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Title of paper

MALAYSIA: MODERNISATION IN CAPITAL STOCK STATISTICS

Abstract

Capital stock statistics is produced by Department of Statistics, Malaysia (DOSM) since 2011 with the time series from 1955 onwards. The statistics has time series of 62 years and uses the perpetual inventory method (PIM) in the compilation exercise. The process of compilation the capital stock statistics starts with generation, tabulation, analysis and end with verification by several officers to ensure the consistency and accuracy of the generated data. As a consequence, in producing this statistics for each industry and assets, it is time-consuming and uses a lot of human resources. In addition, the computers need to be upgraded frequently to accommodate and ensure the smooth generation and dissemination of capital stock statistics. DOSM has been faced with many challenges in producing the capital stock statistics. These challenges need to be addressed to ensure the delivery of capital stock statistics is not affected. It requires careful planning to get the best solutions. These efforts have led to the modernisation of existing practices in the compilation. This paper will elaborate the modernisation efforts undertaken, describes the challenges faced and how DOSM overcome all the challenges in stages up to the development of the capital stock system for the compilation of capital stock statistics in Malaysia.

Keywords: Capital Stock, Modernisation, Perpetual Inventory Method

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II. Introduction

Capital stocks statistics in Malaysia was compiled in the collaboration between Department of Statistics, Malaysia (DOSM) and Economic Planning Unit with technical consultation from the Australian Bureau of Statistics. The compilation was prepared based on Organisation for Economic Co-operation and Development (OECD) Manual 2009, Measuring Capital and the framework of System of National Accounts 2008 as recommended by the United Nations. DOSM was requested by the Economic Planning Unit to provided capital stock statistics in 2002.

Since then, DOSM started the initial studies on all the requirements to establish the compilation. Working visit has been arranged to Australian Bureau of Statistics in 2002 and Badan Pusat Statistik, Indonesia in 2005 to get the knowledge and experience from other countries in the compilation. In 2008, DOSM has received technical consultation from the Australian Bureau of Statistics specifically to provide a comprehensive framework for the compilation of capital stock statistics. The laborious process involves accommodating the perpetual inventory method (PIM) requirements. In 2011, capital stock statistics has been disseminated to public for the first time.

The advancement of Information and Communication Technology (ICT) is an advantage to DOSM mainly in terms of integrated digital framework system, efficiency in data management and capability of interactive statistical communication. These require an extensive modernisation particularly in ICT infrastructure & security and data management. Development of capital stock system (myCapstock) is one of the initiatives that have been identified in the Department of Statistics ICT Transformation Plan, 2015-2020.

The purpose of this paper is to document the modernisation effort taken by DOSM to overcome challenges in compiling and producing the capital stock statistics. The organisation of the paper is as follow. The first part is the brief history of the compilation in

Malaysia. Section A comprises of all the concepts and methodology used in this paper. Section B describes the modernisation phases of the compilation and the development of the myCapstock system. Section C will focus on the challenges. The concluding remarks are at the end of the paper.

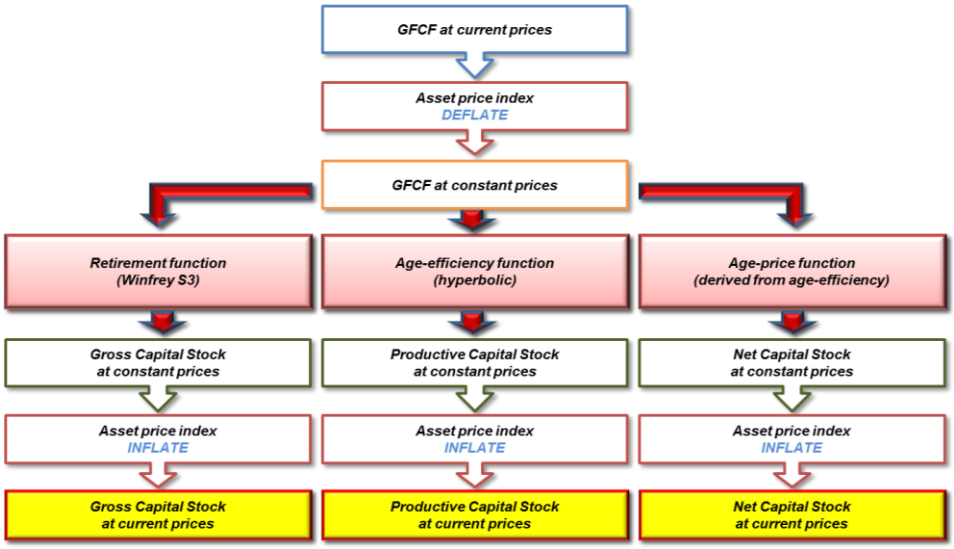
III. Modernisation in capital stock statistics compilation

A. Concepts and methodology

1. Capital stock compilation using perpetual inventory method (PIM)

The PIM is an economic model that generates an estimate of capital stock by accumulating past purchases of assets over their estimated service lives. Capital stocks statistics provides information on accumulated fixed assets and measures the wealth of the country at a particular point in time. The statistics are important to enable economists to estimate and predict economic growth and the potential output of the economy.

Diagram 1: Application of PIM (Integrated approach)



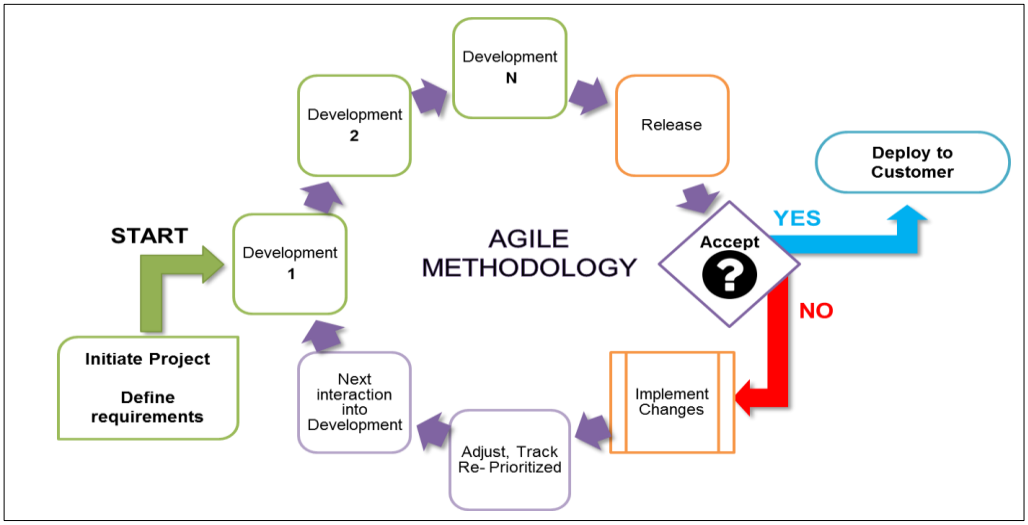
There are two approaches in applying PIM that are the traditional PIM and integrated approach. PIM integrated approach was pioneered by the United States Bureau of Labor Statistics and also used by the Australian Bureau of Statistics. PIM integrated approach is applied to estimate the capital stocks in Malaysia. The integrated approach has an advantage that all stocks and flow data are necessarily consistent with each other. The steps involved in applying the PIM are summarised in Diagram 1.

The basic requirements to apply the PIM are the time series of Gross fixed capital formation (GFCF) by kind of economic activity and type of assets, Asset price indices for the entire time series of GFCF, average asset service lives (average length of time they are used in production), retirement function (the extent to which assets are retired before, on or after the average asset lives for that asset), age-efficiency profile that refers to the asset's ability to produce a quantity of capital services for a given amount of inputs and age-price profile which describes the change (usually the decline) in the price of an asset as it ages.

2. System Development Life Cycle (SDLC).

Agile System Development Life Cycle (SDLC) is the best practice for the development of a data warehouse (DW) and business intelligence (BI) solution. With SDLC, the requirements and design phases overlap with development, thus reducing the development cycles for faster delivery. Agile lifecycle focuses on continual changing and refining based on user requirement before finalising the system development.

Diagram 2: The Agile System Development Life Cycle



3. Capital stock business process

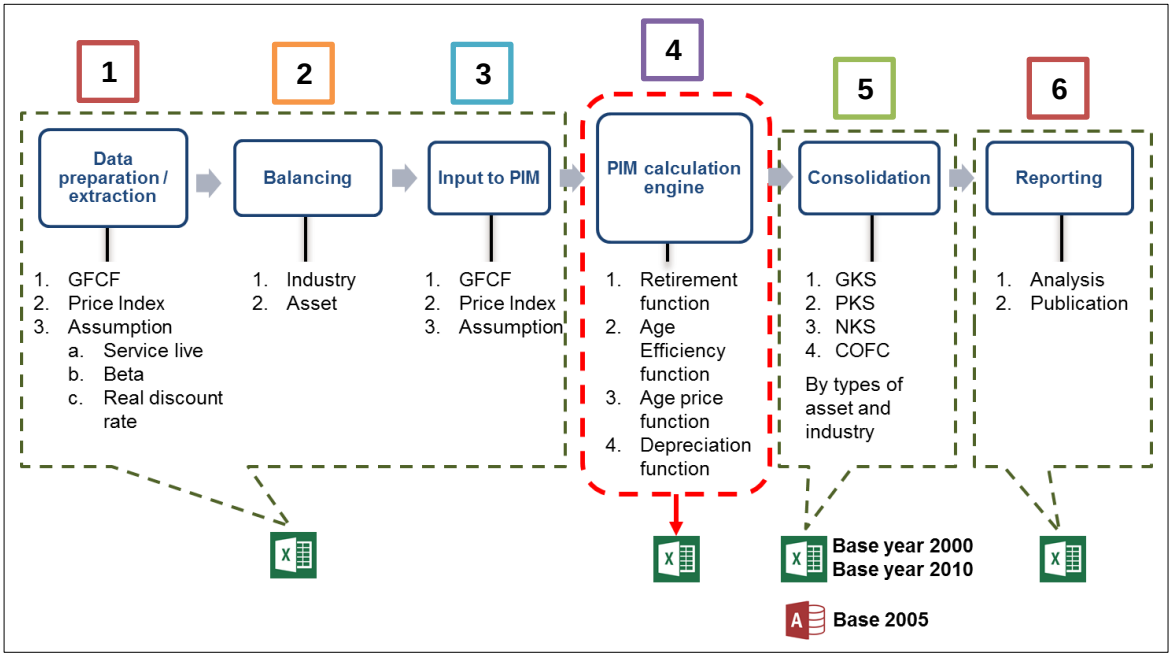
The capital stock production process starts with the extraction of data from several sources including economic census or survey databases as well as company accounts to calculate the GFCF. Then, the process of balancing GFCF by type of asset and the industry will be implemented and aligned to the requirements of PIM input. Asset price index will also be compiled according to the requirements of capital stock data generation. All the input is used in the PIM calculation to generate capital stock statistics. Generated data are consolidated and tabulated according to the requirements of analysis and publication.

4. Generation of capital stock using worksheets

The process of generating and preparing the capital stock statistics using Microsoft Excel (Ms Excel) worksheets can be divided according to the base year that is 2000, 2005 and 2010. During rebasing activity, latest recommendations, concepts and methodology for capital stock compilation will be implemented accordingly. The worksheets to generate the capital stock statistics (PIM

calculation - Process 4 in Diagram 4) will be prepared for each asset type and industry based on the improvements realised in the base year compilation.

Diagram 3: Production process of capital stock statistics



a) The base year 2000

The compilation is based on OECD Manual 2001 and 1993 SNA. The estimation of capital stock statistics using PIM for an asset in a particular industry requires 9 worksheets. The industries were aggregated by 15 main groups and each group has 9 to 12 types of assets. The PIM calculation engine used a total of 1,500 worksheets to generate the capital stock statistics. The computers are set up with 2 Gigabyte of RAM.

b) The base year 2005

The estimation of capital stock statistics for an asset in a particular industry requires 19 worksheets. The industries were aggregated by 23 main groups and each group has 9 to 18 types of assets. The total of

4,000 worksheets required for PIM calculation engine in the generation while the consolidation at aggregated level is using Microsoft Access as a database. The computers are set up with 8 Gigabyte of RAM.

c) The base year 2010

The estimation of capital stock statistics for an asset in a particular industry requires 19 worksheets. The industries were aggregated by 24 main groups and each group has 9 to 18 types of assets. The compilations are based on OECD Manual 2009 and 2008 SNA using more than 6,000 worksheets in PIM calculation engine. The worksheets are set up using Ms Excel VBA to simplify the generation and consolidation process. The computers are equipped with 16 Gigabyte of RAM.

B. Modernising the production of capital stock statistics

1. Worksheets improvement

The numbers of the worksheets are constantly increasing to meet the needs of the detailed generation of capital stock statistics. The processes of generating the capital stock start with PIM calculation for a single asset for each industry. The results of the calculations for all types of assets in each industry will be aggregated into 24 mains group for Malaysia. Any changes require repeating the generation process of all the related worksheets in sequence. The worksheets will be reviewed from time to time in terms of linking and formula used in the calculation to eliminate errors. In addition, the computers need to be upgraded frequently to accommodate and ensure the smooth generation and dissemination of capital stock statistics. DOSM regularly review the compilation process for the

worksheet and make the necessary improvements that would facilitate the production of capital stock statistics. These improvements will be implemented during the rebasing activities.

DOSM has made improvements to the production process during the rebasing of the base year 2005 by using Microsoft Access as the database to consolidate all of the capital stock statistics generated by separate worksheets. This is to accommodate the increasing number of worksheets to calculate at the detailed level of assets. The improvements also reduce the time used to consolidate the generated data.

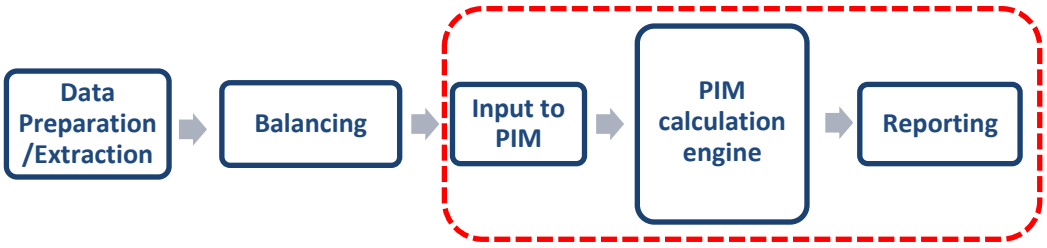
PIM calculation worksheets are set up using Ms Excel VBA to simplify the generation and consolidation process during the base year 2010. The improvement has significantly reduced the time and number of worksheets required to generate and produced capital stock statistics. However, the improvements made are limited to data generation and consolidation process. DOSM still need to perform all subsequent processes manually. Therefore, DOSM needs a system that can accommodate all the production process.

2. Development of capital stock system

The main objectives of the system are to simplify and modernise the manual compilation process starting from data generation to data presentation using systematic data visualisation. Discussions between National Accounts Statistics Division and Information Technology Division have been held regularly in relation to identifying the needs of system users. The development of the system is adopting the Agile SDLC that needs full commitment from the user of the system and the developer. Every step and stage of the development process will be

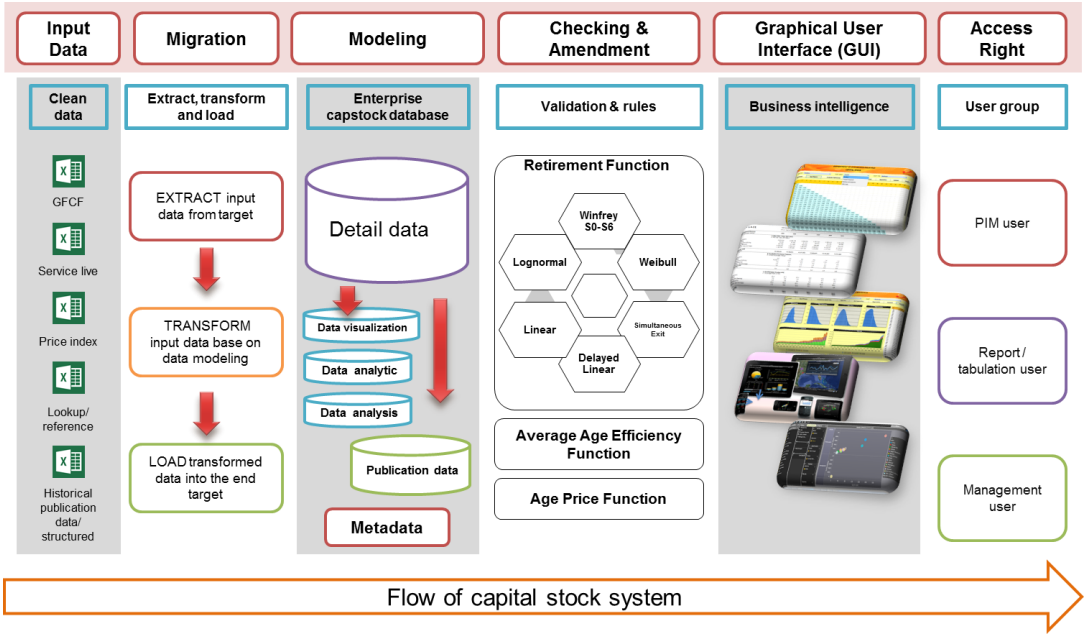
tested and approved before moving on to the next segment in development activities.

Diagram 4: Scope of capital stock system development



The Functional Design Specifications (FDS) specifies the business processes to be performed by the system and was based on the User Requirement Study (URS). The idea is to provide a uniform and integrated framework starting from the preparation of input, data migration, data model where calculation PIM is implemented, checking and amendment of the simulation to review data for six types of retirement function that are Winfrey, Weibull, Simultaneous exit, delayed Linear, Linear and Lognormal.

Diagram 5: Architecture diagram of capital stock system



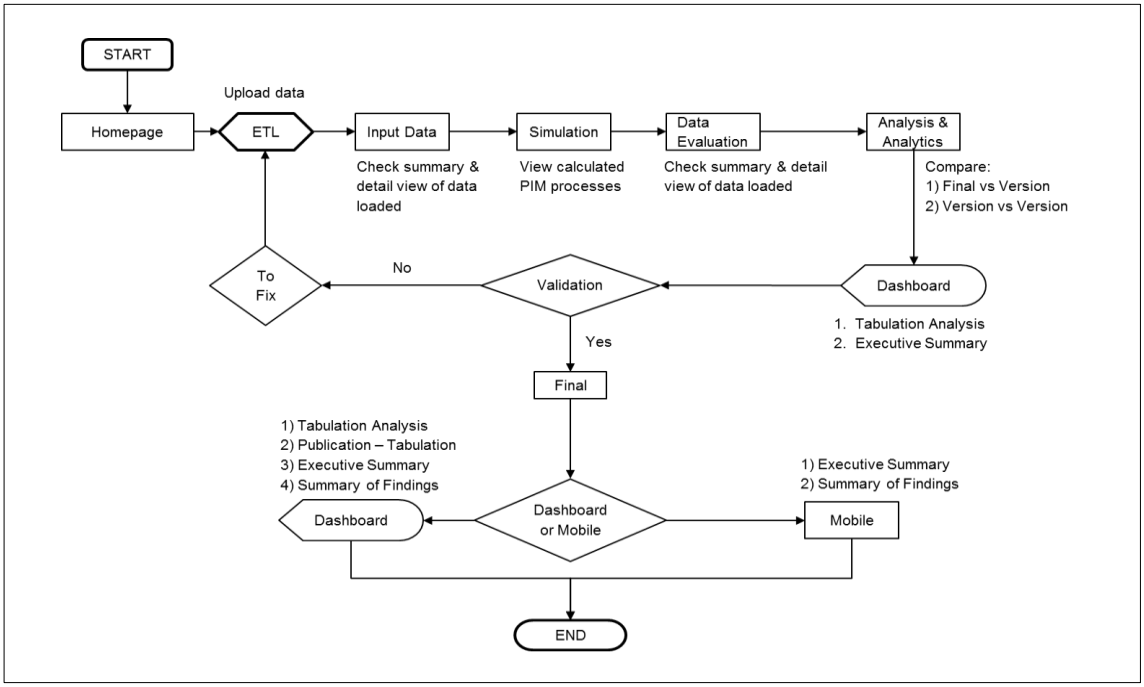
a) Capital stock system - myCapstock

The system can be accessed through the web at http://mycapstock.stats.gov.my. The system acts as a repository of knowledge on capital stock statistics framework. The system is capable of generating the capital stock statistics from the base year 2000 until the base year 2010 and able to accommodate the extension of the base year. All the generated statistics are stored in the capital stock data warehouse in the system. The infrastructure was created to ensure the development and implementations of the system are structured, consistent, and easy to use according to required standards in producing the capital stock statistics. The system is capable of performing the generation of capital stock statistics, analysis table and comprehensive data visualisation all at once. In addition, the system has the capability to do ad-hoc analysis or analytic by using existing data set or external data set concurrently.

b) Implementation of myCapstock system

The system has been completed at the end of 2016 and this year DOSM had the opportunity to produce capital stock statistics by using the system for the first time. The generation begins with the preparation of input data in MS Excel Input Template in the specified folder. The extract, transform and load (ETL) process will take place where the input file will be uploaded automatically into the database and it initiated the process of calculating PIM, data evaluation, analysis & analytics, data validation and data visualisation. All the generated statistics will be displayed on the dashboard for computer and mobile.

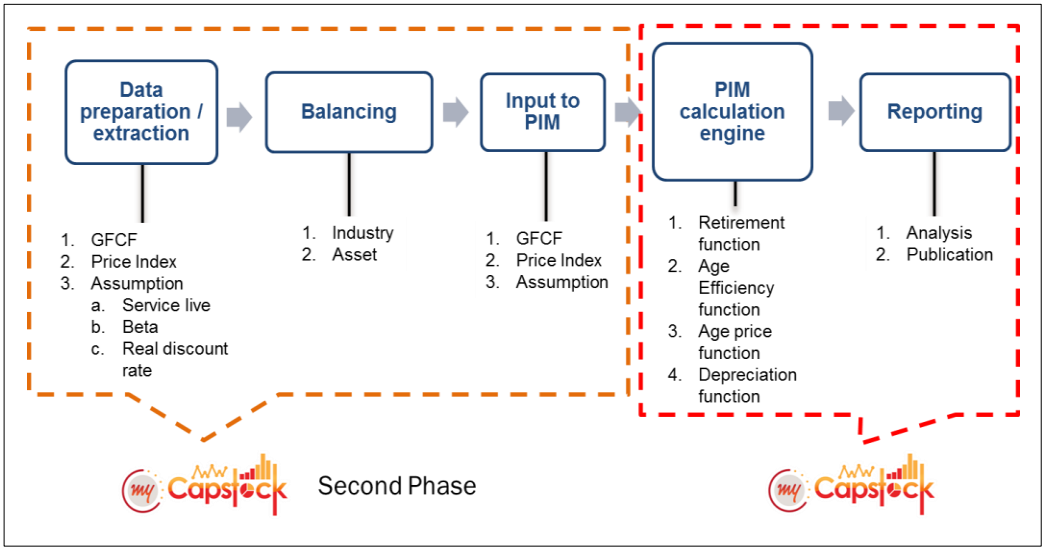
Diagram 6: The flow of myCapstock system



c) Expansion of myCapstock system

During rebasing activity, the GFCF and asset price indices will be updated and harmonised according to the new base year requirements. Preparation and harmonisation of the time series GFCF manually are tedious as all the required data will be imported to the worksheets for calculation and balancing process. In addition, existing worksheets capacity could not accommodate the growing of data. Therefore, plans are ongoing to extend the functionality of the existing system. The scopes of the development are data extraction, preparation, balancing of time series GFCF and computation of asset price indices. The expansion will be integrated with the existing system in order to complete the cycle of capital stock statistics production process.

Diagram 7: Scope of myCapstock future development



C. Challenges and critical success factor

1. Challenges

a) Knowledge

The manual processes use Ms Excel with an advanced level of knowledge to facilitate the compilation as well as maintaining the worksheets. All the calculations are carried out using a complex formula to simplify the process and to ensure the accuracy of the data. Knowledge in databases is crucial prior to any system development planning. The members of the capital stock unit have to prepare themselves with knowledge of the software in addition to the concept and methodology of capital stock statistics.

b) Harmonisation of code and classification

Capital stock statistics requires time series data of capital expenditure from all databases of economic censuses and surveys. Code and classifications used constantly changed and adjusted over time. The harmonisation of all the codes used will be the key issue in the future development of the system.

2. Critical success factor

a) Commitment

DOSM management has always supported the ideas for modernising the production process of official statistics. Modernisation can only be implemented if all parties give high commitment to achieve common objectives.

b) Capacity building

DOSM has initiated strategies by sending selected members to attend multiple courses in any related software to develop in-house expertise in maintaining the production process of official statistics. Conducted knowledge sharing sessions on selected topic on a regular basis among the members with the experienced members share their knowledge through lectures, workshops and hands-on.

IV. Conclusion

Modernisation of statistical production and services is required to stay relevance in ICT dynamic era. The modernisation effort from worksheet improvement and the development of capital stock system are based on the challenges faces over time. The challenges will make DOSM to regularly review the business processes which can be modernised in order to overcome the challenges and to improve the efficiency and ability in producing official statistics. The system will enhance the DOSM delivery in statistical services as it facilitates sharing and reuse of business processes, statistical methods and tools which reduce time, cost and human resources.

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