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***Title of paper: Enhancement of Changes in Inventories Estimation***

## Abstract

Inventories play several roles in the economy and it related to inclusive economic growth (goal 8) of Sustainable Development Goals (SDGs). From the perspective of stocks, it provides information for monitoring trend in transportation and communication systems. From the perspective of flow transactions, changes in inventories is a component of gross capital formation that compose gross domestic product (GDP) on the demand side. As a volatile component, changes in inventories has important role in determining short term GDP growth. In Indonesia, changes in inventories is no longer treated as a residual component in the GDP compilation. However, due to the lack of the data sources comparing to other components and industries, leads it to be an unsteady component in data reconciliation process. Therefore the accurate and timely data sources needed to support the estimation. In this era, information disclosure in the internet makes the data sources to be easier to obtain, such as corporate financial statement and news from online media. In current estimation, we use surveys and administrative data as data sources in compiling changes in inventories. We also use corporate financial statements that downloaded from Indonesian Stock Exchanges (IDX) in portable document format (PDF) form. The data also accompanied by supporting information that collected in online media. However, this method needs many resources in the implementation. To resolve this issue, we develop a system that crawling the corporate financial statement data from IDX website to estimate the value of changes in inventories. We also crawl news from online media to collect supporting information. This system allows us to produce the value and supporting information of changes in inventories in more effective and efficient method.

Keywords: changes in inventories, administrative data, crawling

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## II. INTRODUCTION

Inventories consist of goods and services held by the units that managed them for the purpose of being further processed, sold, or used in other ways-such as intermediate inputs. Inventories can be owned by companies, governments, Non-Profit Institutions Serving Households (NPISHs), and household (unincorporated enterprises within households). It consists of materials and supplies, work-in-progress, finished goods, military inventories and goods for resale which exists because of the difference between the amount of goods produced and used, price speculation, etc. Inventories provides information for monitoring trend in transportation and communication systems.

From the perspective of flow transaction, changes in inventories affects national accounts aggregates on production, incomes and uses. In other words, it affects the estimates of GDP by production, income and expenditure approaches. From the expenditure approach, changes in inventories is a component of gross capital formation that has volatile movement. It is an important determinant of short term variations in GDP growth (Eurostat-OECD, 2017). With regard to the contribution of inventory changes to short-term fluctuations in output, changes in inventories appear to be an important factor driving output volatility in the short term (European Central Bank, 2003).

Achieving inclusive and sustainable economic growth as goal 8 in Sustainable Development Goals (SDGs) must be supported by a good quality data. As one of GDP components, data on changes in inventories are notoriously unreliable because of measurement problems and conceptual issues (Rougemont, 2011). In Indonesia case limitations of changes in inventories data particularly lies on the data sources, therefore it needs to be improved.

Conceptually, national accounts data on changes in inventories are measured by the value of entries less the value of withdrawals and the value of any recurrent losses of goods held in inventories. However in practice, data sources are still incomplete and has a long lag. It causes changes in inventories values often revised and being a balancing

component in the national accounts data compilation. In some cases, this treatment causes volatility on estimation of changes in inventories.

To resolve this issue, it is necessary to improve the quality of inventories data compilation. The improvement can be done from various sides, such as completing coverage, increasing data sources, using more accurate calculation methods, and improving data processing methods. In Indonesia case, improving changes in inventories data quality become more important to meet the needs of national balance sheet preparation and Supply and Use Table (SUT) compilation that will be compiled annually.

This paper aims to explain the current compilation of changes in inventories data and its improvement from various sides, particularly in data sources. This paper also describes the process of developing web scraping technology to obtain financial reports data and other supporting data more efficiently. In addition, this paper also states forward efforts to achieve better changes in inventories data.

### **III. CURRENT COMPILATION**

The principles underlying the recording of changes in inventories are explained in the System of National Accounts, 2008 (2008 SNA). Inventories are produced assets that consist of goods and services, which come into existence in the current period or in earlier period, and that are held for sale, use in production or other use at a later date. While changes in inventories are measured by the value of the entries into inventories less the value of withdrawals and less the value of any recurrent losses of goods held in inventories during the accounting period (2008 SNA: 10.12, 10.118).

In general, the inventories consists of five components: (1) materials and supplies; (2) work-in-progress; (3) finished goods; (4) military inventories; (5) goods for resale (Eurostat-OECD: 2017). In the manufacturing entity, inventories are categories as follows: (1) finished goods; (2) work-in-progress; (3) consumable stores; (4) raw material (IASB Foundation: 2009)

A lag generally exists between production or acquisition and use of products (Shrestha and Segismundo, 2003). It causes some goods or services become inventories and sold or used in another time. 2008 SNA Paragraph 3.178 explained about the time recording of inventories. Additions to inventories are recorded when products are purchased, produced or otherwise acquired. Deductions from inventories are recorded when products are sold, used up as intermediate consumption or otherwise relinquished.

The valuation of inventories is different for each kind of inventories. 2008 SNA paragraph 13.39 explains that inventories of materials and supplies are valued at purchasers' prices, inventories of finished goods and work-in-progress are valued at basic prices, while inventories of goods intended for resale without further processing by wholesalers and retailers are valued at prices paid for them, excluding any transportation costs that have been separately invoiced to the wholesalers or retailers and included in their intermediate consumption. Paragraph 6.108 also explained that goods entering inventories are valued at the basic prices prevailing at that time and the goods withdrawn from inventories are valued at the basic prices prevailing at that time.

Most countries use enterprise surveys as their main data source when compiling annual estimate of inventories. Additionally, tax data from administrative sources or financial reports are frequently used as a supplementary source of data (Eurostat-OECD, 2017). At current condition, there are various data sources that used for the calculation of changes in inventories in Indonesia. It includes annual manufacturing surveys, annual financial report of public enterprises, annual financial report of state enterprises, and annual enterprise surveys for compiling inventories data. The supporting data sources to explain the direction and value of changes in inventories comes from news and articles that obtained from online media. That news and articles is usually related to the supply of strategic commodities that concern to the government. These commodities include rice, coal, sugar, oil, and others.

There are several limitations that carried out in current condition. It comes from data sources, coverage, and calculation methods. The data coverage have not been comprehensive. The data is particularly obtained from enterprises, while its coverage does not have a good representation from total economy. In addition, the response rate for annual manufacturing surveys tends to be low, so the data cannot describe the whole population. The lag in availability of the data is also exists as a problem in current condition. Furthermore, the types of inventory commodities recorded in the financial report are not as detailed as those required in the compilation of the Supply and Use Table (SUT).

Estimating changes in inventories can be classified in three ways. There are transforming accounts data on changes in inventories into national accounts, direct estimation, and commodity supply-demand method (Eurostat-OECD, 2017). In Indonesia case, transforming accounts data on changes in inventories into national accounts is mainly used because the main data sources for estimating changes in inventories comes from financial report. The limitation from the calculation methods that are conducted now is the use of inventory data of enterprises that is not differentiated based on the inventory valuation method used by each enterprise. The valuation methods include Last in First Out (LIFO), First in First Out (FIFO), or other methods.

Another limitation found is the inefficiency in data acquisition. Financial report of public enterprises is obtained by downloading them in the Indonesia Stock Exchanges (IDX) website. In the other side, the financial report of own-stated enterprises is obtained

from the Own-Statement Enterprises Ministry. The financial report is in PDF or XLS format that have to be entered one by one into the worksheet. With a large number of companies, which is around 600 companies, so that considerable resources are needed.

Due to several limitations in current condition, it causes changes in inventories becomes a component that is often revised and becomes a balancing component in the compilation of national accounts. Therefore the improvement is needed to get a better estimation.

#### **IV. IMPROVEMENT PROGRESS**

Improvement in calculation of changes in inventories is carried out from various sides, include the scope of data sources, the calculation methods, and the efficiency of data acquisition. The data sources used in this process are more extensive. The development of the calculation method lies in the method to obtain the total economic inventories value from the indicator ratio of inventory to output. The efficiency of data acquisition is done by utilizing technological developments to obtain financial report and news related to inventories through online media more quickly. The steps to get the estimation of changes in inventories is depicted in Figure 1.



The main data sources used is covering almost all institutional sectors. The data sources include data from the 2016 economic census that describe enterprises inventories and household inventories, annual household business survey that describe household inventories, and annual Non-Profit Institutions Serving Households (NPISHs) survey that describe NPISHs inventories. Based on data from the economic census, the number of small, medium and large companies reaches around 26 million businesses. This census is conducted every 10 years.

Table 1. Position of Inventories by Category of Industries in Indonesia, 2016 (2016 Economic Census)

INDUSTRY	ECONOMIC CENSUS 2016	
	Value (In Billion Rp)	Percentage
A. Agriculture, Forestry and Fishing	214.394	24,2%
B. Mining and Quarrying	6.498	0,7%
C. Manufacturing	278.743	31,4%
D. Electricity and Gas	5.909	0,7%
E. Water supply, Sewerage, Waste Management and Remediation Activities	2.034	0,2%
F. Construction	18.888	2,1%
G. Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles	183.698	20,7%
H. Transportation and Storage	18.298	2,1%
I. Accommodation and Food Service Activities	8.812	1,0%
J. Information and Communication	7.868	0,9%
K. Financial and Insurance Activities	153	0,0%
L. Real Estate Activities	71.785	8,1%
M,N. Business Activities	45.370	5,1%
P. Education	9.962	1,1%
Q. Human Health and Social Work Activities	1.399	0,2%
R, S, T, U. Other Services Activities	13.880	1,6%
TOTAL	887.691	100,0%

The comparative data that used includes administrative data and supporting data from online media. Administrative data includes financial report of public enterprises, financial report of own-stated enterprises, and financial report of private companies registered in the Ministry of Trade. The financial report of go public enterprises is obtained from the Indonesia Stock Exchanges (IDX) website, while the financial report of state-owned enterprises are obtained directly from the Ministry of State-Owned Enterprises. The financial report of private companies registered in the Ministry of Trade are new data source obtained from the collaboration between BPS Statistics Indonesia and the Ministry of Trade. The number of company for each sources is 516 go public companies, 109 state-owned companies and 1.855 other private companies. The combination of them used as comparative data for the 2016 economic census data.

Table 2. Position of Inventories by Data Sources and Category of Industries in Indonesia, 2016 (In Billion Rp)

INDUSTRY	DATA SOURCES			
	REGISTERED COMPANIES FROM MINISTRY OF TRADE	PUBLIC ENTERPRISES	STATE-OWNED ENTERPRISES	HOUSEHOLD
A. Agriculture, Forestry and Fishing	14.415	6.793	23.310	4
B. Mining and Quarrying	21.439	11.067	74.290	0
C. Manufacturing	778.884	178.234	15.177	1
D. Electricity and Gas	855	492	12.444	0
E. Water supply, Sewerage, Waste Management and Remediation Activities	188.169	0	3	0
F. Construction	2.234	28.691	6.412	0
G. Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles	685.179	43.674	11.170	9
H. Transportation and Storage	3.372	3.144	2.762	1
I. Accommodation and Food Service Activities	348	5.133	8	1
J. Information and Communication	805	31.885	232	0
K. Financial and Insurance Activities	38.793	1.385	954	0
L. Real Estate Activities	31.175	136.802	1.092	0
M,N. Business Activities	1.560	4.124	16	0
P. Education	0	0	0	0
Q. Human Health and Social Work Activities	116	277	0	0
R, S, T, U. Other Services Activities	206	160	2	0
<b>TOTAL</b>	<b>1.767.552</b>	<b>451.862</b>	<b>147.870</b>	<b>16</b>

Table 3. Distribution of Inventories by Data Sources and Category of Industries in Indonesia, 2016 (what are the data sources in this Table)

INDUSTRY	DATA SOURCES			
	REGISTERED COMPANIES FROM MINISTRY OF TRADE	PUBLIC ENTERPRISES	STATE-OWNED ENTERPRISES	HOUSEHOLD
A. Agriculture, Forestry and Fishing	0,8%	1,5%	15,8%	24,2%
B. Mining and Quarrying	1,2%	2,4%	50,2%	0,0%
C. Manufacturing	44,1%	39,4%	10,3%	7,0%
D. Electricity and Gas	0,0%	0,1%	8,4%	0,1%
E. Water supply, Sewerage, Waste Management and Remediation Activities	10,6%	0,0%	0,0%	0,0%
F. Construction	0,1%	6,3%	4,3%	0,9%
G. Wholesale and Retail Trade; Repair of Motor Vehicles and Motorcycles	38,8%	9,7%	7,6%	53,5%
H. Transportation and Storage	0,2%	0,7%	1,9%	4,2%
I. Accommodation and Food Service Activities	0,0%	1,1%	0,0%	5,2%
J. Information and Communication	0,0%	7,1%	0,2%	0,1%
K. Financial and Insurance Activities	2,2%	0,3%	0,6%	0,0%
L. Real Estate Activities	1,8%	30,3%	0,7%	2,6%
M,N. Business Activities	0,1%	0,9%	0,0%	0,4%
P. Education	0,0%	0,0%	0,0%	0,0%
Q. Human Health and Social Work Activities	0,0%	0,1%	0,0%	0,2%
R, S, T, U. Other Services Activities	0,0%	0,0%	0,0%	1,7%
TOTAL	100,0%	100,0%	100,0%	100,0%

The main data and comparative data above are used to obtain an estimated total economic of changes in inventories in 2016. For estimation in the following years, the main data in the form of economic census data is no longer available, so another method is needed to obtain the data. Enterprises inventories data can be estimated by utilizing indicators that can be obtained from financial report of???? public enterprises, state-owned enterprises and other private companies. The indicator used is the ratio of inventory to output. The ratio of inventory to output is break down by category of industries. The total economic of inventory can be obtained by applying the ratio to total output that break down by category of industries.

Furthermore, estimation of changes in inventories by commodities is carried out by utilizing enterprises survey for compiling inventories data. This survey is conducted annually. In this survey information that collected is about the inventories that the company has according to the type of commodity. Although this survey is purposive, the structure of the inventories by the type of commodity that produced can be used to break down the total economic of inventory.

In preparing the estimation of changes in inventories by type of commodity, other data are also used as comparative data. The comparative data is administrative data that present inventories data of certain commodities. The commodities include livestock data and other strategic commodities data, such as rice, sugar, grain, etc.

After the value of the inventories position both in total and break down by the type of commodity is obtained, the value of changes in inventories can be calculated by the deflation method. The position of inventories value that has been obtained is then divided by the corresponding year-end indices to obtain position of inventories value at constant price. Then changes in inventories at constant prices can be obtained by calculating the difference in inventories position at constant prices from two consecutive periods. Then changes in inventories at current prices can be obtained by multiplying changes in inventories at constant prices with corresponding annual average indices. The result of calculation in changes in inventories shown in Table 4.

Table 4. Changes in Inventories of Some Commodities in Indonesia, 2016

COMMODITY	Value (In Billion Rp)	Percentage
Seasonal Crop Farming	146	1,0%
Annual Crop Farming	-639	-4,2%
Livestock	-371	-2,4%
Coal	-8.031	-52,4%
Footwear	6	0,0%
Chemical Material	-166	-1,1%
Plastic Goods	-1.968	-12,9%
Furnitures	5	0,0%
Grain Milling Product	-7.113	-46,43%
Petroleum Mining Product	4	0,03%

Improvements in the efficiency of the data acquisition is done by utilizing technological developments. This improvements used to obtain financial report data and news related to inventories from online media. Previously, the acquisition of these data was done manually and need a long time. By utilizing the crawling methods, these data can be obtained faster. Therefore the data compiler can focus on estimating rather than collecting data.

To support the value of changes in inventories by commodity, the supporting information is needed to explain the direction of changes in inventories. Crawling system

with python language is developed to get an effective way to collect news related to inventories from online media. According to the <https://www.alexa.com> website, the 6 largest online media in Indonesia include [tribunnews.com](http://tribunnews.com), [detik.com](http://detik.com), [okezone.com](http://okezone.com), [liputan6.com](http://liputan6.com), [sindonews.com](http://sindonews.com), and [kompas.com](http://kompas.com). In order to get relevant news, crawling system use these 6 online media and several keywords. The keywords are shown in Table 5.

Table 5. Keyword in Google Search Engine Crawler

KEYWORDS	
detik.com persediaan beras desember 2016	liputan6.com persediaan beras desember 2016
detik.com persediaan minyak bumi desember 2016	liputan6.com persediaan minyak bumi desember 2016
detik.com persediaan minyak sawit desember 2016	liputan6.com persediaan minyak sawit desember 2016
tribunnews.com persediaan beras desember 2016	sindonews.com persediaan beras desember 2016
tribunnews.com persediaan minyak bumi desember 2016	sindonews.com persediaan minyak bumi desember 2016
tribunnews.com persediaan minyak sawit desember 2016	sindonews.com persediaan minyak sawit desember 2016
okezone.com persediaan beras desember 2016	kompas.com persediaan beras desember 2016
okezone.com persediaan minyak bumi desember 2016	kompas.com persediaan minyak bumi desember 2016
okezone.com persediaan minyak sawit desember 2016	kompas.com persediaan minyak sawit desember 2016

Python language and google search engine module is powerful combination to build crawler system to collect the data from 6 online media sources. The following figure is a code description to make the google search engine crawler and get scrape its content of online media in python language.

```

googlesearchnews.py x
1 from google import google
2 import urllib
3 from bs4 import BeautifulSoup
4
5 def google_scrape(url):
6     thepage = urllib.request.urlopen(url)
7     soup = BeautifulSoup(thepage, "html.parser")
8     title = soup.title.text
9     #detikcom
10    time = soup.find("div", {"class": "date"}).text
11    news = soup.find("div", {"id": "detikdetailtext"}).text
12    #tribunnews
13    time = soup.find("time", {"class": "grey"}).text
14    news = soup.find("div", {"class": "txt-article"}).text
15    #okezone
16    time = soup.find("div", {"class": "namerap"}).text
17    news = soup.find("div", {"id": "content"}).text
18    #liputan6
19    time = soup.find("time", {"itemprop": "datePublished"}).text
20    news = soup.find("div", {"class": "article-content-body__item-page"}).text
21    #kompas
22    time = soup.find("div", {"class": "read_time"}).text
23    news = soup.find("div", {"class": "read_content"}).text
24    result = '~time~'+time+'~title~'+title+'~news~'+news
25    return result
  
```

Figure 2. Code to Scrape News Article about Inventories

The result from this crawling process shown in Table 6. It is divided into some variables, such as URL, Date Time, Title, and Content of News.

Table 6. News Related to Inventories of Some Commodities in Indonesia, 2016

No	URL	Date Time	Title	News
1	<a href="https://finance.detik.com">https://finance.detik.com</a>	Selasa, 02 Jan 2018 14:16 WIB	BPS: Harga Beras di Penggilingan Naik Selama Desember	Jakarta - Harga beras medium selama November ke Desember 2017 di penggilingan Rp 9.526, naik dari se
2	<a href="https://finance.detik.com">https://finance.detik.com</a>	Senin, 01 Feb 2016 12:22 WIB	Harga Beras Naik, BPS Peringatkan Pemerintah	Jakarta - Lonjakan harga beras menjadi salah satu pemicu inflasi Januari 2016 yang tercatat sebesar
3	<a href="https://finance.detik.com">https://finance.detik.com</a>	Selasa, 07 Feb 2017 07:04 WIB	Benarkah Minyak RI Habis 12 Tahun Lagi?	Jakarta - Banyak data yang menyebutkan cadangan minyak Indonesia tinggal 3,6 miliar barel, dan akan
4	<a href="https://finance.detik.com">https://finance.detik.com</a>	Senin, 05 Des 2016 11:40 WIB	Bos Medco: Eksplorasi Migas di Timur Tengah dan Afrika Utara Melimpah dan Murah	Jakarta - Meningkatnya konsumsi bahan bakar minyak dalam negeri mendorong adanya peningkatan penemuan
5	<a href="http://www.tribunnews.com">http://www.tribunnews.com</a>	Selasa, 20 Desember 2016 12:46 WIB	Jawa Timur Amankan Stok Beras Sampai Juli 2017 - Tribunnews.com	TRIBUNNEWS.COM, MALANG- Stok beras untuk kebutuhan warga Jawa Timur masih aman hingga Juli 2017 den
6	<a href="http://www.tribunnews.com">http://www.tribunnews.com</a>	Minggu, 4 Desember 2016 07:43 WIB	Cadangan Minyak di Indonesia Diprediksi Habis 12 Tahun Lagi - Tribunnews.com	TRIBUNNEWS.COM, JAKARTA - Cadangan minyak di perut bumi Indonesia, tanpa ada eksplorasi baru, dipred
7	<a href="http://www.tribunnews.com">http://www.tribunnews.com</a>	Sabtu, 29 Oktober 2016 11:26 WIB	Cadangan Terus Menipis, Indonesia Tak Lagi Kaya Minyak - Tribunnews.com	TRIBUNNEWS.COM, JAKARTA - Satuan Khusus Pelaksana Kegiatan Usaha Hulu Minyak dan Gas Bumi (SKK Mig
8	<a href="http://www.tribunnews.com">http://www.tribunnews.com</a>	Rabu, 7 Desember 2016 17:12 WIB	Industri Minyak Kelapa Sawit Indonesia Diserang Isu Lingkungan, Ini Latar Belakangnya - Tribunnews.com	TRIBUNNEWS.COM, JAKARTA - Industri kelapa sawit di Indonesia mengalami pertumbuhan yang sangat pesat

Another improvement in data acquisition that conducted is developing a system to get the financial report data of public enterprises from Indonesia Stock Exchange (IDX) website automatically. IDX provide information in several format, such as .pdf, .xlsx, and .zip. IDX also implement financial report with XBRL-based. Extensible Business Reporting Language (XBRL) is an electronic communication language that is universally used for the transmission and exchange of business information, which enhances the process of preparation, analysis and accuracy for various parties that provide and use business information. The benefit of using XBRL is to improve efficiency, speed and automate data processing that can support the analysis process and the quality of information that will be used for corporate decision making.

The method that has been developed is utilizing extraction data from IDX in the XBRL format. We create function to extract company names, currencies, currency units, position of inventories value, and output value. Based on crawling data from IDX website, the number of enterprises that have implemented the XBRL format in 2016 is 190. While the total number of public enterprises in 2016 is around 500. Thus, the number of reports in XBRL format is less than half of the total report. But in the following years, this method can be applied because more enterprises are using the XBRL format.

## **V. FORWARD EFFORT**

The improvement in the compilation changes in inventories data carried out at this time still has several things that can still be developed and improved. One of them that can be developed and improved is data sources. Improving data sources are prioritized for administrative data.

Expansion of administrative data can be carried out by entering into agreements with relevant ministries. For now, the administrative data that has been obtained is the financial report of private companies registered in the Ministry of Trade. The number of companies registered in the Ministry of Commerce is around 2.000 companies. The last updated data from the financial report is data for 2016. This collaboration must be maintained to obtain the relevant company's financial statement data continuously.

In addition, the data sources that still unavailable is government inventories data. Government inventories data is managed by the Ministry of Finance. They have an off-line application of inventories government and it must be reconciled every semester with data from government property goods report and government financial account. This data is on-line managed so it tends to be easy to process. Thus, an agreement with the Ministry of Finance is needed to obtain the data. In addition, we are also identifying inventories data that can be obtained from other ministries, such as oil and gas supplies, forest product supplies, and other supplies.

Other improvement was made to enterprises survey for compiling inventories data. The improvement was made in terms of the number of samples. For survey that conducted in 2019, the number of samples has increased from around 2.000 companies to 10.000 companies. With the addition of this number, it is expected that the more accurate indicators can be obtained.

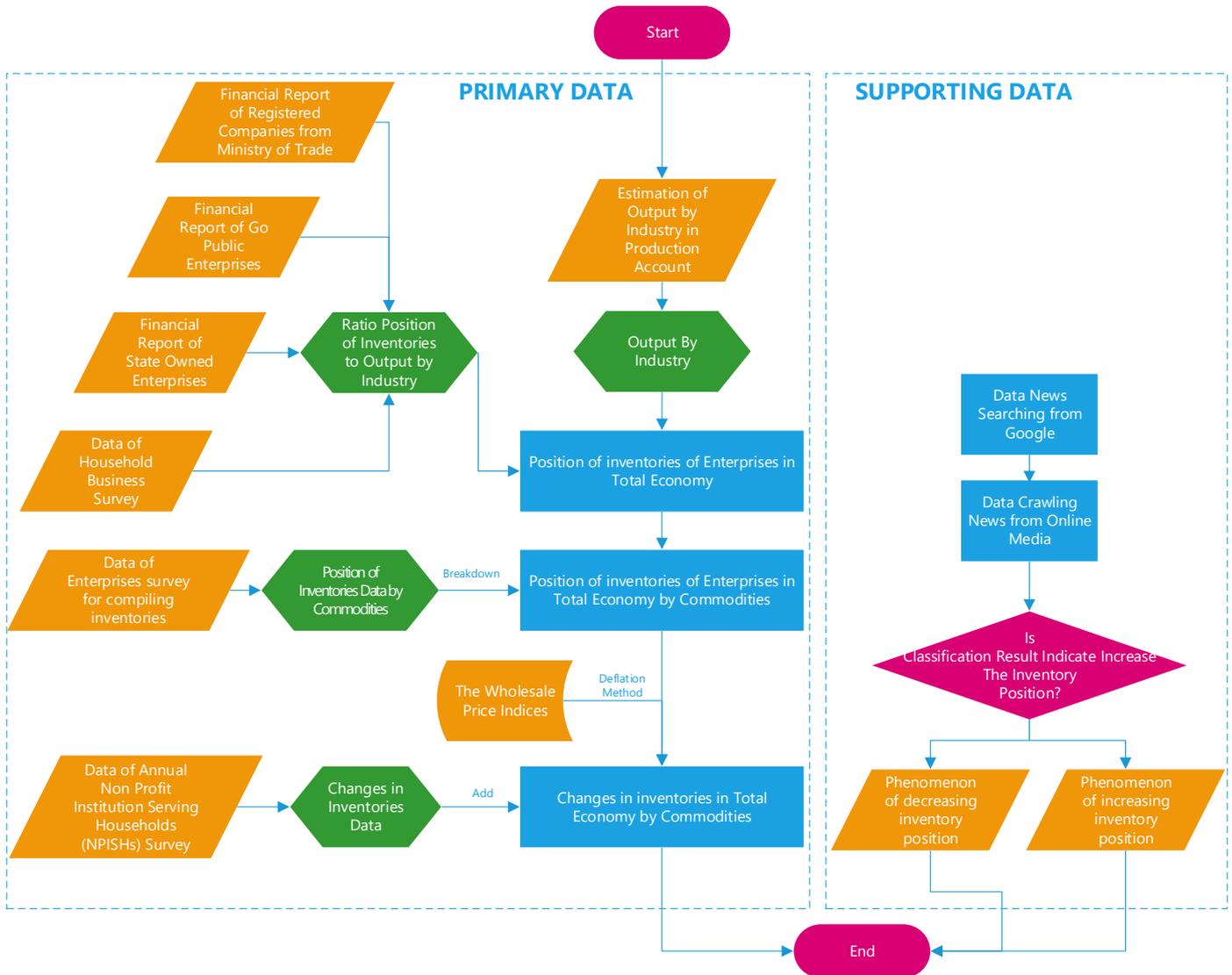


Figure 3. Flowchart for Upcoming Estimation of Changes in Inventories

**Your conclusions:**

Review the main objectives of the paper. What exactly are you trying to achieve. Your conclusions should reflect this. I don't think your objective was to determine which industry holds the most inventories. Your paper is simply trying to use alternative methods to inventory estimation. What conclusions do you draw from the use of alternative method relative to traditional methods. This would add more value and be the main pillar of your paper.

**VI. CONCLUSIONS**

1. The improvement in changes in inventories data compilation expected to provide a more reliable estimation in a more efficient way. It produces initial data to be reconciled in the 2016 SUT framework and the following years.
2. The forward effort that have to should be carried out is expanding data sources, particularly for administrative data. The data can be obtained by making agreements with relevant ministries and institutions that provide it.
3. The development of an automatic online media classification system is needed to support the estimation of changes in inventories value.
4. The result of the study should be improved with consecutive research in related topic particularly in estimating quarterly changes in inventories data.

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