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**Singapore's Producer Price Indices E-Survey System (PIES)**

for

Cross-cutting topic (1) – New methods and challenges employed by NSOs post-pandemic to collect data "electronically" in lieu of in-person

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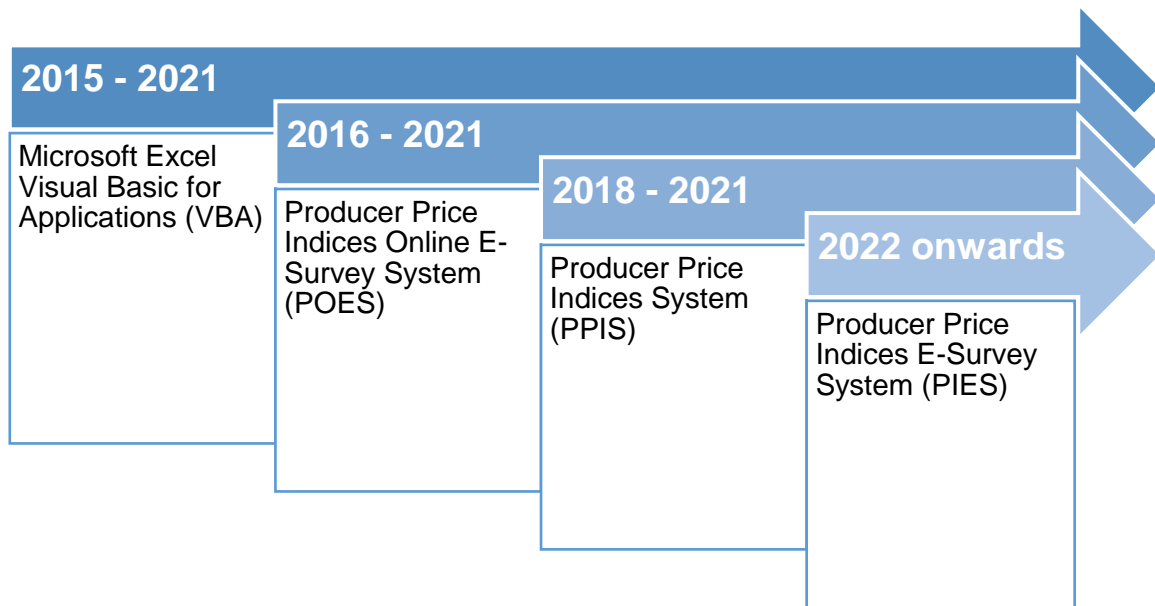
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Cross-cutting topic (1) – New methods and challenges employed by NSOs post-pandemic to collect data "electronically" in lieu of in-person

## I    INTRODUCTION

The Singapore Department of Statistics (DOS) has been compiling the International Trade and Producer Price Indices (PPI) for Goods since 1974, whereas the compilation of Services Producer Price Indices (SPPIs) began in 2007.

As part of DOS's digital transformation, we are constantly adopting and implementing digital technology to facilitate the compilation of the various price indices. Over the course of time, our operations have been supported by the following software and systems as displayed in Figure 1.

**Figure 1: Timeline of Software and Systems Used**



**2015 - 2021**
Microsoft Excel Visual Basic for Applications (VBA)

**2016 - 2021**
Producer Price Indices Online E-Survey System (POES)

**2018 - 2021**
Producer Price Indices System (PPIS)

**2022 onwards**
Producer Price Indices E-Survey System (PIES)

This paper summarises Singapore's experience in developing PIES, which is an integrated system for data collection, data processing and index compilation. The planning of PIES began in 2019, before the COVID-19 pandemic accelerated the development of PIES to allow survey respondents to submit their survey returns "paperlessly". The system went live on January 2022.

## II      SURVEY PROCESSES BEFORE COVID-19 PANDEMIC

**Overview of Producer Price Indices Online E-Survey System (POES)**

POES was developed to facilitate data collection from survey respondents. It allowed officers from DOS to generate survey forms to be sent via email and conduct surveys online. Our survey respondents could choose to provide their data by replying to the email with the completed survey form or submit their responses in POES. There were also in-built validation checks to ensure the data entered by our respondents were sensible. After which, the data collected would be transferred to the PPIS for data processing and index compilation. Figure 2 illustrates the survey process before the commencement of PIES.

**Figure 2: Survey Processes before PIES**
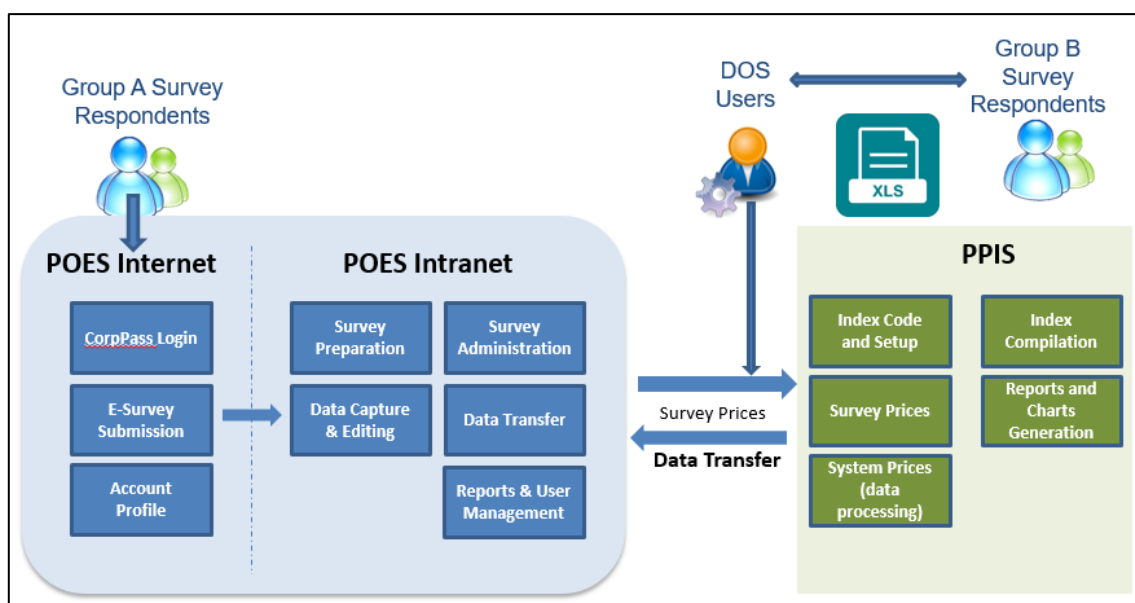


**Overview of Producer Price Indices System (PPIS)**

PPIS was a separate system to facilitate data processing and index compilation. It enabled officers from DOS to compile producer price indices based on the defined index structure using the selected index formula. Moreover, DOS officers could carry out price imputations such as carrying forward previous month's prices or applying a weighted average price change of a group of linked items within the price index.

**Limitations of POES and PPIS**

While POES and PPIS brought about several advantages to DOS's work processes, it was not efficient and cost effective due to the following factors.

As POES and PPIS were 2 separate systems developed by different vendors, resources were expended to ensure smooth communication between both systems. For example, the output files produced by POES had to be modified to meet the input requirements of PPIS to be transferred and uploaded successfully. DOS officers must also take the additional step to

verify the accuracy of data transfers between both systems. Furthermore, additional costs were incurred to host and maintain 2 systems, as well as to manage 2 different vendors.

The modules within POES were also hard coded to collect the relevant data items of the respective price indices for the specified base year. Hence, the survey forms generated by POES were not customisable to incorporate any new data items to reflect relevant changes in the industry. The lack of any customisability also resulted in costs incurred as the vendor of POES had to create bespoke modules to meet the requirements of newly developed or rebased price indices.

As a stop-gap solution to facilitate the data collection process for newly developed and rebased price indices, DOS officers wrote Visual Basic for Applications (VBA) Macros using Microsoft Excel to generate the customised survey forms externally from POES. While it was more cost effective to write VBA Macros than to engage the vendor to create bespoke modules, significant manual effort was still required by DOS officers to actively manage and debug the codes for the respective price indices. Furthermore, the data transfer issue caused by managing 2 separate databases persisted as DOS officers were required to continue preparing the output files to be uploaded into PPIS.

## III    DEVELOPMENT OF PIES

Considering the limitations of POES and PPIS, and the accelerated digitalisation exacerbated by the COVID-19 pandemic, DOS initiated the development of PIES. PIES is an amalgamation of the existing PPIS with the data collection features of POES. It is an integrated system whereby data collection, data processing and index compilation can be conducted on a single platform.

### Initial Fact Finding

In 2020, multiple meetings were held between DOS officers and the vendor for the latter to understand the constraints of the current systems (i.e., POES and PPIS). Thereafter, the vendor consolidated the requirements by DOS officers and proposed a list of enhancements to be implemented as part of PIES. These enhancements would allow for customisability and scalability to meet the needs of existing and new price indices, as well as to streamline work processes from data collection to index compilation.

### System Design and Planning

Two sessions of Usability Interview and Workshop were conducted before the new e-survey modules within PIES were developed. The aim of the workshop was to gather feedback from the survey respondents' perspective to improve the concept design and information architecture of PIES e-survey interface for Desktop and Mobile sites.

The first session involved participants from DOS who preferably had experience in handling survey respondents and/or managing e-survey systems. It focused on the following areas:
1. To gather feedback on the advantages and drawbacks while using POES;
2. To gather comments from participants regarding their first impression of the PIES e-survey concept design and the wireframe of the e-survey webpage; and
3. To participate in a closed card sorting activity to assess the category structure of the e-survey webpage.
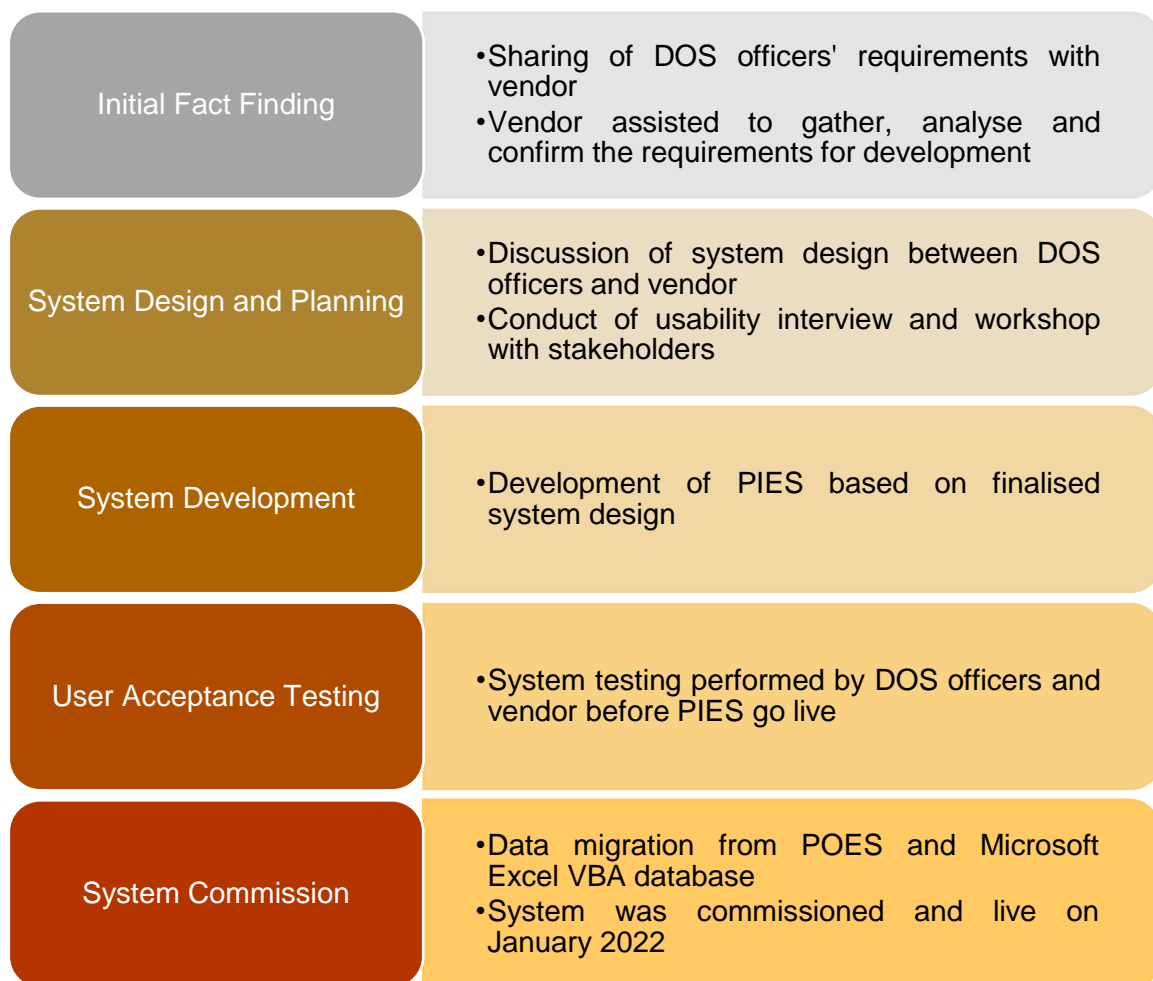
The second session involved participants who were existing survey respondents that volunteered to take part in the user experience design. A usability test was conducted, where the participants were introduced to eye tracking and hands-on experiences on the PIES e-survey interface. Subsequently, a follow-up interview was arranged with the participants to enquire on the usability of each webpage and to suggest improvements. This allowed DOS officers and the vendor to understand how the participants visually interacted with PIES e-survey interface design and whether it addressed the common navigation problems faced.

**System Development & User Acceptance Testing**

After incorporating the feedback and comments received from the Usability Interview and Workshop, the design specifications were finalised and the vendor proceeded with the development of PIES.

Upon completion of PIES development, both DOS officers and the vendor conducted a thorough user acceptance testing (UAT) to ensure that all functional specifications of PIES were met. Once all test scenarios were validated, PIES went live on January 2022. Figure 3 below provides an overview of PIES development across the various stages.

**Figure 3: Flowchart of PIES Development**

| Initial Fact Finding | •Sharing of DOS officers' requirements with vendor<br>•Vendor assisted to gather, analyse and confirm the requirements for development |
|---|---|
| System Design and Planning | •Discussion of system design between DOS officers and vendor<br>•Conduct of usability interview and workshop with stakeholders |
| System Development | •Development of PIES based on finalised system design |
| User Acceptance Testing | •System testing performed by DOS officers and vendor before PIES go live |
| System Commission | •Data migration from POES and Microsoft Excel VBA database<br>•System was commissioned and live on January 2022 |

## IV    SURVEY PROCESSES AFTER COVID-19 PANDEMIC

To date, PIES has generated significant benefits and addressed most of the limitations of POES and PPIS. It has streamlined the entire process by integrating the data collection functions with the existing data processing and index compilation functions. It is also more cost effective and saves resources by removing the need to manage 2 different systems and vendors. Data accuracy have also improved as DOS officers no longer need to modify the output and input files, which will be prone to human error. Figure 4 depicts the integrated work process following the implementation of PIES.

**Figure 4: Survey Processes with PIES**
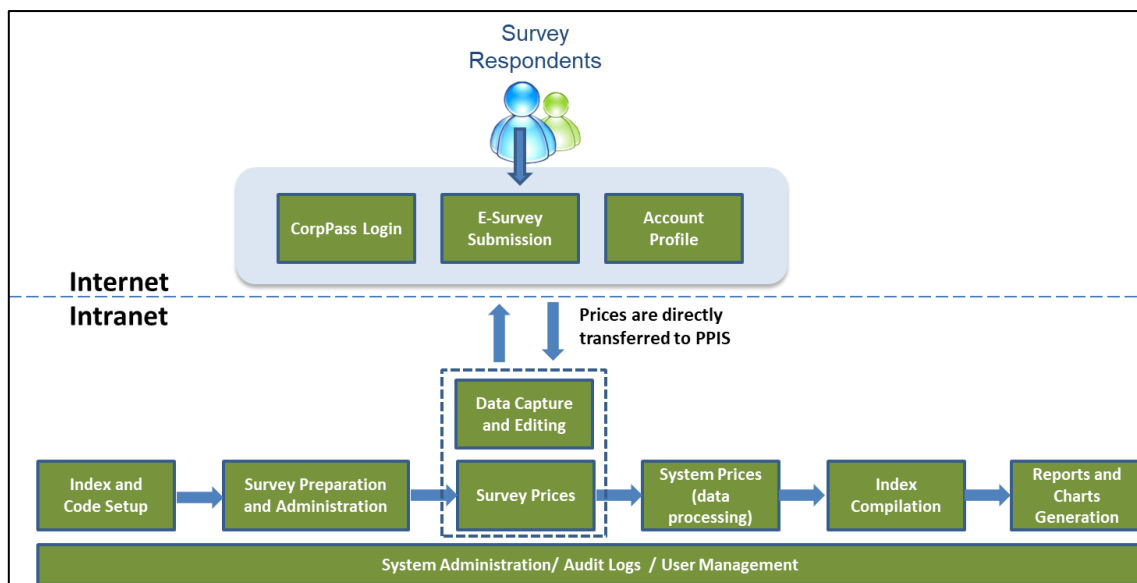


The noteworthy features that made PIES such an innovation are highlighted below:

**Customisation of Survey Form Design**

As compared to POES, where the modules were hard coded, PIES was built to be customisable and scalable. The latter allows DOS officers, instead of the vendor, to design bespoke survey forms that cater to the needs of the respective price indices and base years. Thus, this eliminated unnecessary costs incurred to develop new prices indices or to rebase existing price indices.

The Survey Item Format page allows DOS officers to configure the survey form based on the specifications of the item. As shown in Figure 5 below, DOS officers can choose to display the Remarks or the Unit of Measurement (UOM) column in the specified survey form.

**Figure 5: PIES Survey Item Format Screen**



In the Survey Template page indicated in Figure 6, DOS officers can configure the settings for e-surveys. The settings include specifying the email templates to be sent to respondents and enabling the appropriate actions (e.g., request to unlock survey, request for survey extension) to be automatically triggered by PIES.

**Figure 6: PIES Survey Template Screen**

Besides e-survey settings, DOS officers can also configure the setup of the survey form with the use of placeholders, specify the name of the Excel or PDF containing the survey form and indicate the instructions to complete the survey. Figure 7 presents the Excel survey form based on the corresponding settings indicated in Figures 5 and 6.

**Figure 7: Survey Form in Excel**



**E-Survey**

Similar to POES, PIES provides survey respondents with the option to submit their survey responses via email or online. For the former, they may fill up the softcopy survey form (Figure 7 is a sample of the Sea Freight Transport Price Survey) and email the completed copy to the designated DOS officer.

For the latter, survey respondents will be required to access PIES using their Corppass[1] accounts. Once the login is successful, they will be redirected to the online e-survey form as shown in Figure 8 below, where they can fill in the required price information. To reduce respondent burden, any data entry will be auto-saved so that survey respondents do not need to restart the entire submission if they close the page unintentionally. Simple validation checks are also embedded in the e-survey page to ensure all mandatory fields are filled. If the survey is submitted successfully, an automated acknowledgment email will be sent to the survey respondents for their record.

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[1] Corppass is the authorisation system for entities to manage digital service access of employees who need to perform corporate transactions.

**Figure 8: Online E-Survey Form**



## V     CONCLUSION

The COVID-19 pandemic has resulted in significant ripple effects to DOS's survey operations and accelerated the adoption of digitalisation in our work processes. Prior to the pandemic, DOS has already been providing survey respondents with the option to submit their survey responses "paperlessly". However, it was only during the peak of the pandemic when most workplaces were converted to remote work, that we saw a spike in the submission rate via email or e-survey. DOS officers promoted the convenience of email and online surveys since respondents were unable to access the postal surveys mailed to their office addresses during Singapore's nationwide lockdown. In addition, DOS officers had to put in additional efforts to convince a small proportion of our survey respondents given the lower digital literacy and inability to keep pace with the changing digital landscape at the time.

To date, 97 per cent of our respondents have adopted either email or e-survey as their preferred mode of survey submission. The development of PIES has brought about significant benefits to survey and work processes in DOS while providing greater convenience to our survey respondents.