intersecting point and merging point for both distributions were identified to fall between year 2000 and 2001. This suggests that in 2000, land prices in Colombo was exactly same as average land prices in Sri Lanka, which was not the case. It was established that developing one trendline to account urban land price changes before 2015, price hike in 2016, and changes after 2016 was not practical. R^2 value being 0.08655 also suggest that the trendline was not a good match with the distribution. A sudden fluctuation in average Sri Lankan land prices also can be witnessed after 2016, but those fluctuations behaves in a manner the trend was not changed. Therefore, average Sri Lankan land prices were assumed to have a unique unchanged trend from 2006 to 2018.

Therefore, land price changes were disaggregated in to three scenarios, trend before 2015, price hike in 2016, and trend after 2016 and analysed separately, aggregated again later by feeding one's results as input to other. Altogether, they were used to convert 2018 data in to 2006 data.

Change of land prices over the time - 2012 to 2016

Colombo land prices changes from 2012 to 2016 with Average Sri Lankan land prices (2012 to 2018) were analysed separately and distributions were represented by exponential distributions because land price variations were expected to follow exponential distributions. See Figure 3.5. Equations were derived and solved simultaneously. It is noted that the exponential distribution for average Sri Lankan land prices was having a R^2 value of 0.6958, which suggest trendline is not a good match. But that was expected, due to the land price fluctuations happened after 2016.

Equations

Average Sri Lankan land price

$$y = 3 * 10^{-72} * e^{0.08169\,x}$$

Average Colombo/Urban sector land price

$$y = 5 * 10^{-57} * e^{0.0651\,x}$$

Where y is average land price per perch in Rs millions, and x is the year. These two equations were solved with an accuracy level of $1 * 10^{-10}$ at x = 1642 and y = 0.

Change of land prices over the time – 2016 to 2018

Colombo land prices from 2016 to 2018 with average Sri Lankan land prices (2012 to 2018) were analysed separately and distributions were represented by exponential distributions. See Figure 3.6 and Figure 3.7. Equations were derived and solved simultaneously. Equation for average Sri Lankan land price changes was not changed. Graph and the derived equations are given below.

Equations

Average Sri Lankan land price

$$y = 3 * 10^{-72} * e^{0.08169\,x}$$

Average Colombo/Urban sector land price

$$y = 2 * 10^{-177} * e^{0.2028\,x}$$

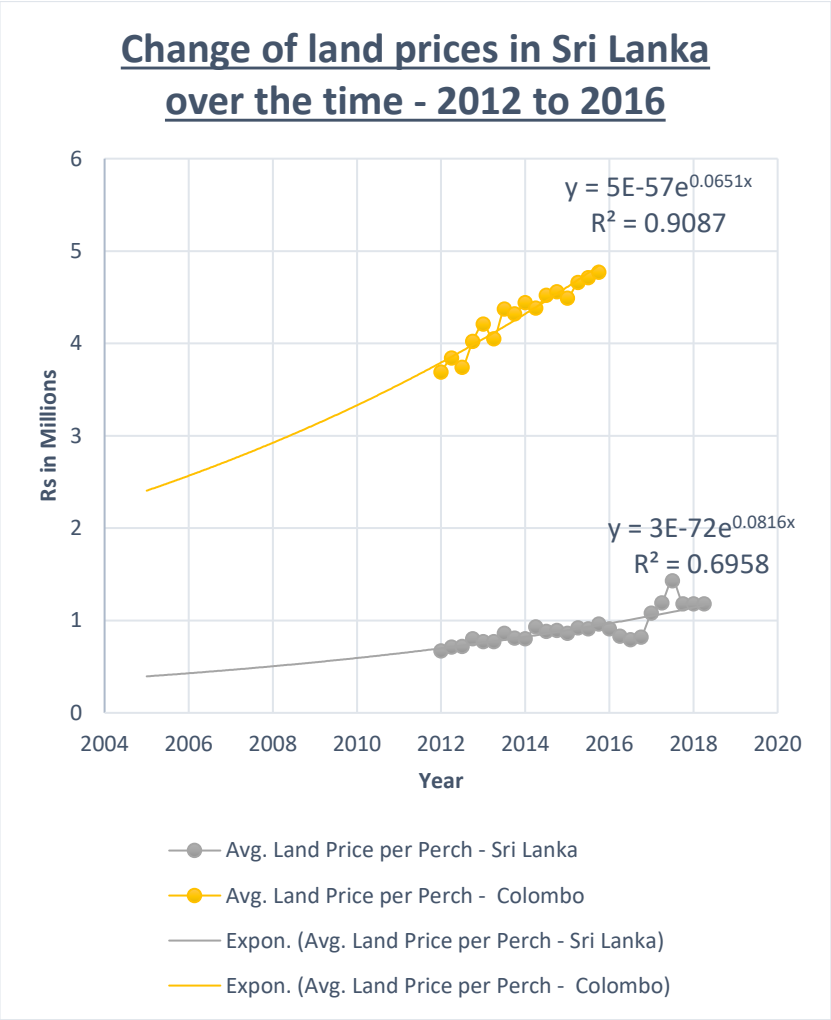

Figure 3.6- Change of land prices from 2012 to 2018

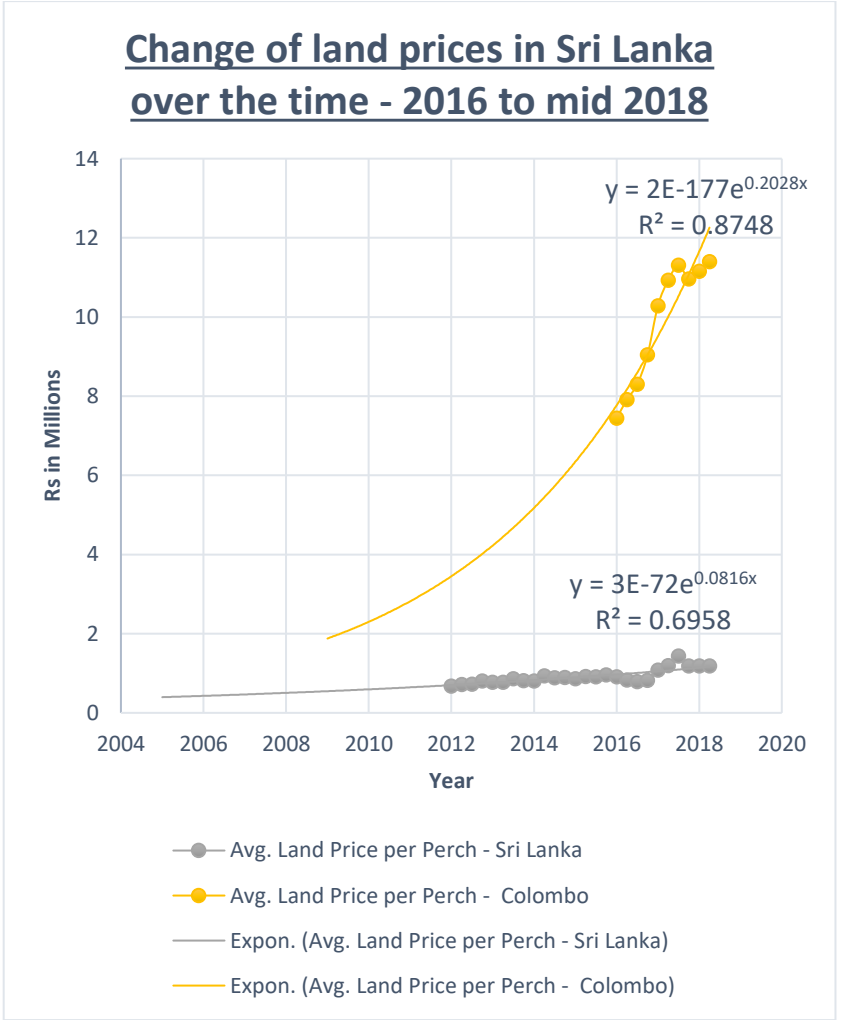

Figure 3.7 - Change of land prices from 2012 to 2018

Price hike in 2016

The price hike in 2016, was taken as proportionate to after hike price in 2016. The hike in 2016 was calculated as 2.88 (7.85-4.97) and taken as proportionate to 7.85. This suggested a small land price change on average Sri Lankan land prices in 2016, which was contradictory with the assumptions made above on the derivation process. Due to fluctuations on average Sri Lankan land prices, this smaller bump was neglected.

Using the established trends, 2018 land prices were converted to 2006 mid-year prices. See Appendix VI**.** Summary of district wise average land prices for different land uses are in Table 3.26. Total production of land (price * land) at district level as on Table 3.27.

The aggregated final figures to be used in AEF is given on Table 3.25.

Table 3.25 - Space production final matrix (Rs Millions)

	Agricultural Space	**Residential Space**	**Non-Residential Space**
Agriculture land	4,777,880.3		
Residential Land		15,675,812.8	
Non-Residential Land			3,214,501.9

Table 3.26 - District wise average land prices for different land uses

Land Prices (Rs million/perch) ඉඩම් ස්වභාවය Nature of land	අනුරාධපුර - Anuradhapura	පොළොන්නරුව - Polonnaruwa	බදුල්ල - Badulla	මොණරාගල - Monaragala	කොළඹ - Colombo	ගම්පහ - Gampaha	කළුතර - Kaluthara	ගාල්ල - Galle	මාතර - Matara	හම්බන්තොට - Hambantota	කෑගල්ල - Kegalle	රත්නපුර - Ratnapura	මහනුවර - Kandy	මාතලේ - Matale	නුවර එළිය - Nuwara Eliya	කුරුණෑගල - Kurunegala	පුත්තලම - Puttalam
Paddy land	0.0032	0.0032	0.0034	0.0032	0.0159	0.0103	0.0040	0.0057	0.0040	0.0032	0.0335	0.0353	0.0034	0.0034	0.0030	0.0057	0.0057
Tea	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075	0.0075
Rubber	0.0103	0.0103	0.0103	0.0103	0.0103	0.0103	0.0103	0.0103	0.0103	0.0103	0.0103	0.0103	0.0103	0.0103	0.0103	0.0103	0.0103
Coconut	0.0114	0.0114	0.0114	0.0114	0.0114	0.0114	0.0114	0.0114	0.0114	0.0114	0.0114	0.0114	0.0114	0.0114	0.0114	0.0114	0.0114
Other crops	0.0114	0.0114	0.0075	0.0075	0.0075	0.0103	0.0075	0.0075	0.0075	0.0114	0.0075	0.0075	0.0075	0.0075	0.0075	0.0114	0.0114
Home gardens	0.0277	0.0277	0.0335	0.0237	0.1387	0.1087	0.0603	0.0569	0.0499	0.0277	0.0335	0.0353	0.0603	0.0353	0.0499	0.0353	0.0277
Building	0.0534	0.0499	0.0687	0.0427	0.3074	0.1677	0.1009	0.1461	0.1313	0.0770	0.0516	0.0516	0.1387	0.0687	0.0770	0.0770	0.0603

Table 3.27 - Total production of space at district level

Land Prices (Rs million) ඉඩම් ස්වභාවය Nature of land	අනුරාධපුර - Anuradhapura	පොළොන්නරුව - Polonnaruwa	බදුල්ල - Badulla	මොණරාගල - Monaragala	කොළඹ - Colombo	ගම්පහ - Gampaha	කළුතර - Kaluthara	ගාල්ල - Galle	මාතර - Matara	හම්බන්තොට - Hambantota	කෑගල්ල - Kegalle	රත්නපුර - Ratnapura	මහනුවර - Kandy	මාතලේ - Matale	නුවර එළිය - Nuwara Eliya	කුරුණෑගල - Kurunegala	පුත්තලම - Puttalam
Agriculture	306,600	120,884	224,992	158,056	126,463	171,014	292,482	241,751	22,7725	143,144	428,575	655,386	153,126	109,200	20,0410	90,0275	317,798
Residential	943,863	587,367	310,847	705,218	1,050,793	3,351,959	1,078,863	1,129,059	208,829	730,903	727,515	922,233	1,187,018	517,009	303,241	1,642,416	278,680
Non-Residential	45,385	25,874	21,740	4,592	1,361,090	530,132	75,730	35,333	203,831	46,016	88,570	24,215	101,928	20,490	46,823	555,658	27,095

3.7 Consumption of Space by Manufacturing Activities

3.7.1 Data availability

The Department of Census and Statistics has been conducting the Annual Survey of Manufacturing Industries (ASMI) since 1979. It started covering Mining and Quarrying and Manufacturing, Generation and Distribution of Electricity Gas and Water since 1983, which changed ASMI in to Annual Survey of Industries. The ASI 2007 follows the well-established survey methodologies since 1983 and provide reliable data on consumption of land (space commodity) by formal sector manufacturing industries. ASI basically covers the manufacturing establishments registered with the ministry of Industries and the state-owned industrial establishments (i.e. Government owned business activities, Departmental undertakings, and State-owned corporations). Table 23 of ASI 2007 (reference period is 2006) report provides land consumption data in monetary figures using the 4-digit system of International Standard Industry Classification (ISIC), see Appendix VII for simplified version of Table 23.

Land use of informal sector manufacturing activities were not available, may be due to complexities of collecting data as they have lesser than 05 people working. And it was identified that most of the informal sector manufacturing establishments were operating using residential land spaces.

3.7.2 Assumptions

- It was assumed that land values declared by manufacturing industries were effectively used for manufacturing process.
- Per employee land use (non-residential) for an informal sector employee was taken as 1/10 of formal sector employee.
- As for the Economic Survey data 2013, it was identified that formal and informal manufacturing sector employments have following unique relationships as given in Table 3.28.

Table 3.28 - Formal and informal sector relationships in manufacturing industry

Formal Sector	Formal Sector	Informal Sector	Informal / Formal
Per employee value addition (Rs)	1,760,107	355,701.9	0.202091
Per employee intermediate consumption (Rs)	2,340,440	450,338.8	0.192416
Per employee output (Rs)	4,100,000	806,040.7	0.196595

All the relationships showed an approximate ratio of 1/5 for all attributes, expecting the same behaviour for 2006, per employee land consumption for informal sector was assumed to be 1/5 of formal sector. But to account the usage of residential lands for manufacturing works, it's assumed only half the establishments in informal sector use dedicated space for their activities, hence the ratio 1/10.

3.7.3 Process of data derivation

The land consumption data provided following 4-digit ISIC in Tables 23 of ASI 2007, was simplified to 3-digit ISIC. See Appendix VII. The 3-digit ISIC classification consists 49 industry categories, therefore merging similar industry categories together to match with the industry categories used in AA module was needed. Therefore, each 3-digit industry category was carefully examined and assigned to one of ten manufacturing industry categories used in AA module. Once the assignment was done, industries in a same category was aggregated, given in Table 3.29

Table 3.29 - Consumption of land by formal sector manufacturing activities

Manufacturing Industry Activity	Value of land at beginning of 2006 (Rs Million)
Fishing, Aquaculture, and Service Activities Incidental to Fishing	474.61
Mining and Quarrying	687.30
Manufacture of Food Products, Beverages, and Tobacco	23,099.59
Manufacture of Textiles, Wearing Apparel, and Footwear	19,947.76
Manufacturing of Wood, Wood Products, Paper and Paper Products	11,048.93
Manufacture of Rubber and Plastic Products	9,999.48
Manufacture of Basic Metals	18,654.12
Manufacture of Fabricated Metal Products; Office Comp. Machines	8,168.54
Manufacture of Motor Vehicles and Other Transport Equipment	174.12
Other Manufacturing	19,633.56
Electricity, Gas, and Water Supply	12,248.14

According to LFS 2007 report, informal sector employment share for manufacturing industries was 46%. Land used by informal sector was calculated by multiplying formal sector land value by 0.085 (46% / 54% * 1/10). Collective Informal sector totals and formal sector totals added to manufacturing activity total, Table 3.30.

Table 3.30 - Land use by manu. activities - (formal, informal sectors combined)

Manufacturing Activity	**Sum of Land Value - Formal Sector (Rs Millions)**	**Sum of Land Value - Informal Sector (Rs Millions)**	**Total (Rs millions)**
Fishing, Aquaculture, and Service Activities Incidental to Fishing	474.61	40.43	515.04
Mining and Quarrying	687.30	58.55	745.85
Manufacture of Food Products, Beverages, and Tobacco	23,099.59	1,967.74	25,067.33
Manufacture of Textiles, Wearing Apparel, and Footwear	19,947.76	1,699.25	21,647.01
Manufacturing of Wood, Wood Products, Paper, and Paper Products	11,048.93	941.21	11,990.14
Manufacture of Rubber and Plastic Products	9,999.48	851.81	10,851.29
Manufacture of Basic Metals	18,654.12	1,589.05	20,243.17
Manufacture of Fabricated Metal Products; and Office and Computing Machinery	8,168.54	695.84	8,864.38
Manufacture of Motor Vehicles and Other Transport Equipment	174.12	14.83	188.95
Other Manufacturing	19,633.56	1,672.49	21,306.05
Electricity, Gas, and Water Supply	12,248.14	1,043.36	13,291.49

3.8 Consumption of Space Commodity by Service Sector Industries, Agriculture and Households

3.8.1 Data availability

Although Sri Lanka is now moving towards more manufacturing-based and services-based economy, few decades back agriculture was the predominant component of the economy. Even though current share of agriculture in GDP is around 7% according to National Accounts 2018, about 32.5% (based on LFS 2018) of total labour force is employed by agriculture and agriculture related sectors. Both the figures used to be much larger at earlier years. Therefore, more rigorous surveys have been conducted about the use of land by agriculture. Department of Census and Statistics is the predominant institution in collecting data on this regard, while Ministry of Agriculture and Department of Irrigation also collect data based on requirements. Therefore, the extent of land consumption (area) by direct agriculture works is readily available at Divisional Secretariat or District levels. But the value of agricultural lands is not available. This makes the expressing the consumption of land in a monetary figure more complex. Due to lack of sources to calculate or estimate land prices in 2006, for the year AA module is made, data published in the website; Lanka Property Web was used. Agriculture land price figures of 2018 was converted to 2006 and used following the same procedure used when calculating 'Production of Space Commodity' described in previous chapter.

Even though land use for direct agriculture works was readily available, it was identified that land use for agriculture support services, i.e. services, storage, transport, office spaces, machinery yards, etc. was not separately identified.

The only survey conducted to extensively cover the services and trade sectors in Sri Lanka, Economic Survey 2013, has collected data on consumption of land by services sector establishments. But those data were not published due to the unreliable nature of surveyed data. And the above-mentioned data collection was carried out covering formal sector service industries only. No other data sources were identified to give data on land consumption by service sector activities, either by area figures or monetary figures. Due to that, an indirect approach was used to estimate the

consumption of land by service sector. This was done using a parameter, district wise employment data for service sector, to distribute district wise industry land use among respective service activities. Land prices were taken from LPW and converted to 2006.

Land use data by DCS and LUPPD consisted information about total residential space. Further classification about sector wise distribution was not available. Residential land price data was also not available for the current year or 2006.

3.8.2 Assumptions

- The land use category, 'Buildings' available on DCS was taken as primarily the space used by manufacturing industries and service industries. It was assumed that these spaces were fully (100%) used by those industries.
- The percentage land used by manufacturing industries were calculated separately before. Total land used by services industries were taken as the difference between 'Buildings' and manufacturing land use.
- The distribution of use of land between service industries were taken to be proportionate to a distribution of weighted employment. Calculated at district level and priced.
- Distribution of residential space between sectors were considered proportionate to sector wise distribution of total employment.

3.8.3 Process of data derivation

3.8.3.1 Space used by service industries

From the analysis done on land consumption of manufacturing industries, it was identified that manufacturing industry use 4.19% of total built up land. This was assumed to true for every district. Therefore, 95.81% of total built up area (identified as the 'Buildings' in land use data by LUPPD and DCS, used when calculating production of space commodity) of each district was distributed among service industries. The indirect agriculture works (i.e. services, storage, transport, office spaces, machinery yards, etc.), which used not agricultural lands, but built up lands, also considered as a service. The basis of distribution was taken as the weighted employment distribution among industries.

Weighted employment distribution

If the per employee land use for a service industry was defined as the total amount of land used by that service industry upon the total number of employees in that service industry, it could be identified that the values for each service industry are varying from each other. For an instance, per employee land use in Education industry was higher with respect to per employee land use in Public Administration. This suggests that assuming land use by a certain service industry was proportionate with total number of employees, was not accurate. Thus, the concept of weighted employment distribution was introduced.

Among the service industries used for developing the AA module, Post and Telecommunication industry, Financial Intermediation and Insurance, Real Estate Renting and Business Services, and Public Administration are having low per employee space/land use. In all these service industries, employees work in an office environment and their per employee land use is approximately same. Consequently, they all were grouped together to a Class A, which has lowest per employee land use. Thus, all the service industries were assigned to groups binding service industries have approximate closer per employee land use together. Three distinct classes were identified and called weight classes, A, B and C. Where Class C having the highest per employ space use. Table 3.31 summarizes assigned classes.

Table 3.31 - Space use per employee weight classes

Ref	Industry	Weight Class
13	Construction	C
14	Wholesale and Retail Trade; and Repair of Motor Vehicles	B
15	Hotels and Restaurants	B
16	Transport Services and Storage	B
17	Post and Telecommunications	A
18	Financial Intermediation and Insurance	A
19	Real Estate, Renting, and Business Services	A
20	Public Administration and Defence	A
21	Education	B
22	Health and Social Work	C
23	Other Community Service Activities	A

Per capita space use (office space of a person) in weight class A was taken as a unit to calculate equivalent space units for other classes. Due to availability of limited data about service sector industries, one service industry having vivid data from both class B and C was used to calculate to equivalent space units for each weight class. Education industry was selected from Class B and Health industry was selected from C, due to availability of data. As these two industries were predominantly governed by state sector, more information was available with government accounts. Equivalent space unit for each class was determined using government sector statistics.

Total education sector land use comprised space used by employees and students. It was assumed that the office space used by a Class A employee was equivalent to the space used by 8 students. Apart from the space required for employees, Health sector need space to its service receivers, which was measured in number of beds in government sector. Table 3.32 shows the process of weight calculations for Weight classes B and C. Additional data are extracted from Central Bank Report 2007.

Table 3.32 - Space units for per capita sector employment

Weight Class A	Space units per capita
	1

Weight Class B					
Health	Gvt sector employees	Number of Beds	Bed space in equivalent space units	Total space units	Space units per capita sector employment
	87,869	62,749	2	238,487	2.714119883

Weight Class C					
Education	Gvt sector employees	Number of Students	Student space in equivalent space units	Total space units	Space units per capita sector employment
	259,213	4,066,206	0.25	1,275,764.5	4.921684098

Data on distribution of total employment across industry group for a district was taken from ‘Census of Population and Housing 2001’ report, as data for 2006 was not available. While total employment in district was bound to change with time, the ratios of total employment between service industries not to change was considered a valid assumption. The observed distribution was weighted by Class weights and weighted istribution is calculated. Table 3.33 summarizes the process for Anuradhapura district.

Indirect agriculture related land uses used by support services also considered as a service. The analysis done for consumption of labour by service industries suggests that, out of 2,287,268 people worked on agriculture sector only 2,017,797 worked on agricultural lands. (summation of Skilled Agricultural Workers and Elementary Occupations). 11.78% worked on built up lands. Therefore, when distributing total built up lands of a district among service industries, 11.78% of agriculture sector of employment of each district assumed to provide agriculture related services.

Thus, percentage distribution of weighted employment was found for each district (Appendix VIII) and, share of built up area for services (Land use category 'Building') was distributed as for it. Lands were priced using district wise non-residential land prices developed in the analysis done to determine production of space commodity. Aggregated results give the final consumption of land by service industries at national level. See Table 3.35, Table 3.36, and Table 3.37.

Table 3.33 - Percentage dist. of weighted employment in Anuradhapura district

Reference	Service Industry	Weight Class	Weight	Employment distribution as for CHP 2001	Percentage employment distribution as for CHP 2001	Weighted employment distribution	Percentage weighted employment distribution
1	Agriculture, Hunting, Forestry, and Related Service Activities	B	2.71	14,335	13%	47,243	12%
13	Construction	B	2.71	5,627	5%	15,272	5%
14	Wholesale and Retail Trade; and Repair of Motor Vehicles	C	4.92	21,731	20%	106,953	34%
15	Hotels and Restaurants	C	4.92	3,258	3%	16,035	5%
16	Transport Services and Storage	C	4.92	7,010	7%	34,502	11%
17	Post and Telecommunications	A	1.00	948	1%	948	0%
18	Financial Intermediation and Insurance	A	1.00	1,599	1%	1,599	1%
19	Real Estate, Renting, and Business Services	A	1.00	1,612	2%	1,612	1%
20	Public Administration and Defence	A	1.00	35,027	33%	35,027	11%
21	Education	C	4.92	10,190	9%	50,152	16%
22	Health and Social Work	B	2.71	3,772	4%	10,238	3%
23	Other Community Service Activities	A	1.00	2,340	2%	2,340	1%

3.8.3.2 Space used by agriculture sector

According to the model, the agricultural lands were used only by the activity, Agriculture, Hunting, Forestry, and Related Services, total produced agriculture space was used by it. Apart from that, some of the built-up space was also used by Agriculture activities, which was considered as a service and its land use was calculated on above step. Final land consumption of Agriculture, Hunting, Forestry, and Related Service Activity was the summation of that two. See Table 3.35, Table 3.36 and Table 3.37.

3.8.3.3 Data derivation of space used by service industries – concise flow chart

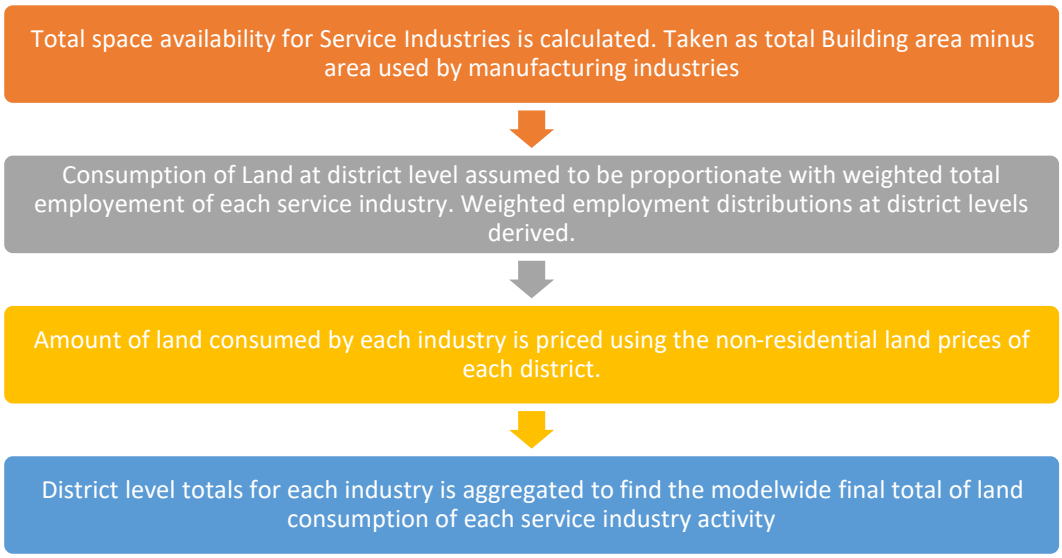

Figure 3.8 - Flow chart for data derivation of use of space commodity by service activities

3.8.3.4 Use of residential space by households

Consumption of residential space by households in each sector, Urban, Rural and Estate, was assumed to be proportionate to total employed population in each sector. Employed population data for 2006 was used from LFS 2006 report. Distribution was done at provincial level, see

Table 3.34, (all districts in a province assumed to have the same distribution) and priced using the district level residential land prices developed at the analysis done to find the total production of space commodity. Finally aggregated to find the total

consumption of residential spaces at sector level. See Table 3.35, Table 3.36 and Table 3.37

It was understood that average residential space used by a typical urban sector house owner was much smaller than a typical rural sector house owner. But the approach used on developing data, assume both to be same. The adverse effects raised here were expected to cancel out at the stage of pricing lands. Due to lack of information, it was assumed a constant price for all residential lands in a district, irrespective whether they are situated in urban sector or rural sector. In reality, the urban sector land prices are much higher. Assuming an urban sector house owner to own more lands at reduced price, expected to give same (or approximately equal) land prices as owning lesser lands with increased prices.

Table 3.34 - Sector wise employment distribution at provincial level

	Employment Distribution			
	Total	**Urban**	**Rural**	**Estate**
Western	100%	31%	69%	1%
Central	100%	10%	70%	20%
Southern	100%	9%	90%	2%
North Westrn	100%	5%	95%	0%
North Central	100%	5%	95%	0%
Uva	100%	4%	81%	14%
Sabaragamuwa	100%	4%	87%	9%

Table 3.35 - Consumption of space commodity by service activities, households and agriculture - In hectares

Land Area in Hectares ඉඩම් ස්වභාවය Nature of land	ඇනුරාධපුර - Anuradhapura	පොළොන්නරුව - Polonnaruwa	බදුල්ල - Badulla	මොණරාගල - Monaragala	කොළඹ - Colombo	ගම්පහ - Gampaha	කළුතර - Kaluthara	ගාල්ල - Galle	මාතර - Matara	හම්බන්තොට - Hambantota	කෑගල්ල - Kegalle	රත්නපුර - Ratnapura	මහනුවර - Kandy	මාතලේ - Matale	නුවර එළිය - Nuwara Eliya	කුරුණෑගල - Kurunegala	පුත්තලම - Puttalam
Agriculture, Hunting, Forestry, and																	
Paddy land	127631	62749	29600	26070	6081	15115	16193	17309	18271	39724	9140	22618	16005	17985	6834	82877	20446
Tea	0	0	34100	873	88	0	7170	27427	23704	394	11551	43585	27940	3212	50266	104	0
Rubber	0	0	400	0	17739	4614	29852	6679	3733	144	51976	40055	2162	3012	33	3445	0
Coconut	17800	7750	3600	12580	3149	19567	11276	12548	14398	15967	12507	4624	4729	4973	954	152358	48379
All other Crops	14800	1637	22900	22478	535	663	24825	12962	16521	4405	1944	9157	6626	14011	13500	3047	12033
Grass lands/Chena	42603	13610	47000	75575	584	972	4238	12216	1764	77906	4814	51531	21755	51401	16098	42340	59399
Home gardens																	
Urban	4150	2583	1029	3294	5851	23832	13824	4317	910	5742	2302	2762	4831	3590	1492	5416	1173
Rural	82004	51032	19070	61060	13141	53529	31050	45041	9497	59902	47879	57454	34867	25908	10767	111647	24190
Estate	99	62	3402	10891	162	661	384	864	182	1149	4820	5784	10097	7502	3118	478	103
Building																	
Agriculture, Hunting, Forestry, and	256	161	102	44	31	50	45	32	245	124	182	120	59	55	254	1113	37
Construction	100	117	35	11	739	646	156	52	307	124	385	85	135	49	74	1508	117
Wholesale and Retail Trade; and	703	426	261	90	4581	3189	738	208	1381	534	1516	462	707	288	523	6868	478
Hotels and Restaurants	105	66	34	12	766	464	137	48	147	73	231	52	122	53	101	727	57
Transport Services and Storage	227	130	100	31	1995	1615	307	87	593	189	771	152	261	98	176	2607	188
Post and Telecommunications	6	4	3	1	55	44	8	2	16	5	21	4	7	3	5	72	5
Financial Intermediation and	11	7	4	1	140	72	15	4	27	8	24	5	11	4	5	106	5
Real Estate, Renting, and Business	11	5	4	1	231	121	21	4	23	7	29	6	15	5	6	123	8
Public Administration and Defense	230	140	49	18	608	406	104	33	181	86	211	53	103	43	69	942	46
Education	329	161	140	43	1023	776	219	91	707	249	630	156	280	103	209	2757	116
Health and Social Work	67	30	28	7	424	202	51	19	107	38	125	34	66	17	39	542	22
Other Community Service Activities	15	10	6	2	137	74	17	5	28	11	30	8	13	5	11	126	9

Table 3.36 - Consumption of space commodity by service activities, households and agriculture - in Rs millions

Land Price in Rs Millions ඉඩම් ස්වභාවය Nature of land	අනුරාධපුර - Anuradhapura	පොළොන්නරුව - Polonnaruwa	බදුල්ල - Badulla	මොණරාගල - Monaragala	කොළඹ - Colombo	ගම්පහ - Gampaha	කළුතර - Kaluthara	ගාල්ල - Galle	මාතර - Matara	හම්බන්තොට - Hambantota	කෑගල්ල - Kegalle	රත්නපුර - Ratnapura	මහනුවර - Kandy	මාතලේ - Matale	නුවර එළිය - Nuwara Eliya	කුරුණෑගල - Kurunegala	පුත්තලම - Puttalam
Agriculture, Hunting, Forestry, and																	
Paddy land	160041	78683	39209	32690	38225	61558	25928	39116	29255	49811	120900	316046	21201	23823	8081	187288	46204
Tea	0	0	100487	2571	260	1	21129	80823	69852	1160	34039	128438	82334	9465	148127	306	0
Rubber	0	0	1629	0	72245	18789	121577	27203	15203	585	211680	163130	8805	12267	134	14029	0
Coconut	80023	34842	16184	56555	14156	87968	50693	56412	64730	71784	56228	20788	21260	22357	4287	684956	217497
All other Crops	66536	7359	67482	66239	1577	2698	73155	38197	48685	19805	5729	26984	19526	41288	39782	13697	54097
Grass lands/Chena																	
Home gardens																	
Urban	45413	28261	13607	30869	320966	1023860	329540	97060	17952	62833	30446	38595	115160	50158	29419	75680	12841
Rural	897361	558429	252247	572271	720921	2299688	740178	1012572	187283	655495	633315	802821	831169	362018	212334	1560063	264707
Estate	1089	677	44994	102078	8907	28411	9144	19427	3593	12576	63754	80817	240690	104833	61488	6673	1132
Building																	
Agriculture, Hunting, Forestry, and	5395	3174	2785	735	3755	3339	1803	1820	12701	3763	3725	2445	3231	1487	7737	33885	887
Construction	2118	2308	961	187	89832	42859	6221	2989	15927	3774	7853	1728	7400	1340	2242	45893	2798
Wholesale and Retail Trade; and	14830	8401	7093	1522	556798	211480	29428	12031	71724	16251	30944	9434	38787	7814	15933	209068	11402
Hotels and Restaurants	2223	1309	922	211	93102	30778	5472	2763	7656	2236	4723	1053	6697	1452	3089	22124	1353
Transport Services and Storage	4784	2570	2722	524	242424	107072	12254	5041	30777	5745	15742	3102	14328	2668	5365	79344	4479
Post and Telecommunications	131	71	75	14	6660	2941	337	138	845	158	432	85	394	73	147	2180	123
Financial Intermediation and	222	129	118	17	16987	4764	586	210	1382	252	487	107	617	105	152	3220	126
Real Estate, Renting, and Business	224	95	108	18	28125	8002	838	256	1210	212	601	129	822	130	196	3733	193
Public Administration and Defense	4857	2758	1330	304	73844	26892	4169	1919	9389	2620	4305	1075	5670	1163	2115	28673	1091
Education	6954	3179	3811	719	124293	51434	8731	5264	36693	7576	12868	3186	15371	2789	6355	83932	2757
Health and Social Work	1420	601	753	118	51558	13427	2053	1116	5547	1164	2554	698	3634	470	1187	16497	535
Other Community Service Activities	324	196	152	30	16674	4926	665	306	1438	338	622	157	706	139	342	3824	216

Table 3.37 - Space consumption by non-nanufacturing activities - final matrix

Space Commodity Consumption in Rs Millions	Agricultural Space	Residential Space	Non-Residential Space
Agriculture, Hunting, Forestry, and Related Service Activities	4,777,880		92,670
Home gardens			
Urban		2,322,659	
Rural		12,562,871	
Estate		790,283	
Building			
Construction			236,428
Wholesale and Retail Trade; and Repair of Motor Vehicles			1,252,939
Hotels and Restaurants			187,164
Transport Services and Storage			538,941
Post and Telecommunications			14,805
Financial Intermediation and Insurance			29,480
Real Estate, Renting, and Business Services			44,891
Public Administration and Defence			172,173
Education			375,913
Health and Social Work			103,331
Other Community Service Activities			31,056

3.9 Household Consumption

3.9.1 Data availability

In the supply and use table developed by ADB for the year 2006, data is available about the total consumption of goods and services by households. Those are monetary figures. The main objective was to distribute the category wise total expenses of total households at sector level. This was planned to achieve through a weighted ratio (weighted with sector wise purchasing power, and sector wise households) for each good or service activity.

Sector wise data about consumption of goods and services by a household was available in 'Household Income and Expenditure Survey' of 2006 (HIES 2006). HIES 2006 contains above data under 36 expense categories at sector level, data was retrieved through, quick online data retrieval facility. The expense categories are not

exactly same as the commodities and services used in AA module development. Purchasing power data were derived using HIES 2006 data.

3.9.2 Process of data derivation – concise flow chart

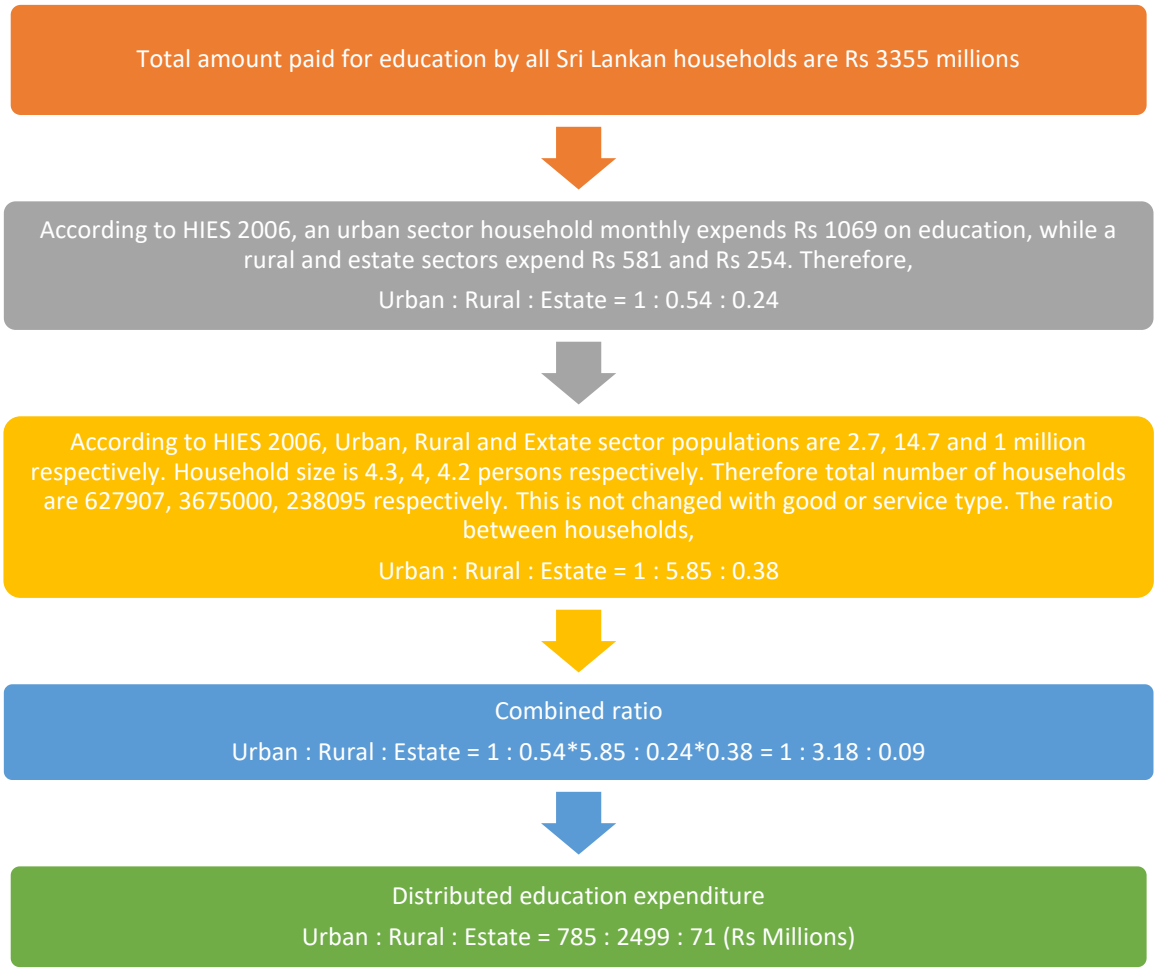

Figure 3.9 – Derivation process of household commodity consumption

3.9.3 Process of data derivation

It was noted that the list of goods and services used in AA module table development have slight differences from the categories available at HIES 2006 report. While some of the categories have a direct match, some of them need few categories bound together. In those cases, bounding categories were identified, and summation was taken as the matched value.

The ratio of expenses for a good or service by a typical household in each sector was identified. Then it was developed as a ratio. On developing the ratio, urban sector was

selected as the base and its ratio value was taken as 1, Appendix IX. The observed ratio was multiplied by the number of household ratio (1 : 5.85 : 0.38), see Table 3.38, in each sector to identify the final weighted ratio, Table 3.40. Goods or Services, which Supply and Use table did not give total expense figure (zero) were recognized as goods or services not used by households, ex. coal and lignite; peat, crude petroleum, and natural gas or basic metals etc.

Table 3.38 - Sector wise household ratio

	Population	**Household Size**	**Num. of HH**	**Ratio**
Sri Lanka	18.4	4.1	4,541,002	
Urban	2.7	4.3	627,907	1.00
Rural	14.7	4	3,675,000	5.85
Estate	1	4.2	238,095	0.38

Even though the Supply and Use table did not contain labour categories, households typically use different types of labour for routinely activities. Ex. cleaning, gardening, paint jobs, plumbing, renovation works, construction works etc. HIES 2006 did not identify these expenses separately and aggregated under the heading 'Housing' expenses with many other housing expenses. Types of labour used were recognized basically as Elementary Occupation Labour (a labour category used at AA Module labour commodity). Based on a sample of interviews carried out with house owners, it was assumed that a 50% of 'Housing' expenditure of urban households was used for labour hiring, while the figure was approximately 35% for rural households and 10% for estate sector households. It is assumed that this trend was true for 2006 also.

Table 3.39 - Consumption of 'Elementary' labour by households 2006

	Annual Share of 'Housing' Expenditure	**Total Households**	**Cost of Labour in millions**
Urban	35,585.4	627,907	22,344.33
Rural	9,187.584	3,675,000	33,764.37
Estate	1,008.984	238,095	240.23

Table 3.41 summarizes the distribution of total household consumption of goods and services between sector wise households.

Consumption of space commodity by households was calculated in a separate chapter.

Table 3.40 - Final weighted ratio (weighted with purchasing power and number of households)

	Ratio Between Sectors			
	Matched Row on Appendix IX	**Urban**	**Rural**	**Estate**
Agriculture, Forestry, and Logging Products	Summation of rows 2, 4, 5, 6, 7, 10	1.00	5.39	0.44
Fish and Other Fishing Products	Summation of 8 and 9	1.00	4.04	0.13
Other Minerals, n.e.c.	1	1.00	3.56	0.14
Electricity, Gas, and Water	22	1.00	3.05	0.14
Food, Beverages, and Tobacco	Summation of 11 thru 20	1.00	4.60	0.28
Clothing and Wearing Apparel; and Leather and Leather Products	31	1.00	4.27	0.22
Products of Wood, Paper, and Paper Products	32	1.00	3.75	0.19
Basic Chemicals and Other Chemicals	29	1.00	4.48	0.20
Rubber and Plastics Products	32	1.00	3.75	0.19
Furniture and Other Transportable Goods, n.e.c.	33	1.00	5.76	0.25
Fabricated Metal Products, Except Machinery and Equipment	1	1.00	3.56	0.14
General and Special Purpose Machinery	1	1.00	3.56	0.14
Office, Accounting, and Computing Machinery	34	1.00	4.44	0.07
Transport Equipment	1	1.00	3.56	0.14
Other Manufacturing	34	1.00	4.44	0.07
Construction Services	1	1.00	3.56	0.14
Lodging, Food, and Beverage Serving Services	28	1.00	2.71	0.06
Transport Services, and Supporting and Auxiliary Transport Services	25	1.00	3.34	0.06
Postal, and Courier and Telecommunications Services	26	1.00	2.61	0.06
Financial Intermediation, Insurance, and Auxiliary Services	1	1.00	3.56	0.14
Real Estate, Leasing Services, and Other Business Services	1	1.00	3.56	0.14
Education Services	27	1.00	3.18	0.09
Health and Social Services	24	1.00	4.03	0.14
Other Services, n.e.c.	30.0	1.00	2.25	0.03

Table 3.41 – Sector wise household consumption (Rs. millions)

		Good / Service	HHs Urban	HHs Rural	HHs Estate	Sum
Goods	1	Agriculture, Forestry, and Logging Products	50,983	274,960	22,434	348,377
	2	Fish and Other Fishing Products	13,362	54,000	1,687	69,049
	4	Other Minerals, n.e.c.	898	3,193	130	4,221
	5	Electricity, Gas, and Water	14,731	44,882	2,124	61,737
	6	Food, Beverages, and Tobacco	119,529	550,152	33,125	702,805
	7	Clothing and Wearing Apparel; and Leather and Leather Products	24,743	105,584	5,344	135,671
	8	Products of Wood, Paper, and Paper Products	1,350	5,065	255	6,670
	9	Basic Chemicals and Other Chemicals	12,410	55,578	2,514	70,503
	10	Rubber and Plastics Products	82	308	16	406
	11	Furniture and Other Transportable Goods, n.e.c.	6,909	39,822	1,700	48,431
	13	Fabricated Metal Products, Except Machinery and Equipment	566	2,012	82	2,659
	14	General and Special Purpose Machinery	956	3,399	138	4,493
	15	Office, Accounting, and Computing Machinery	4,667	20,719	345	25,731
	16	Transport Equipment	4,862	17,295	703	22,860
	17	Other Manufacturing	5,409	24,011	400	29,819
Services	18	Construction Services	1,011	3,597	146	4,755
	20	Lodging, Food, and Beverage Serving Services	3,764	10,200	236	14,200
	21	Transport Services, and Supporting and Auxiliary Transport Services	31,179	104,029	1,931	137,139
	22	Postal, and Courier and Telecommunications Services	7,802	20,338	492	28,632
	23	Financial Intermediation, Insurance, and Auxiliary Services	27,395	97,450	3,963	128,807
	24	Real Estate, Leasing Services, and Other Business Services	24,888	88,534	3,600	117,022
	26	Education Services	785	2,499	71	3,355
	27	Health and Social Services	356	1,438	51	1,846
	28	Other Services, n.e.c.	1,347	3,034	46	4,426
Labour	42	Elementary occupations	22,344	33,764	240	56,349

3.10 Development of the Final Matrix

Once the matrix developed it was observed that the goods, services and space productions and consumptions were perfectly balanced.

But in the estimations on labour production and consumption, small differences could be observed. The reasons for these differences was identified as, trying to combine different data sources together and complexity of the process followed. Percentage difference with respect to total labour production for each category is as Table 3.42.

Table 3.42 - Difference between produced and consumed labour

Labour Category	Difference
Senior Officials and Managers	-5%
Professionals	-6%
Technical and Associate Professionals	-6%
Clerks	-3%
Proprietors and Managers of Enterprises	-6%
Sales and Service workers	-6%
Skilled Agricultural and Fishery workers	-7%
Craft and Related workers	-6%
Plant and Machine operators and Assemblers	-1%
Elementary occupations	-2%
Unidentified	-3%

Those errors were redistributed on labour production. And the final aggregate economic flow table developed, which is the basic component of AA module is given in Table 3.43.

Table 3.43 - Final AEF table

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	
			Goods																	Services											Adjustments			Labour													Finance					Space			
			Agriculture, Forestry, and Logging Products	Fish and Other Fishing Products	Coal and Lignite; Peat, Crude Petroleum, and	Other Minerals, n.e.c.	Electricity, Gas, and Water	Food, Beverages, and Tobacco	Clothing and Wearing Apparel; and Leather and	Products of Wood, Paper, and Paper Products	Basic Chemicals and Other Chemicals	Rubber and Plastics Products	Furniture and Other Transportable Goods, n.e.c.	Basic Metals	Fabricated Metal Products, Except Machinery and	General and Special Purpose Machinery	Office, Accounting, and Computing Machinery	Transport Equipment	Other Manufacturing	Construction Services	Wholesale and Retail Trade Services	Lodging, Food, and Beverage Serving Services	Transport Services, and Supporting and Auxiliary Transport	Postal, and Courier and Telecommunications	Financial Intermediation, Insurance, and	Real Estate, Leasing Services, and Other Business Services	Public Administration and Compulsory Social	Education Services	Health and Social Services	Other Services, n.e.c.	Adjustments:	CIF/FOB Adjustment on Imports	Direct Purchases Abroad by Residents	Compensation of Employees	Senior Officials and Managers	Professionals	Technical and Associate Professionals	Clerks	Proprietors and Managers of Enterprises	Sales and Service workers	Skilled Agricultural and Fishery workers	Craft and Related workers	Plant and Machine operators and Assemblers	Elementary occupations	Unidentified	Taxes Less Subsidies on Production and Imports	Taxes on Products	Subsidies on Products	Other Taxes Less Subsidies on Production	Gross Operating Surplus	Agricultural Space	Residential Space	Non-Residential Space	
Domestic Production by Industry Group	1	Agriculture, Hunting, Forestry, and Related Service Activities	424,742	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-						4777880			Agricultural Land
	2	Fishing, Aquaculture, and Service Activities Incidental to	-	47,143	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-							15675813		Residential Land
	3	Mining and Quarrying	-	-	-	56,740	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-								3214502	Non Residential Land
	4	Manufacture of Food Products, Beverages, and Tobacco	-	-	-	-	-	540,306	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	5	Manufacture of Textiles, Wearing Apparel, and Footwear	-	-	-	-	-	-	180,414	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	6	Manufacturing of Wood, Wood Products, Paper, and Paper	-	-	-	-	-	-	-	10,231	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	7	Manufacture of Rubber and Plastic Products	-	-	-	-	-	-	-	-	-	28,347	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	8	Manufacture of Basic Metals	-	-	-	-	-	-	-	-	-	-	-	1,650	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	9	Manufacture of Fabricated Metal Products; and Office and	-	-	-	-	-	-	-	-	-	-	-	-	2,866	270	62,557	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	10	Manufacture of Motor Vehicles and Other Transport	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,386	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	11	Other Manufacturing	-	-	-	-	-	-	-	-	160,844	-	54,186	-	-	-	-	-	259,053	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	12	Electricity, Gas, and Water Supply	-	-	-	-	127,867	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	13	Construction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	480,624	-	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	14	Wholesale and Retail Trade; and Repair of Motor Vehicles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	558,416	-	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	15	Hotels and Restaurants	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28,492	-	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	16	Transport Services and Storage	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	640,136	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	17	Post and Telecommunications	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	49,946	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	18	Financial Intermediation and Insurance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	313,125	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	19	Real Estate, Renting, and Business Services	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120,846	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	20	Public Administration and Defense	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	337,358	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	21	Education	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	68,424	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	22	Health and Social Work	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51,801	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
	23	Other Community Service Activities	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	126,842	-	-	-	43,045		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
Imports		Goods	40,720	17,761	97,835	30,458	19	56,858	214,814	36,155	33,508	52,446	23,407	59,536	19,761	135,940	96,168	76,648	74,580	-	-	-	-	-	-	-	-	-	-	-		-14,764	-	-	-	-	-	-	-	-	-	-	-	-	-									
		Services	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	572	-	-	94,909	5,100	3,861	34,051	-	-	-	3,650		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
		CIF/FOB Adjustment on Imports	-564.00	-246	-1,354	-422	0	-787	-2,973	-500	-464	-726	-324	-824	-274	-1,882	-1,331	-1,061	-1,032	-	-	-	-	-	-	-	-	-	-	-		14,764	-	-	-	-	-	-	-	-	-	-	-	-	-									
Trade and Transport Margins			189,441	21,748	1,750	33,420	17,063	284,682	167,092	12,723	55,083	18,922	13,554	11,316	6,078	12,362	49,127	13,318	50,563	-	-558,416	-	-399,826	-	-	-	-	-	-	-		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
Taxes Less Subsidies on Products			-6,356	2,069	6,078	5,438	3,238	69,242	24,927	4,612	16,008	7,131	1,583	7,113	2,485	8,158	13,239	29,223	40,713	3,819	-	2,028	-4,467	8,501	9,606	24,305	-470	1,378	3,767	11,795		-	-	-	-	-	-	-	-	-	-	-	-	-	-									
Households		Households - Urban																																	35065	23912	25579	11357	32044	8799	3057	10560	16867	28681	189									
		Households - Rural																																	24424	105641	45623	20576	101159	67985	161133	76037	66002	83906	496									
		Households - Estate																																	12	2335	1888	860	3935	783	7203	269	1241	8258	0									
Total Supply at Purchasers' Prices			647,984	88,476	104,309	125,635	148,187	950,301	584,274	63,220	264,980	106,120	92,407	78,790	30,918	154,848	219,760	119,514	423,877	485,015	-	30,520	330,752	63,546	326,592	306,044	336,888	69,802	55,567	58,490		-	-																					

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51
Intermediate Consumption by Industry Group	1	Agriculture, Hunting, Forestry, and Related Service Activities	32,775	-	-	-	8,474	1,157	517	95	40,696	104	145	2	23	361	26	7,932	8,976	3,323	-	94	1,383	154	9,269	353	-	-	-	673		-	-	129,122	917	6663	14824	2325	4604	1630	170874	4667	3286	13779	127	-	-	-	-	179,086	4777880		92670
	2	Fishing, Aquaculture, and Service Activities Incidental to	-	54	-	-	633	282	1,946	187	239	-	-	182	168	-	-	1,841	2,932	-	-	-	282	-	2,179	-	-	-	-	-		-	-	14,332	113	151	227	85	113	223	519	0	0	517	6	-	-	-	-	21,886			515
	3	Mining and Quarrying	-	-	-	-	1,898	-	1	70	1,839	243	23	-	116	1,128	2	82	924	1,390	-	23	425	90	826	881	-	-	-	579		-	-	17,921	27	5	8	32	27	179	0	0	1,611	525	3	-	-	-	-	28,281			746
	4	Manufacture of Food Products, Beverages, and Tobacco	117,869	8,813	-	45	5,172	131,568	1,245	2,826	6,604	503	138	35	275	3,533	766	105	2,066	1,993	-	-	2,178	336	9,724	7,263	-	-	-	838		-	-	39,519	2161	1,024	1,536	2,982	2,161	1,001	0	0	9,011	8,329	71	-	-	-	-	196,892			25067
	5	Manufacture of Textiles, Wearing Apparel, and Footwear	1,868	-	-	1	1,074	20	48,858	1,618	6,006	1,302	935	43	186	2,320	16	0	1,251	1,612	-	2	403	673	3,809	4,217	-	-	-	1,533		-	-	36,127	5821	2,569	3,854	2,974	5,821	3,799	0	9,578	26,594	9,540	104	-	-	-	-	66,538			21647
	6	Manufacturing of Wood, Wood Products, Paper, and Paper	983	0	-	3	176	11	32	2,700	624	106	51	15	28	14	45	2	182	94	-	-	47	20	226	45	-	-	-	54		-	-	2,295	166	322	484	957	166	582	0	1,524	4,073	836	19	-	-	-	-	2,479			11990
	7	Manufacture of Rubber and Plastic Products	1,145	-	-	11	366	8	177	170	5,953	2,650	44	108	103	78	8	3	294	22	-	-	49	42	299	51	-	-	-	125		-	-	3,632	855	161	241	523	855	329	0	0	2,959	2,045	15	-	-	-	-	13,010			10851
	8	Manufacture of Basic Metals	17	-	-	73	62	0	0	2	42	3	1	397	43	5	2	0	194	6	-	-	4	9	28	0	-	-	-	3		-	-	169	1562	242	364	1,474	1,562	520	0	0	4,683	4,216	61	-	-	-	-	593			20243
	9	Manufacture of Fabricated Metal Products; and Office and	302	0	-	122	538	2	331	405	2,050	1,002	556	7,115	2,297	1,476	9,027	31	3,416	645	-	-	182	1,059	1,363	1,015	-	-	-	971		-	-	7,024	2216	63	94	2,167	2,216	472	0	535	3,780	1,558	3	-	-	-	-	24,766			8864
	10	Manufacture of Motor Vehicles and Other Transport	0	-	-	1	24	0	7	7	30	37	11	153	59	63	56	131	12	7	-	-	6	14	61	5	-	-	-	41		-	-	313	32	24	36	86	32	29	0	0	259	23	0	-	-	-	-	349			189
	11	Other Manufacturing	5,468	0	91,542	50,814	15,536	4,644	1,615	5,413	60,678	6,234	1,630	2,340	1,108	1,183	1,197	77	35,339	1,840	-	-	1,705	537	21,685	22,459	-	-	-	1,355		-	-	37,005	4489	796	1,194	2,495	4,489	905	0	2,213	7,236	3,716	69	-	-	-	-	102,681			21306
	12	Electricity, Gas, and Water Supply	469	0	-	1	22,896	1	3	114	307	8	470	18	17	312	912	37	29,736	1,059	-	36	59	189	1,432	55	-	-	-	283		-	-	19,051	930	1,222	1,833	2,184	930	572	0	0	5,146	2,900	53	-	-	-	-	50,401			13291
	13	Construction	13,507	-	-	22,644	5,689	-	4,710	4,446	26,278	53	3,711	55,877	6,725	1,141	20,706	181	72,512	3,790	-	5	789	751	20,717	3,363	-	-	-	14		-	-	156,663	252	730	639	174	14,601	1,057	0	16,970	2,552	1,086	10	-	-	-	-	56,351			236428
	14	Wholesale and Retail Trade; and Repair of Motor Vehicles	4	-	-	-	971	-	974	5,224	10	544	2,408	163	512	439	39	190	4,126	5,663	-	2,622	23,540	3,101	43,796	13,895	-	-	-	2,261		-	-	107,022	3,829	310	12,722	1,166	84,556	25,926	0	10,051	4,966	6,391	59	-	-	-	-	340,912			1252939
	15	Hotels and Restaurants	6,603	522	-	-	236	3,548	10	38	21	0	194	-	1	33	96	0	237	412	-	202	27	60	1,587	17	-	-	-	29		-	-	5,461	261	481	251	35	4,412	1,353	0	6,344	91	155	1	-	-	-	-	9,158			187164
	16	Transport Services and Storage	18,489	0	-	-	5,672	533	3,941	3,909	3,048	25,619	13,262	19	3,592	5,058	7,823	29,526	126,690	11,745	-	4,687	9,896	3,543	26,831	10,322	-	119	974	14,619		-	-	105,723	1,165	313	1,350	943	344	5,139	0	19,043	3,474	793	7	-	-	-	-	204,497			538941
	17	Post and Telecommunications	-	-	-	-	755	-	9	335	-	49	419	-	41	45	4,225	115	384	1,041	-	164	354	311	828	1,476	-	-	27	101		-	-	20,409	63	18	2,635	109	19	295	0	147	58	1,228	11	-	-	-	-	18,856			14805
	18	Financial Intermediation and Insurance	1,000	-	-	-	1,902	6,173	620	5,337	0	861	1,092	-	111	1,286	7,331	1,526	4,678	5,504	-	3,501	4,015	2,918	5,085	21,856	-	-	-	1,155		-	-	46,397	27,672	1,775	4,581	3,484	8,171	4,144	0	588	756	682	6	-	-	-	-	190,777			29480
	19	Real Estate, Renting, and Business Services	17	-	-	-	50	-	16	86	54	0	115	-	59	0	85	26	13	16,181	-	860	1	490	220	3,913	-	-	-	463		-	-	15,305	19	30	86	12	6	11	0	17	10	171	2	-	-	-	-	82,891			44891
	20	Public Administration and Defense	-	-	-	-	9,505	29,170	5,364	1,944	-	-	-	-	-	9,333	4,892	639	22,474	2,138	-	174	20,864	2,625	-	24,176	-	-	-	12,577		-	-	191,482	1,131	33,158	4,356	1,271	334	23,577	0	3,482	761	1,571	15	-	-	-	-	0			172173
	21	Education	-	-	-	-	363	-	4	268	-	-	-	-	-	-	3	11	57	-	-	-	80	83	-	64	-	-	5,423	3,714		-	-	51,903	798	68,797	3,196	510	236	591	0	1,034	253	885	8	-	-	-	-	6,452			375913
	22	Health and Social Work	-	-	-	-	2,802	-	31	92	17,628	-	-	-	-	-	6,269	2	240	-	-	945	186	178	2,934	499	-	-	1,260	1,836		-	-	15,400	157	10,428	3,270	273	46	2,249	0	427	380	1,302	12	-	-	-	-	1,499			103331
	23	Other Community Service Activities	1,496	-	-	1,128	1,597	8,584	580	3,738	454	6,702	463	0	1,906	3	394	131	19,333	3,042	-	3,006	6,510	484	38,943	42,046	-	-	-	6,456		-	-	10,488	4,863	2,606	15,311	6,532	1,436	2,983	0	10,246	2,172	2,248	21	-	-	-	-	12,401			31056
Households		Households - Urban	50,983	13,362	-	898	14,731	119,529	24,743	1,350	12,410	82	6,909	-	566	956	4,667	4,862	5,409	1,011	-	3,764	31,179	7,802	27,395	24,888	-	785	356	1,347	-	-	-	-	-	-	-	-	-	-	-	-	-	22,344	-	-	-	-	-	-	-	2,322,659	-
		Households - Rural	274,960	54,000	-	3,193	44,882	550,152	105,584	5,065	55,578	308	39,822	-	2,012	3,399	20,719	17,295	24,011	3,597	-	10,200	104,029	20,338	97,450	88,534	-	2,499	1,438	3,034	-	-	-	-	-	-	-	-	-	-	-	-	-	33,764	-	-	-	-	-	-	-	########	-
		Households - Estate	22,434	1,687	-	130	2,124	33,125	5,344	255	2,514	16	1,700	-	82	138	345	703	400	146	-	236	1,931	492	3,963	3,600	-	71	51	46	-	-	-	-	-	-	-	-	-	-	-	-	-	240	-	-	-	-	-	-	-	790,283	-
		Total Household Consumption Expenditure	348,377	69,049	-	4,221	61,737	702,805	135,671	6,670	70,503	406	48,431	-	2,659	4,493	25,731	22,860	29,819	4,755	-	14,200	137,139	28,632	128,807	117,022	-	3,355	1,846	4,426		-	-																				
General Government Consumption Expenditure			-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	336,888	66,328	46,038	2,185		-	-																				
Total Gross Capital Formation			44,352	-	12,767	-	-	33,182	2,370	504	10,301	781	5,268	218	4,067	119,606	103,216	38,019	20,570	415,725	-	-	-	-	-	11,294	-	-	-	-		-	-																				
Export		Goods	53,242	10,037	-	46,572	57	28,613	375,240	17,024	11,615	58,913	13,039	12,107	6,821	2,938	26,893	16,046	37,422	-	-	-	-	-	-	-	-	-	-	-		-	-																				
		Services	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,028	-	-	120,629	17,247	5,942	19,754	-	-	-	2,202		-	-																				
Total Use			647,984	88,476	104,309	125,635	148,187	950,301	584,274	63,221	264,980	106,120	92,407	78,790	30,918	154,848	219,759	119,514	423,876	485,015	-	30,520	330,752	63,546	326,592	306,044	336,888	69,802	55,567	58,490		-	-																				

4 CONCLUSIONS AND WAY FORWARD

The current transport models that are used in Sri Lanka are not fully capable of representing the integrated nature between transportation and land use. Due to this reason, assumption based, traditional forecasting can cause over or under estimating. Therefore, the importance of having a tool to properly analyse the integrated systems was identified. While most of the developed countries have been building models to account this integrated nature, developing countries like Sri Lanka are yet to develop such models.

PECAS (Production, Exchange, and Consumption Allocation System) is a generalized theoretical framework for representing economic activities happening in the economic space and capable of producing the demand for the land, product and services. It works in association with a transport model to model the whole system. PECAS framework consists of two basic modules with two supporting modules. The two basic modules are Activity Allocation Module and Space Development Module. Activity Allocation Module represents how activities are allocated within the study area and their interactions at a given instant. It is an aggregate representation. The module allocates the total activities provided between zones. It was identified that the data availability for constructing a PECAS activity allocation module is much limited. The need of deriving data to various components in AA module was identified as a challenging task due to required data processing and deriving.

Activity allocation module allocates activities among zones when the complete PECAS model is run. Before the model run, AA module is an aggregate representation of economy on the whole study area, with a set of data which accounts for the zonal properties. Therefore, developing the AA module was principally identified as developing necessary data to build the aggregate representation of economy, which is called an Aggregate Economic Flow Table (AEF Table). To develop the AEF Table, 4 basic data requirements were identified: consumption and production of goods and services by manufacturing and service activities, production of space commodity and consumption of it by activities, production of labour commodity and use of it by

activities, household and government consumption, production of exports and consumption of imports.

The study successfully developed major land use and economic inputs to build an Activity Allocation Module using the PECAS Framework for Sri Lanka. It contains 42 commodity categories (17 good categories, 11 service commodities, 11 labour categories, 3 space categories and 8 financial and adjusting categories). Model has 12 manufacturing activities and 11 service activities. It includes government and 3 categories of households. Import and export markets are also accounted. Developed AEF table, emphasize the possibility of developing a comprehensive AA module which is stronger than a basic setup model, ultimately the developed model can be used as a starting point to develop a complete PECAS Setup or Demonstration Model for Sri Lanka.

In the PECAS Framework, households are categorized according to income levels. Level of income is identified as a major factor which affects ones' social economic activities. Department of Census and Statistics or Central Bank of Sri Lanka have no information about income (salaries and wages) of people/households with income classifications. This limit expanding the number of household categories, beyond sectors nest, which is used at the model development. Unavailability of the land use data in Sri Lanka for the built-up area is identified as one of the limiting criteria of developing an effective PECAS Model. Land-use data identifies all the built-up area as a single entity. Due to these reasons, the developed model has limited number of household and space categories.

The model development processes used in this research study synthesized a lot of data. While the internal checks validate the figures, synthesized data needed to be checked for the reliability. It is understood that checking the values developed for 2006 now, is quite impossible. But the trends, which expects not to change quickly over time was checked and data were validated.

While the research study developed land use and economic inputs to the Activity Allocation Module, PECAS contains few more modules which need developed before a complete model. Developing the Spatial Distribution Module identified as the next

challenging effort on the path to a complete model. Model development for a demonstration model or higher model understood as lot of resource consuming. Therefore, it was identified as a task to major government planning agencies of Sri Lanka. The current economic growth of the country, arising transport, economic and land use problems, the largest scale infrastructure projects going on underline the need to have a tool to make more accurate forecasting and policy checking, where PECAS becomes a best candidate.

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APPENDICES

Appendix I - Reshaped Data to be Used in AEF Development

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
			Agriculture, Forestry, and Logging Products	Fish and Other Fishing Products	Coal and Lignite; Peat, Crude Petroleum, and	Other Minerals, n.e.c.	Electricity, Gas, and Water	Food, Beverages, and Tobacco	Clothing and Wearing Apparel; and Leather and Leather Products	Products of Wood, Paper, and Paper Products	Basic Chemicals and Other Chemicals	Rubber and Plastics Products	Furniture and Other Transportable Goods, n.e.c.	Basic Metals	Fabricated Metal Products, Except Machinery and	General and Special Purpose Machinery	Office, Accounting, and Computing Machinery	Transport Equipment	Other Manufacturing	Construction Services	Wholesale and Retail Trade Services	Lodging, Food, and Beverage Serving Services	Transport Services, and Supporting and Auxiliary Transport	Postal, and Courier and Telecommunications	Financial Intermediation, Insurance, and	Real Estate, Leasing Services, and Other Business Services	Public Administration and Compulsory Social Security	Education Services	Health and Social Services	Other Services, n.e.c.	Adjustments:	CIF/FOB Adjustment on Imports	Direct Purchases Abroad by Residents	Total	Total Gross Value Added/Gross Domestic Product	Compensation of Employees	Taxes Less Subsidies on Production and Imports	Taxes on Products	Subsidies on Products	Other Taxes Less Subsidies on Production	Gross Operating Surplus
Domestic Production by Industry Group	1	Agriculture, Hunting, Forestry, and Related Service Activities	424,742	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**424,742**							
	2	Fishing, Aquaculture, and Service Activities Incidental to	-	47,143	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**47,143**							
	3	Mining and Quarrying	-	-	-	56,740	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**56,740**							
	4	Manufacture of Food Products, Beverages, and Tobacco	-	-	-	-	-	540,306	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**540,306**							
	5	Manufacture of Textiles, Wearing Apparel, and Footwear	-	-	-	-	-	-	180,414	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**180,414**							
	6	Manufacturing of Wood, Wood Products, Paper, and Paper	-	-	-	-	-	-	-	10,231	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**10,231**							
	7	Manufacture of Rubber and Plastic Products	-	-	-	-	-	-	-	-	-	28,347	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**28,347**							
	8	Manufacture of Basic Metals	-	-	-	-	-	-	-	-	-	-	-	1,650	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1,650**							
	9	Manufacture of Fabricated Metal Products; and Office and	-	-	-	-	-	-	-	-	-	-	-	-	2,866	270	62,557	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**65,693**							
	10	Manufacture of Motor Vehicles and Other Transport	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,386	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**1,386**							
	11	Other Manufacturing	-	-	-	-	-	-	-	-	160,844	-	54,186	-	-	-	-	-	259,053	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**474,083**							
	12	Electricity, Gas, and Water Supply	-	-	-	-	127,867	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**127,867**							
	13	Construction	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	480,624	-	-	-	-	-	-	-	-	-	-	-	-	-	**480,624**							
	14	Wholesale and Retail Trade; and Repair of Motor Vehicles	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	558,416	-	-	-	-	-	-	-	-	-	-	-	-	**558,416**							
	15	Hotels and Restaurants	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	28,492	-	-	-	-	-	-	-	-	-	-	-	**28,492**							
	16	Transport Services and Storage	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	640,136	-	-	-	-	-	-	-	-	-	-	**640,136**							
	17	Post and Telecommunications	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	49,946	-	-	-	-	-	-	-	-	-	**49,946**							
	18	Financial Intermediation and Insurance	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	313,125	-	-	-	-	-	-	-	-	**313,125**							
	19	Real Estate, Renting, and Business Services	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120,846	-	-	-	-	-	-	-	**120,846**							
	20	Public Administration and Defense	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	337,358	-	-	-	-	-	-	**337,358**							
	21	Education	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	68,424	-	-	-	-	-	**68,424**							
	22	Health and Social Work	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	51,801	-	-	-	-	**51,801**							
	23	Other Community Service Activities	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	126,842	-	-	-	43,045	-	-	-	**169,887**							
		Total Domestic Production	424,742	47,143	-	56,740	127,867	540,306	180,414	10,231	160,844	28,347	54,186	1,650	2,866	270	62,557	1,386	259,053	480,624	558,416	28,492	640,136	49,946	313,125	247,688	337,358	68,424	51,801	43,045		-	-	**4,777,657**							
		Total Economy																																							
Imports	Goods		40,720	17,761	97,835	30,458	19	56,858	214,814	36,155	33,508	52,446	23,407	59,536	19,761	135,940	96,168	76,648	74,580	-	-	-	-	-	-	-	-	-	-	-	-14,764	-	**1,051,851**							
	Services		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	572	-	-	94,909	5,100	3,861	34,051	-	-	-	3,650	-	-	-	**142,143**							
	CIF/FOB Adjustment on Imports		-564.00	-246	-1,354	-422	0	-787	-2,973	-500	-464	-726	-324	-824	-274	-1,882	-1,331	-1,061	-1,032	-	-	-	-	-	-	-	-	-	-	-	14,764	-	**0**							
	Total Imports		40,156	17,515	96,481	30,036	19	56,071	211,841	35,655	33,044	51,720	23,083	58,712	19,488	134,058	94,837	75,587	73,548	572	-	-	94,909	5,100	3,861	34,051	-	-	-	3,650	-	-	-	**1,193,994**							
Total Supply at Basic Prices			464,898	64,659	96,481	86,777	127,886	596,376	392,255	45,885	193,889	80,067	77,269	60,362	22,354	134,329	157,394	76,973	332,601	481,196	558,416	28,492	735,045	55,046	316,986	281,739	337,358	68,424	51,801	46,695		-	-	**5,971,651**							
Trade and Transport Margins			189,441	21,748	1,750	33,420	17,063	284,682	167,092	12,723	55,083	18,922	13,554	11,316	6,078	12,362	49,127	13,318	50,563	-	-558,416	-	-399,826	-	-	-	-	-	-	-	-	-	-	**-**							
Taxes Less Subsidies on Products			-6,356	2,069	6,078	5,438	3,238	69,242	24,927	4,612	16,008	7,131	1,583	7,113	2,485	8,158	13,239	29,223	40,713	3,819	-	2,028	-4,467	8,501	9,606	24,305	-470	1,378	3,767	11,795	-	-	-	**295,164**							
Total Supply at Purchasers' Prices			647,984	88,476	104,309	125,635	148,187	950,301	584,274	63,220	264,980	106,120	92,407	78,790	30,918	154,848	219,760	119,514	423,877	485,015	-	30,520	330,752	63,546	326,592	306,044	336,888	69,802	55,567	58,490		-	-	**6,266,815**							

			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39
			Agriculture, Forestry, and Logging Products	Fish and Other Fishing Products	Coal and Lignite; Peat, Crude Petroleum, and	Other Minerals, n.e.c.	Electricity, Gas, and Water	Food, Beverages, and Tobacco	Clothing and Wearing Apparel; and Leather and Leather Products	Products of Wood, Paper, and Paper Products	Basic Chemicals and Other Chemicals	Rubber and Plastics Products	Furniture and Other Transportable Goods, n.e.c.	Basic Metals	Fabricated Metal Products, Except Machinery and	General and Special Purpose Machinery	Office, Accounting, and Computing Machinery	Transport Equipment	Other Manufacturing	Construction Services	Wholesale and Retail Trade Services	Lodging, Food, and Beverage Serving Services	Transport Services, and Supporting and Auxiliary Transport	Postal, and Courier and Telecommunications	Financial Intermediation, Insurance, and	Real Estate, Leasing Services, and Other Business Services	Public Administration and Compulsory Social Security	Education Services	Health and Social Services	Other Services, n.e.c.	Adjustments:	Direct Purchases in Domestic Market by Nonresidents	Direct Purchases Abroad by Residents	Total	Total Gross Value Added/Gross Domestic Product	Compensation of Employees	Taxes Less Subsidies on Production and Imports	Taxes on Products	Subsidies on Products	Other Taxes Less Subsidies on Production	Gross Operating Surplus
Intermediate Consumption by Industry Group	1	Agriculture, Hunting, Forestry, and Related Service Activities	32,775	-	-	-	8,474	1,157	517	95	40,696	104	145	2	23	361	26	7,932	8,976	3,323	-	94	1,383	154	9,269	353	-	-	-	673			-	116,534	308,208	129,122	-	-	-	-	179,086
	2	Fishing, Aquaculture, and Service Activities Incidental to	-	54	-	-	633	282	1,946	187	239	-	-	182	168	-	-	1,841	2,932	-	-	-	282	-	2,179	-	-	-	-	-	-	-	-	10,925	36,218	14,332	-	-	-	-	21,886
	3	Mining and Quarrying	-	-	-	-	1,898	-	1	70	1,839	243	23	-	116	1,128	2	82	924	1,390	-	23	425	90	826	881	-	-	-	579			-	10,538	46,202	17,921	-	-	-	-	28,281
	4	Manufacture of Food Products, Beverages, and Tobacco	117,869	8,813	-	45	5,172	131,568	1,245	2,826	6,604	503	138	35	275	3,533	766	105	2,066	1,993	-	-	2,178	336	9,724	7,263	-	-	-	838			-	303,895	236,411	39,519	-	-	-	-	196,892
	5	Manufacture of Textiles, Wearing Apparel, and Footwear	1,868	-	-	1	1,074	20	48,858	1,618	6,006	1,302	935	43	186	2,320	16	0	1,251	1,612	-	2	403	673	3,809	4,217	-	-	-	1,533			-	77,749	102,666	36,127	-	-	-	-	66,538
	6	Manufacturing of Wood, Wood Products, Paper, and Paper	983	0	-	3	176	11	32	2,700	624	106	51	15	28	14	45	2	182	94	-	-	47	20	226	45	-	-	-	54			-	5,457	4,774	2,295	-	-	-	-	2,479
	7	Manufacture of Rubber and Plastic Products	1,145	-	-	11	366	8	177	170	5,953	2,650	44	108	103	78	8	3	294	22	-	-	49	42	299	51	-	-	-	125			-	11,706	16,641	3,632	-	-	-	-	13,010
	8	Manufacture of Basic Metals	17	-	-	73	62	0	0	2	42	3	1	397	43	5	2	0	194	6	-	-	4	9	28	0	-	-	-	3			-	889	762	169	-	-	-	-	593
	9	Manufacture of Fabricated Metal Products; and Office and	302	0	-	122	538	2	331	405	2,050	1,002	556	7,115	2,297	1,476	9,027	31	3,416	645	-	-	182	1,059	1,363	1,015	-	-	-	971			-	33,904	31,790	7,024	-	-	-	-	24,766
	10	Manufacture of Motor Vehicles and Other Transport	0	-	-	1	24	0	7	7	30	37	11	153	59	63	56	131	12	7	-	-	6	14	61	5	-	-	-	41			-	724	662	313	-	-	-	-	349
	11	Other Manufacturing	5,468	0	91,542	50,814	15,536	4,644	1,615	5,413	60,678	6,234	1,630	2,340	1,108	1,183	1,197	77	35,339	1,840	-	-	1,705	537	21,685	22,459	-	-	-	1,355			-	334,397	139,686	37,005	-	-	-	-	102,681
	12	Electricity, Gas, and Water Supply	469	0	-	1	22,896	1	3	114	307	8	470	18	17	312	912	37	29,736	1,059	-	36	59	189	1,432	55	-	-	-	283			-	58,415	69,452	19,051	-	-	-	-	50,401
	13	Construction	13,507	-	-	22,644	5,689	-	4,710	4,446	26,278	53	3,711	55,877	6,725	1,141	20,706	181	72,512	3,790	-	5	789	751	20,717	3,363	-	-	-	14			-	267,610	213,014	156,663	-	-	-	-	56,351
	14	Wholesale and Retail Trade; and Repair of Motor Vehicles	4	-	-	-	971	-	974	5,224	10	544	2,408	163	512	439	39	190	4,126	5,663	-	2,622	23,540	3,101	43,796	13,895	-	-	-	2,261			-	110,482	447,934	107,022	-	-	-	-	340,912
	15	Hotels and Restaurants	6,603	522	-	-	236	3,548	10	38	21	0	194	-	1	33	96	0	237	412	-	202	27	60	1,587	17	-	-	-	29			-	13,874	14,618	5,461	-	-	-	-	9,158
	16	Transport Services and Storage	18,489	0	-	-	5,672	533	3,941	3,909	3,048	25,619	13,262	19	3,592	5,058	7,823	29,526	126,690	11,745	-	4,687	9,896	3,543	26,831	10,322	-	119	974	14,619			-	329,916	310,219	105,723	-	-	-	-	204,497
	17	Post and Telecommunications	-	-	-	-	755	-	9	335	-	49	419	-	41	45	4,225	115	384	1,041	-	164	354	311	828	1,476	-	-	27	101			-	10,680	39,265	20,409	-	-	-	-	18,856
	18	Financial Intermediation and Insurance	1,000	-	-	-	1,902	6,173	620	5,337	0	861	1,092	-	111	1,286	7,331	1,526	4,678	5,504	-	3,501	4,015	2,918	5,085	21,856	-	-	-	1,155			-	75,951	237,174	46,397	-	-	-	-	190,777
	19	Real Estate, Renting, and Business Services	17	-	-	-	50	-	16	86	54	0	115	-	59	0	85	26	13	16,181	-	860	1	490	220	3,913	-	-	-	463			-	22,650	98,196	15,305	-	-	-	-	82,891
	20	Public Administration and Defense	-	-	-	-	9,505	29,170	5,364	1,944	-	-	-	-	-	9,333	4,892	639	22,474	2,138	-	174	20,864	2,625	-	24,176	-	-	-	12,577			-	145,876	191,482	191,482	-	-	-	-	0
	21	Education	-	-	-	-	363	-	4	268	-	-	-	-	-	-	3	11	57	-	-	-	80	83	-	64	-	-	5,423	3,714			-	10,070	58,354	51,903	-	-	-	-	6,452
	22	Health and Social Work	-	-	-	-	2,802	-	31	92	17,628	-	-	-	-	-	6,269	2	240	-	-	945	186	178	2,934	499	-	-	1,260	1,836			-	34,902	16,899	15,400	-	-	-	-	1,499
	23	Other Community Service Activities	1,496	-	-	1,128	1,597	8,584	580	3,738	454	6,702	463	0	1,906	3	394	131	19,333	3,042	-	3,006	6,510	484	38,943	42,046	-	-	-	6,456			-	146,997	22,890	10,488	-	-	-	-	12,401
	24	Total Intermediate Consumption	202,013	9,390	91,542	74,842	86,393	185,701	70,994	39,022	172,560	46,020	25,669	66,465	17,370	27,811	63,920	42,588	336,065	61,508	-	16,320	72,984	17,667	191,843	157,973	-	119	7,683	49,677			-	2,134,140	2,643,517	1,032,762	-	-	-	-	1,610,755
	25	Total Economy																																2,938,681	1,032,762	295,164	295,164	-	-	-	1,610,755
Final Consumption Expenditure	Household Consumption Expenditure		348,377	69,049	-	4,221	61,737	702,805	135,671	6,670	70,503	406	48,431	-	2,659	4,493	25,731	22,860	29,819	4,755	-	14,200	137,139	28,632	128,807	117,022	-	3,355	1,846	4,426			-	1,973,614							
	General Government Consumption	Individual	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	66,328	46,038	-			-	112,366							
		Collective	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	336,888	-	-	2,185			-	339,073							
		Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	336,888	66,328	46,038	2,185			-	451,439							
	Nonprofit Institutions Serving Households		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			-	-							
Total Final Consumption Expenditure			348,377	69,049	-	4,221	61,737	702,805	135,671	6,670	70,503	406	48,431	-	2,659	4,493	25,731	22,860	29,819	4,755	-	14,200	137,139	28,632	128,807	117,022	336,888	69,683	47,884	6,611			-	2,425,053							
Gross Capital Formation	Gross Fixed Capital Formation		31,910	-	-	-	-	-	-	-	-	749	1,840	-	1,075	118,920	99,397	37,902	12,099	415,725	-	-	-	-	-	11,294	-	-	-	-			-	730,910							
	Changes in Inventories		12,442	-	12,767	-	-	33,182	2,370	504	10,301	32	3,428	218	2,992	687	3,819	117	8,471	-	-	-	-	-	-	-	-	-	-	-			-	91,332							
	Acquisition Less Disposals of Valuables		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-			-	-							
Total Gross Capital Formation			44,352	-	12,767	-	-	33,182	2,370	504	10,301	781	5,268	218	4,067	119,606	103,216	38,019	20,570	415,725	-	-	-	-	-	11,294	-	-	-	-			-	822,242							
Export	Goods		53,242	10,037	-	46,572	57	28,613	375,240	17,024	11,615	58,913	13,039	12,107	6,821	2,938	26,893	16,046	37,422	-	-	-	-	-	-	-	-	-	-	-			-	716,578							
	Services		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,028	-	-	120,629	17,247	5,942	19,754	-	-	-	2,202			-	168,802							
Total Exports			53,242	10,037	-	46,572	57	28,613	375,240	17,024	11,615	58,913	13,039	12,107	6,821	2,938	26,893	16,046	37,422	3,028	-	-	120,629	17,247	5,942	19,754	-	-	-	2,202			-	885,380							
Total Use			647,984	88,476	104,309	125,635	148,187	950,301	584,274	63,221	264,980	106,120	92,407	78,790	30,918	154,848	219,759	119,514	423,876	485,015	-	30,520	330,752	63,546	326,592	306,044	336,888	69,802	55,567	58,490			-	6,266,815							

Appendix II - Employed Persons by Occupation Groups

CURRENTLY EMPLOYED PERSON BY OCCUPATION GROUP (BASED ON ISCO88) - BY PROVINCE - MALE/FEMALE												
Province	**Total**	**Occupation group**										
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**0**
Total	7,105,322	128,944	376,469	362,275	276,587	526,322	513,217	1,590,110	1,214,163	501,561	1,576,960	38,715
Western	2,263,368	90,693	158,220	192,741	150,113	227,921	218,008	125,433	453,866	230,877	398,282	17,214
Central	929,841	11,916	46,776	39,527	26,949	61,543	61,356	187,262	124,170	53,409	313,903	3,031
Southern	976,352	3,560	48,327	45,097	33,404	62,348	51,253	254,406	175,963	56,560	241,467	3,966
North Western	1,023,567	10,240	53,673	33,222	24,815	66,752	75,089	260,388	228,314	73,884	192,848	4,343
North Central	496,316	5,080	22,424	13,824	8,780	21,916	38,797	246,769	53,509	19,216	61,704	4,297
Uva	603,769	3,232	17,808	11,494	10,866	23,354	26,865	320,749	42,270	20,951	123,831	2,349
Sabaragamuwa	812,107	4,223	29,242	26,370	21,661	62,488	41,848	195,103	136,071	46,662	244,925	3,514

Occupation Groups	6 Sales and Service workers
1 Senior Officials and Managers	7 Skilled Agricultural and Fishery workers
2 Professionals	8 Craft and Related workers
3 Technical and Associate Professionals	9 Plant and Machine operators and Assemblers
4 Clerks	10 Elementary occupations
5 Proprietors and Managers of Enterprises	0 Unidentified

Appendix III - Doubly Restrained Employment Distribution

Western Province						
Occupation Category	**Urban Sector**	**Rural Sector**	**Estate Sector**	**Actual Total**	**Expected Total**	**Exp/Act**
Senior Officials and Managers	57,282	33,401	11	90,693	90,693	1.00
Professionals	44,080	112,765	1,376	158,220	158,220	1.00
Technical and Associate Professionals	100,844	90,037	1,861	192,741	192,741	1.00
Clerks	84,214	64,892	1,007	150,113	150,113	1.00
Proprietors and Managers of Enterprises	84,944	140,339	2,638	227,921	227,921	1.00
Sales and Service workers	50,991	166,312	705	218,008	218,008	1.00
Skilled Agricultural and Fishery workers	8,069	116,006	1,357	125,433	125,433	1.00
Craft and Related workers	97,981	355,524	361	453,866	453,866	1.00
Plant and Machine operators and Assemblers	86,520	143,167	1,190	230,877	230,877	1.00
Elementary occupations	72,890	316,712	8,680	398,282	398,282	1.00
Unidentified	3,533	13,681	0	17,214	17,214	1.00
Actual Total	691,348	1,552,835	19,184			
Expected Total	691,348	1,552,835	19,184			
Exp/Act	1.00	1.00	1.00			

Central Province						
Occupation Category	**Urban Sector**	**Rural Sector**	**Estate Sector**	**Actual Total**	**Expected Total**	**Exp/Act**
Senior Officials and Managers	4,999	6,873	44	11,916	11,916	1.00
Professionals	5,493	33,133	8,150	46,776	46,776	1.00
Technical and Associate Professionals	9,926	20,895	8,706	39,527	39,527	1.00
Clerks	7,961	14,464	4,524	26,949	26,949	1.00
Proprietors and Managers of Enterprises	9,659	37,626	14,258	61,543	61,543	1.00
Sales and Service workers	6,564	50,476	4,316	61,356	61,356	1.00
Skilled Agricultural and Fishery workers	4,366	147,987	34,909	187,262	187,262	1.00
Craft and Related workers	12,761	109,175	2,234	124,170	124,170	1.00
Plant and Machine operators and Assemblers	9,614	37,510	6,285	53,409	53,409	1.00
Elementary occupations	18,567	190,219	105,116	313,903	313,903	1.00
Unidentified	299	2,732	0	3,031	3,031	1.00
Actual Total	90,209	651,089	188,542			
Expected Total	90,209	651,089	188,542			
Exp/Act	1.00	1.00	1.00			

Southern Province						
Occupation Category	**Urban Sector**	**Rural Sector**	**Estate Sector**	**Actual Total**	**Expected Total**	**Exp/Act**
Senior Officials and Managers	1,223	2,336	1	3,560	3,560	1.00
Professionals	5,076	42,533	719	48,327	48,327	1.00
Technical and Associate Professionals	11,251	32,904	942	45,097	45,097	1.00
Clerks	9,335	23,562	506	33,404	33,404	1.00
Proprietors and Managers of Enterprises	9,515	51,493	1,340	62,348	62,348	1.00
Sales and Service workers	4,363	46,616	274	51,253	51,253	1.00
Skilled Agricultural and Fishery workers	5,208	245,225	3,974	254,406	254,406	1.00
Craft and Related workers	13,638	162,097	228	175,963	175,963	1.00
Plant and Machine operators and Assemblers	8,725	47,291	544	56,560	56,560	1.00
Elementary occupations	15,309	217,887	8,271	241,467	241,467	1.00
Unidentified	290	3,676	0	3,966	3,966	1.00
Actual Total	83,933	875,620	16,799			
Expected Total	83,933	875,620	16,799			
Exp/Act	1.00	1.00	1.00			

North Western Province						
Occupation Category	**Urban Sector**	**Rural Sector**	**Estate Sector**	**Actual Total**	**Expected Total**	**Exp/Act**
Senior Officials and Managers	2,099	8,140	1	10,240	10,240	1.00
Professionals	2,968	50,488	217	53,673	53,673	1.00
Technical and Associate Professionals	4,760	28,257	205	33,222	33,222	1.00
Clerks	4,034	20,668	113	24,815	24,815	1.00
Proprietors and Managers of Enterprises	5,536	60,814	402	66,752	66752	1.00
Sales and Service workers	3,305	71,677	107	75,089	75,089	1.00
Skilled Agricultural and Fishery workers	2,685	256,646	1,057	260,388	260,388	1.00
Craft and Related workers	9,083	219,152	78	228,314	228,314	1.00
Plant and Machine operators and Assemblers	6,139	67,547	198	73,884	73,884	1.00
Elementary occupations	6,392	184,675	1,781	192,848	192,848	1.00
Unidentified	162	4,181	0	4,343	4,343	1.00
Actual Total	47,164	972,244	4,159			
Expected Total	47,164	972,244	4,159			
Exp/Act	1.00	1.00	1.00			

North Central Province						
Occupation Category	**Urban Sector**	**Rural Sector**	**Estate Sector**	**Actual Total**	**Expected Total**	**Exp/Act**
Senior Officials and Managers	1,337	3,743	0	5,080	5,080	1.00
Professionals	1,686	20,713	25	22,424	22,424	1.00
Technical and Associate Professionals	2,610	11,191	23	13,824	13,824	1.00
Clerks	1,866	6,904	11	8,780	8,780	1.00
Proprietors and Managers of Enterprises	2,449	19,430	36	21,916	21,916	1.00
Sales and Service workers	2,328	36,454	15	38,797	38,797	1.00
Skilled Agricultural and Fishery workers	3,520	242,967	283	246,769	246,769	1.00
Craft and Related workers	2,904	50,600	5	53,509	53,509	1.00
Plant and Machine operators and Assemblers	2,146	17,055	14	19,216	19,216	1.00
Elementary occupations	2,815	58,729	160	61,704	61,704	1.00
Unidentified	219	4,078	0	4,297	4,297	1.00
Actual Total	23,880	471,864	572			
Expected Total	23,880	471,864	572			
Exp/Act	1.00	1.00	1			

Uva Province						
Occupation Category	**Urban Sector**	**Rural Sector**	**Estate Sector**	**Actual Total**	**Expected Total**	**Exp/Act**
Senior Officials and Managers	974	2,249	9	3,232	3,232	1.00
Professionals	1,395	14,136	2,277	17,808	17,808	1.00
Technical and Associate Professionals	2,089	7,389	2,016	11,494	11,494	1.00
Clerks	2,323	7,090	1,452	10,866	10,866	1.00
Proprietors and Managers of Enterprises	2,547	16,670	4,137	23,354	23,354	1.00
Sales and Service workers	1,835	23,703	1,327	26,865	26,865	1.00
Skilled Agricultural and Fishery workers	4,806	273,669	42,274	320,749	320,749	1.00
Craft and Related workers	2,716	39,031	523	42,270	42,270	1.00
Plant and Machine operators and Assemblers	2,532	16,598	1,821	20,951	20,951	1.00
Elementary occupations	5,067	87,207	31,557	123,831	123,831	1.00
Unidentified	144	2,205	0	2,349	2,349	1.00
Actual Total	26,429	489,947	87,393			
Expected Total	26,429	489,947	87,393			
Exp/Act	1.00	1.00	1.00			

Sabaragamuwa Province						
Occupation Category	**Urban Sector**	**Rural Sector**	**Estate Sector**	**Actual Total**	**Expected Total**	**Exp/Act**
Senior Officials and Managers	877	3,339	7	4223	4,223	1.00
Professionals	1,528	25,526	2,187	29,242	29,242	1.00
Technical and Associate Professionals	3,436	20,027	2,907	26,370	26,370	1.00
Clerks	3,293	16,563	1,805	21,661	21,661	1.00
Proprietors and Managers of Enterprises	4,731	51,022	6,736	62,488	62,488	1.00
Sales and Service workers	1,825	38,865	1,158	41,848	41,848	1.00
Skilled Agricultural and Fishery workers	1,902	178,529	14,671	195,103	195,103	1.00
Craft and Related workers	5,474	129,672	924	136,071	13,6071	1.00
Plant and Machine operators and Assemblers	3,753	40,542	2,367	46,662	46,662	1.00
Elementary occupations	7,033	199,488	38,404	244,925	244,925	1.00
Unidentified	134	3,380	0	3,514	3,514	1.00
Actual Total	33,986	706,954	71,167			
Expected Total	33,986	706,954	71,167			
Exp/Act	1.00	1.00	1.00			

Appendix IV - Matching ASI Labour Categories with AEF Labour Categories

	Senior Officials and Managers		Professionals		Technical and Associate Professionals		Clerks		Proprietors and Managers of Enterprises		Sales and Service Workers	
Agriculture, Hunting, Forestry, and Related Service Activities	S_Administrative	50%	S_Technical	40%	S_Technical	60%	S_Clerical	100%	S_Administrative	50%	S_Skilled	20%
Fishing, Aquaculture, and Service Activities Incidental to Fishing	S_Administrative	50%	S_Technical	40%	S_Technical	60%	S_Clerical	100%	S_Administrative	50%	S_Skilled	30%
Mining and Quarrying	S_Administrative	50%	S_Technical	40%	S_Technical	60%	S_Clerical	100%	S_Administrative	50%	S_Skilled	10%
Manufacture of Food Products, Beverages, and Tobacco	S_Administrative	50%	S_Technical	40%	S_Technical	60%	S_Clerical	100%	S_Administrative	50%	S_Skilled	10%
Manufacture of Textiles, Wearing Apparel, and Footwear	S_Administrative	50%	S_Technical	40%	S_Technical	60%	S_Clerical	100%	S_Administrative	50%	S_Skilled	10%
Manufacturing of Wood, Wood Products, Paper, and Paper Products	S_Administrative	50%	S_Technical	40%	S_Technical	60%	S_Clerical	100%	S_Administrative	50%	S_Skilled	10%
Manufacture of Rubber and Plastic Products	S_Administrative	50%	S_Technical	40%	S_Technical	60%	S_Clerical	100%	S_Administrative	50%	S_Skilled	10%
Manufacture of Basic Metals	S_Administrative	50%	S_Technical	40%	S_Technical	60%	S_Clerical	100%	S_Administrative	50%	S_Skilled	10%
Manufacture of Fabricated Metal Products; and Office and Computing Machinery	S_Administrative	50%	S_Technical	40%	S_Technical	60%	S_Clerical	100%	S_Administrative	50%	S_Skilled	10%
Manufacture of Motor Vehicles and Other Transport Equipment	S_Administrative	50%	S_Technical	40%	S_Technical	60%	S_Clerical	100%	S_Administrative	50%	S_Skilled	10%
Other Manufacturing	S_Administrative	50%	S_Technical	40%	S_Technical	60%	S_Clerical	100%	S_Administrative	50%	S_Skilled	10%
Electricity, Gas, and Water Supply	S_Administrative	50%	S_Technical	40%	S_Technical	60%	S_Clerical	100%	S_Administrative	50%	S_Skilled	10%

	Skilled Agricultural and Fishery Workers		Craft and Related Workers		Plant and Machine operators and Assemblers		Elementary occupations		Unidentified	
Agriculture, Hunting, Forestry, and Related Service Activities	S_Skilled	70%	S_Skilled	5%	S_Skilled	5%	S_Unskilled	100%	S_Other	5%
Fishing, Aquaculture, and Service Activities Incidental to Fishing	S_Skilled	70%					S_Unskilled	100%	S_Other	5%
Mining and Quarrying					S_Skilled	90%	S_Unskilled	100%	S_Other	5%
Manufacture of Food Products, Beverages, and Tobacco					S_Skilled	90%	S_Unskilled	100%	S_Other	5%
Manufacture of Textiles, Wearing Apparel, and Footwear			S_Skilled	20%	S_Skilled	70%	S_Unskilled	100%	S_Other	5%
Manufacturing of Wood, Wood Products, Paper, and Paper Products			S_Skilled	20%	S_Skilled	70%	S_Unskilled	100%	S_Other	5%
Manufacture of Rubber and Plastic Products					S_Skilled	90%	S_Unskilled	100%	S_Other	5%
Manufacture of Basic Metals					S_Skilled	90%	S_Unskilled	100%	S_Other	5%
Manufacture of Fabricated Metal Products; and Office and Computing Machinery			S_Skilled	10%	S_Skilled	80%	S_Unskilled	100%	S_Other	5%
Manufacture of Motor Vehicles and Other Transport Equipment					S_Skilled	90%	S_Unskilled	100%	S_Other	5%
Other Manufacturing			S_Skilled	10%	S_Skilled	80%	S_Unskilled	100%	S_Other	5%
Electricity, Gas, and Water Supply					S_Skilled	90%	S_Unskilled	100%	S_Other	5%

Appendix V - Formal and Informal Sector Share of Occupational Categories

Occupation	Formal		Informal		Total	
	Employees	%	Employees	%	Employees	%
Senior Officials and Managers	114,854	89.07%	14,090	10.93%	128,944	100%
Professionals	320,371	85.10%	56,098	14.90%	376,469	100%
Technical and Associate Professionals	311,558	86.00%	50,717	14.00%	362,275	100%
Clerks	252,798	91.40%	23,789	8.60%	276,587	100%
Proprietors and Managers of Enterprises	156,751	29.78%	369,571	70.22%	526,322	100%
Sales and Service Workers	223,090	43.47%	290,127	56.53%	513,217	100%
Skilled Agricultural and Fishery Workers	39,132	2.46%	1,550,978	97.54%	1,590,110	100%
Craft and Related Workers	403,781	33.26%	810,382	66.74%	1,214,163	100%
Plant and Machine operators and Assemblers	206,741	41.22%	294,820	58.78%	501,561	100%
Elementary occupations	660,911	41.91%	916,049	58.09%	1,576,960	100%
Unidentified	36,690	94.77%	*		38,715	100%
Total	2,726,677	38.38%	4,376,620	61.60%	7,105,322	100%

Appendix VI - Converting 2018 Land Prices to 2006

	Average Land prices by Region for mid-year 2018 (Rs million per perch)	Current Price	Merging year	After hike	Before hike	Merging Year	Mid 2006 price
		2018.5	1998.98391	2016	2016	1642	2006.5
Commercial, Institutional land Price (Rs Millions/perch)	Western Province Land price	1.18	0.25	0.97	0.61	0.00	0.348
	Colombo City	11.4	0.25	6.98	4.42	0.00	2.390
	Colombo District	1.02	0.25	0.85	0.54	0.00	0.307
	Gampaha District	0.5	0.25	0.46	0.29	0.00	0.168
	Kaluthara District	0.275	0.25	0.27	0.17	0.00	0.101
	Southern province Land price	0.414	0.25	0.39	0.25	0.00	0.143
	Galle District	0.425	0.25	0.40	0.25	0.00	0.146
	Matara District	0.375	0.25	0.36	0.23	0.00	0.131
	Hambantota District	0.2	0.25	0.21	0.13	0.00	0.077
	Central province Land price	0.371	0.25	0.35	0.22	0.00	0.130
	Kandy District	0.4	0.25	0.38	0.24	0.00	0.139
	Matale District	0.175	0.25	0.18	0.12	0.00	0.069
	Nuwara Eliya District	0.2	0.25	0.21	0.13	0.00	0.077
	North West province Land price	0.189	0.25	0.20	0.12	0.00	0.073
	Kurunegala District	0.2	0.25	0.21	0.13	0.00	0.077
	Puttalam District	0.15	0.25	0.16	0.10	0.00	0.060
	North Central province Land price	0.125	0.25	0.14	0.09	0.00	0.052
	Anuradhapura District	0.13	0.25	0.14	0.09	0.00	0.053
	Polonnaruwa District	0.12	0.25	0.13	0.08	0.00	0.050
	Uva province Residential Land price	0.161	0.25	0.17	0.11	0.00	0.064
	Badulla District	0.175	0.25	0.18	0.12	0.00	0.069
	Monaragala District	0.1	0.25	0.11	0.07	0.00	0.043
	Sabaragamuwa province Land price	0.122	0.25	0.13	0.08	0.00	0.051
	Ratnapura District	0.125	0.25	0.14	0.09	0.00	0.052
	Kegalle District	0.125	0.25	0.14	0.09	0.00	0.052
	Eastern province Land price	0.144	0.25	0.15	0.10	0.00	0.058
	Northern Province Land price	0.154	0.25	0.16	0.10	0.00	0.062
Other	Overall Tea Land price	0.0128125	0.25	0.02	0.01	0.00	0.007
	Overall Rubber Land price	0.01875	0.25	0.03	0.02	0.00	0.010
	Overall Coconut Land price	0.0210625	0.25	0.03	0.02	0.00	0.011

	Average Land prices by Region for mid-year 2018 (Rs million per perch)	Current Price	Merging year	After hike	Before hike	Merging Year	Mid 2006 price
		2018.5	0	2016	2016	0	2006.5
Average Residential Land Prices (Rs Millions/perch)	Western Province Land price						
	Colombo City						
	Colombo District	0.4	0.25	0.38	0.24	0.00	0.139
	Gampaha District	0.3	0.25	0.29	0.19	0.00	0.109
	Kaluthara District	0.15	0.25	0.16	0.10	0.00	0.060
	Southern province Land price						
	Galle District	0.14	0.25	0.15	0.10	0.00	0.057
	Matara District	0.12	0.25	0.13	0.08	0.00	0.050
	Hambantota District	0.06	0.25	0.07	0.05	0.00	0.028
	Central province Land price						
	Kandy District	0.15	0.25	0.16	0.10	0.00	0.060
	Matale District	0.08	0.25	0.09	0.06	0.00	0.035
	Nuwara Eliya District	0.12	0.25	0.13	0.08	0.00	0.050
	North West province Land price						
	Kurunegala District	0.08	0.25	0.09	0.06	0.00	0.035
	Puttalam District	0.06	0.25	0.07	0.05	0.00	0.028
	North Central province Land price				0.00		
	Anuradhapura District	0.06	0.25	0.07	0.05	0.00	0.028
	Polonnaruwa District	0.06	0.25	0.07	0.05	0.00	0.028
	Uva province Residential Land price						
	Badulla District	0.075	0.25	0.09	0.06	0.00	0.033
	Monaragala District	0.05	0.25	0.06	0.04	0.00	0.024
	Sabaragamuwa province Land price						
	Ratnapura District	0.08	0.25	0.09	0.06	0.00	0.035
	Kegalle District	0.075	0.25	0.09	0.06	0.00	0.033

	Average Land prices by Region for mid-year 2018 (Rs million per perch)	Current Price	Merging year	After hike	Before hike	Merging Year	Mid 2006 price
		2018.5	0	2016	2016	0	2006.5
Paddy Cultivated Land Prices (Rs millions/Acre)	Western Province Land price	0.00	0.25		0.00		
	Colombo City	0.00	0.25		0.00		
	Colombo District	0.03	0.25	0.04	0.03	0.00	0.016
	Gampaha District	0.02	0.25	0.03	0.02	0.00	0.010
	Kaluthara District	0.01	0.25	0.01	0.01	0.00	0.004
	Southern province Land price	0.00	0.25				
	Galle District	0.01	0.25	0.01	0.01	0.00	0.006
	Matara District	0.01	0.25	0.01	0.01	0.00	0.004
	Hambantota District	0.00	0.25	0.01	0.00	0.00	0.003
	Central province Land price	0.00	0.25				
	Kandy District	0.01	0.25	0.01	0.01	0.00	0.003
	Matale District	0.01	0.25	0.01	0.01	0.00	0.003
	Nuwara Eliya District	0.00	0.25	0.01	0.00	0.00	0.003
	North West province Land price	0.00	0.25				
	Kurunegala District	0.01	0.25	0.01	0.01	0.00	0.006
	Puttalam District	0.01	0.25	0.01	0.01	0.00	0.006
	North Central province Land price	0.00	0.25				
	Anuradhapura District	0.00	0.25	0.01	0.00	0.00	0.003
	Polonnaruwa District	0.00	0.25	0.01	0.00	0.00	0.003
	Uva province Residential Land price	0.00	0.25				
	Badulla District	0.01	0.25	0.01	0.01	0.00	0.003
	Monaragala District	0.00	0.25	0.01	0.00	0.00	0.003
	Sabaragamuwa province Land price	0.00	0.25				
	Ratnapura District	0.01	0.25	0.01	0.01	0.00	0.003
	Kegalle District	0.01	0.25	0.01	0.01	0.00	0.003

Appendix VII - Value of Land (Jan 2006) classified by industry – Simplified

Matched Manufacturing Industry	Type of Industry	Land value (Rs.)
3	141 Quarrying of stone Clay and Sand	676,442,810
3	142 Mining and Quarrying n.e.c	10,861,250
2 4	151 Produ., proce. & preserving of meat, fish,fruit,vegeta	5,320,572,154
4	152 Manufacture of Dairy Products	5,743,956,267
4	153 Manu.of grain mill products and prepared animal feeds	1,692,665,494
4	154 Manu.of other food products	8,955,814,930
4	155 Manu.of beverags	1,308,027,667
4	160 Manu.of tobacco products	553,162,328
5	171 Spinning, weaving and finishing of Textiles	3,491,255,983
5	172 Manu.of other Textiles	2,320,792,604
5	173 Manu.of knitted and crocheted fabrics and articles	461,126,021
5	181 Manu.of weaving Apparel except fur apparels	12,891,669,316
5	191 Tanning & dressing of leather; manu. Of luggage, Hand b	5,000,000
5	192 Manu.of footwear	777,911,164
6	201 Saw-milling and planning of wood	934,662,222
6	202 Manu.of produ. of wood, cork, straw & plaiting material	793,908,267
6	210 Manu.of paper and paper products	7,326,349,077
NA	221 Publishing, printing and reproduction of recorded media	9,930,000
NA	222 Printing & service activities related to printing for o	1,863,115,401
12	232 Manu.of refined petroleum products	16,000,000
11	241 Manu.of basic chemicals	7,780,224,500
11	242 Manu.of other chemical products	8,460,451,600
7	251 Manu.of rubber products	6,365,491,933
7	252 Manu.of plastic products	3,633,989,624
8	269 Manu.of Non-metallic mineral products(Not elsewhere)	15,232,465,865
8	271 Manu.of basic iron & steel	2,032,321,272
8	272 Manu.of basic precious & non-ferrous metal	1,389,328,143
9	273 Casting of metals	6,738,762,798
9	281 Manu.of structural metal products, tanks, reservoirs &	220,000,000
9	289 Manu.of other fabricated metal products	1,209,774,370
11	292 Manu.of special purpose machinery	3,490,444
11	293 Manu.of domestic appliance n.e.c.	4,081,455
11	311 Manu.of electronic motors, generators and transformers	4,435,582
11	319 Manu.of other electrical equipments n.e.c.	1,088,483,844
11	321 Manu.of electronic valves, tubes & other	17,600,000
11	323 Manu.of TV & Radio receivers, sound or video recording	3,431,182
11	331 Manu.of medical appliances & instruments & appliances	-
11	332 Manu.of optical instruments and photographic eq.	-
10	342 Manu.of bodies for Motor vehicles, Manu. Of trailers &	7,000,000
10	343 Manu.of spare parts and accessories for motor vehicles	166,088,000
10	351 Building and repairing of ships and boats	-
10	359 Manu.of transport equipment n.e.c.	1,030,000
6	361 Manu.of furniture	1,994,015,024
11	369 Manu.of other product not elsewhere classified	2,253,419,619
11	372 Recycling of non-metal waste and scrap	17,944,621
12	401 Production, collection & distribution of electricity	10,627,400,150
12	410 Collection, purification and distribution of water	1,604,735,004
	Total	126,009,187,986

Matched Manufacturing Activity	
Index	**Industry**
1	Agriculture, Hunting, Forestry, and Related Service Activities
2	Fishing, Aquaculture, and Service Activities Incidental to Fishing
3	Mining and Quarrying
4	Manufacture of Food Products, Beverages, and Tobacco
5	Manufacture of Textiles, Wearing Apparel, and Footwear
6	Manufacturing of Wood, Wood Products, Paper, and Paper Products
7	Manufacture of Rubber and Plastic Products
8	Manufacture of Basic Metals
9	Manufacture of Fabricated Metal Products; and Office and Computing Machinery
10	Manufacture of Motor Vehicles and Other Transport Equipment
11	Other Manufacturing
12	Electricity, Gas, and Water Supply

Appendix VIII - Percentage Distribution of Weighted Employment – Service Sector

Index	1	13	14	15	16	17	18	19	20	21	22	23
Industry	Agriculture, Hunting, Forestry, and Related Service Activities	Construction	Wholesale and Retail Trade; and Repair of Motor Vehicles	Hotels and Restaurants	Transport Services and Storage	Post and Telecommunications	Financial Intermediation and Insurance	Real Estate, Renting, and Business Services	Public Administration and Defense	Education	Health and Social Work	Other Community Service Activities
Weight Class	B	B	C	C	C	A	A	A	A	C	B	A
Weight	2.7	2.7	4.9	4.9	4.9	1.0	1.0	1.0	1.0	4.9	2.7	1.0
Anuradhapura District	12%	5%	34%	5%	11%	0%	1%	1%	11%	16%	3%	1%
Polonnaruwa District	13%	9%	34%	5%	10%	0%	1%	0%	11%	13%	2%	1%
Badulla district	13%	5%	34%	4%	13%	0%	1%	1%	6%	18%	4%	1%
Moneragala District	17%	4%	35%	5%	12%	0%	0%	0%	7%	16%	3%	1%
Colombo District	0%	7%	43%	7%	19%	1%	1%	2%	6%	10%	4%	1%
Gampaha District	1%	8%	42%	6%	21%	1%	1%	2%	5%	10%	3%	1%
Kalutara district	2%	9%	41%	8%	17%	0%	1%	1%	6%	12%	3%	1%
Galle District	5%	9%	36%	8%	15%	0%	1%	1%	6%	16%	3%	1%
Matara District	7%	8%	37%	4%	16%	0%	1%	1%	5%	19%	3%	1%
Hambantota district	9%	9%	37%	5%	13%	0%	1%	0%	6%	17%	3%	1%
Kegalle District	4%	9%	36%	6%	19%	1%	1%	1%	5%	15%	3%	1%
Ratnapura District	11%	7%	41%	5%	13%	0%	0%	1%	5%	14%	3%	1%
Kandy district	3%	8%	40%	7%	15%	0%	1%	1%	6%	16%	4%	1%
Matale District	8%	7%	40%	7%	14%	0%	1%	1%	6%	14%	2%	1%
Nuwara Eliya District	17%	5%	36%	7%	12%	0%	0%	0%	5%	14%	3%	1%
Kurunegala District	6%	9%	39%	4%	15%	0%	1%	1%	5%	16%	3%	1%
Puttalam District	3%	11%	44%	5%	17%	0%	0%	1%	4%	11%	2%	1%

Appendix IX - Ratio of Expenses for Goods and Services by Households

	Table A1 - Sector and household expenditure (monthly average) by Food and non-food item group	Total	Urban	Rural	Estate	Urban	Rural	Estate
		Rs.	Rs.	Rs.	Rs.	%	%	%
1	Total	22,952	35,274	21,440	13,456	1.00	0.61	0.38
2	Cereals	1,389	1,231	1,361	2,234	1.00	1.11	1.81
3	Foods prepared outside	1,032	1,894	919	479	1.00	0.49	0.25
4	Pulses	304	300	300	367	1.00	1.00	1.22
5	Vegetables and leaves	727	753	727	659	1.00	0.97	0.88
6	Yams and other similar foods	209	188	214	189	1.00	1.13	1.00
7	Meat	366	676	320	251	1.00	0.47	0.37
8	Fish (fresh)	744	1,250	686	299	1.00	0.55	0.24
9	Dried fish	348	279	369	210	1.00	1.32	0.75
10	Eggs	85	110	81	81	1.00	0.74	0.74
11	Coconuts (nuts and powder)	473	491	476	371	1.00	0.97	0.76
12	Condiments	803	971	780	710	1.00	0.80	0.73
13	Other packed/ tinned/ bottled foods	26	51	23	7	1.00	0.45	0.13
14	Milk and milk foods	754	1,061	710	615	1.00	0.67	0.58
15	Fats and oils	186	216	179	219	1.00	0.83	1.01
16	Sugar/ Jaggery and Treacle	325	347	325	268	1.00	0.94	0.77
17	Fruits (fresh and dried)	294	436	281	118	1.00	0.64	0.27
18	Confectioneries and other short eats	305	421	294	174	1.00	0.70	0.41
19	Beverages (non-alcoholic)	271	340	261	251	1.00	0.77	0.74
20	Liquor/ Narcotic drugs & Tobacco	492	497	472	797	1.00	0.95	1.60
21	Housing	2,639	5,931	2,188	841	1.00	0.37	0.14
22	Fuel and light	1,042	1,796	935	683	1.00	0.52	0.38
23	Personal care expenses	288	418	269	233	1.00	0.64	0.56
24	Health expenses	693	967	666	368	1.00	0.69	0.38
25	Transport	1,862	3,059	1,744	500	1.00	0.57	0.16
26	Communication	539	1,060	472	176	1.00	0.45	0.17
27	Education	632	1,069	581	254	1.00	0.54	0.24
28	Recreations/ Entertainments/ Training and Cultural activities	260	497	230	82	1.00	0.46	0.17
29	Household cleaning and sanitary goods	189	241	184	129	1.00	0.77	0.53
30	Household services	111	245	94	22	1.00	0.38	0.09
31	Clothing and Textiles	585	772	563	439	1.00	0.73	0.57
32	Shoes and other items	109	160	102	79	1.00	0.64	0.50
33	Durable household goods	65	67	66	44	1.00	0.98	0.65
34	Long durable household goods	721	945	717	184	1.00	0.76	0.19
35	Other non-consumption and miscellaneous expenses	2,292	3,824	2,124	800	1.00	0.56	0.21
36	Other windfall expenses	1,791	2,712	1,728	320	1.00	0.64	0.12