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Improving Indonesia's Food Statistics through the Area Sampling Frame Method

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GLOSSARY

BPS :	*Badan Pusat Statistik* (BPS – Statistics Indonesia, the Central Statistics Agency, formerly the Central Bureau of Statistics)
ASF :	Area Sampling Frame; Method for crop area and yield or production estimation using area frame as the statistical unit
Secondary Crops :	Palawija; A classification of agricultural crops other than rice paddy, such as corn, soybeans, peanuts, green beans, cassava, and sweet potatoes.
MoA :	Ministry of Agriculture *(Kementerian Pertanian)*
Crop-Cutting Survey :	*Survei Ubinan*
District Agriculture Office :	*Dinas Pertanian Kabupaten*
City Agriculture Office :	*Dinas Pertanian Kota*
Agricultural Statistics :	*Statistik Pertanian (SP)*
KCD Panen) :	Koordinator Cabang Dinas (KCD)/Agricultural Extension Officer of Subdistrict.
Village Officials :	*Aparat desa*
Harvest Areas :	Gross harvest area
Nett Harvest Area :	Gross harvest areas minus size of bunds
KSK :	*Koordinator Statistik Kecamatan*; Sub-District Statistic Coordinator; A functional officer that collects statistic field data and coordinate statistic activities
GKG : *(Gabah Kering Giling)*	Dry unhusked paddy ready for milling with water content around 14%
SIMTP :	*Sistem Informasi Manajemen Tanaman Pangan*; Food Crop Management Information System.
Galengan :	A line that has a specific function to separate different set of crop areas
GKP : *(Gabah Kering Panen)*	Harvested unhusked paddy with water content between 25-30%.
ARAM :	*Angka Ramalan*; forecasted figures
FMS :	*Forum Masyarakat Statistik*; Community Statistics Forum; discusses recommendations and consideration related to statistic aspect to institutions
IP :	*Indeks Pertanaman*; Intensity Index; A method for quantify cropping intensity
KATR/BPN :	*Kementerian Agraria dan Tata Ruang/Badan Pertanahan Nasional*; Ministry of Agrarian and Spatial Planning/the National Land Agency
T-Test :	A specific hypothesis testing method based on inferential statistic
Coordinating Ministry for Economic Affairs :	*Kemenko Perekonomian*
PIPA :	*Pendataan Industri Penggilingan Padi*; A census held by BPS related to the rice processing industry

Bulog : *Badan Urusan Logistik* (the national food logistics agency)

Susenas : *Survei Sosial Ekonomi Nasional*; National Socio-Economic Survey

SKB : *Survei Konsumsi Beras Nasional*; Indonesian national rice consumption survey for rice consumption data, collected and published by BPS

ST-2013 : *Sensus Pertanian 2013*; Agricultural Census that conducted by BPS in 2013

SLPLLTP : *Survei Luas Panen dan Luas Lahan Tanaman Pangan*; Harvest Area and Area of Food Crop Survey that conducted by BPS

GPS : Global Positioning Survey

SKCB : *Survei Kajian Cadangan Beras*; Rice Reserve Study Survey

Horeka : *Hotel, Restoran, dan Katering*; An abbreviation for Hotel, Restaurant, and Food Catering

GIS : Geospatial Information System

BPPT : *Badan Pengkajian dan Pengembangan Teknologi*; Indonesian Agency for the Assessment and Application of Technology

NASS : National Agricultural Statistics Service; A statistic institution from U.S. that conducts surveys related to agricultural issues

Polygon : One of three feature types – others are line and point – with which almost all spatial data is depicted in GIS

USDA : U.S. Department of Agriculture; A cabinet-level agency that oversees the American farming industry

FAO : Food and Agriculture Organization; A specialized agency of the United Nations that leads international efforts to defeat hunger

PDB : *Pendapatan Domestik Bruto*; Gross Domestic Product

Backcasting : Method to defining desirable future by looking back to the past retrospectively

SSN : *Sistem Statistik Nasional*; National Statistic System

NBM : *Neraca Bahan Makanan*; Balance of Food Materials; Serve a big picture of supply and usage of food in a region within a specific time frame

INTRODUCTION

One of the sources of policy bias against food commodities in Indonesia, particularly rice and secondary crops, is the low level of data accuracy. This situation has led to a surge in policy costs, both in economic and political terms. A paradigmatic example is the implementation of rice import policies that oftentimes provoke widespread public debate, when at the time official data show a relatively large surplus in national production. In 2018, for instance, despite national rice production surplus surpassing 10 million tons, the realized rice import figures reached 2.25 million tons.

This paper specifically addresses a number of issues related to the process of collecting agricultural data on food crops in Indonesia. The analysis focuses on technical account of food crop data collection, the problem of overestimation based on several studies conducted by Statistics Indonesia (BPS), the application of the Area Sampling Frame (ASF) method to revise overestimated data on harvested rice areas, some notes on the ASF application, and closes with several notes and policy recommendations regarding the availability of agricultural data in Indonesia, particularly food crops.

TECHNICAL ACCOUNT OF DATA COLLECTION

Food crop statistics (rice and secondary food crops [1]) have a long history in Indonesia. The data collection was even initiated during the Dutch colonial era. Post-independence, data was collected by Statistics Indonesia (BPS) in cooperation with the Ministry of Agriculture (MoA). Prior to the 1970s, MoA had collected data using a different methodology that generated different numbers. In order to resolve the problem, since 1973 BPS and MoA have agreed on a shared data collection system. The system is based on the Instruction of the Minister of Economics, Finance, and Industry No. IN/05/MENKUIN/1/1973 on January 23, 1973. In essence, the instruction called for standardization in calculating the national production of rice and secondary food crops and assigned BPS as the coordinator.

In its implementation, the system integrated two different data collection systems, namely an administrative report collecting information on the size of crop areas (including the size of harvest areas) and statistical methods (survey sampling) estimating productivity. Subsequently, production figures resulted from multiplying the size of harvest areas with the level of productivity. MoA was responsible for collecting information on the size of crop areas, while BPS was responsible for collecting data on productivity using the Crop-Cutting Survey *(Survei Ubinan)*.

Collecting data on the size of crop areas, which included the size of planted crops areas, the size of standing crops areas, the size of damaged areas, and the size of harvest areas, was carried out by the District/City Agriculture Office through Agricultural Statistics or *Statistik Pertanian* (SP) coordinated by MoA.[2] In the process of collecting data, an officer from the District/City Agriculture Office, who was known as the Agricultural Extension Officer of Subdistrict or *Koordinator Cabang Dinas* (KCD), or *Mantri Tani*, employed a number of conventional approaches that involved subjective measurements, such as the use of seeds and irrigation water (block irrigation), collecting information from farmers and the village officials, as well as direct observations or better known as eye-estimate. The latter were used most often in the field.

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For rice paddy and secondary food crops that are cultivated in paddy fields, the data on the size of harvest areas collected by Agricultural Extension Officer of Subdistrict was termed the gross harvest area. This set of information still included areas of the paddy fields that were not planted with rice paddy,

[1] Secondary food crop commodities include corn, soybeans, peanuts, green beans, cassava, and sweet potatoes.

[2] Information on the size of rice paddy areas are collected using the SP-Padi form while the SP-Palawija form is used for secondary crops. In order to meet demands for various data on food crops, SP also gathers additional information in addition to information on the size of food crop areas, which include information about the equipment and machine used for food crop agriculture (SP-Alsintan TP), the size of agricultural land and its use (SP-Lahan), and the use of food crop seeds (SP-Benih TP). In essence, SP is the process of complete enumeration carried out periodically (monthly, except for SP-Lahan which is collected on a yearly basis) with outputs in the form of administrative reports on the sub-district level which are aggregated into district, province, and national reports. In relation to the implementation of SP, the role of Statistics Indonesia (BPS) is to assist in data processing through the Food Crop Management Information System or *Sistem Informasi Manajemen Tanaman Pangan* (SIMTP). With this system, the recording and processing of data for tabulation is carried out using computers. Technically, data processing is carried out by BPS. Therefore, the availability of SP data highly relies on data processing carried out by BPS.

such as constructed bunds or dikes. In processing the data, the gross harvest area was corrected by the converted size of bunds in order to obtain the nett harvest area[3], which was then multiplied with the level of productivity to gain production figures.

Meanwhile, the data on productivity was collected using objective measurements, namely the Crop-Cutting Survey. BPS was responsible for implementing the Crop-Cutting Survey, which included the methodology to select the sampling, the field organization, and the data processing. The Crop-Cutting Survey applied multi-stage stratified random sampling. Technically, the units of observation for the implementation of the Crop-Cutting Survey were randomly selected 2,5m x 2,5m plots of land for ready-to-harvest food crops. For rice paddy, every sample plot of 6,25 m^2 was considered to represent 140-150 hectares of rice harvest area. For certain selected plots, a BPS officer known as the Sub-District Statistics Coordinator or *Koordinator Statistik Kecamatan* (KSK) measured the harvest results using the Crop-Cutting Survey. Results of the observation carried out by KSK are entered into the questionnaire which is then compiled and processed by the District/City BPS through a website in order to obtain an estimation of the average food crop productivity on the District/City level for every subround. One subround spanned for four months, therefore in one year there are three subrounds, namely January-April, May-August, and September-December.

The production of food crop commodities was then calculated by the District/City BPS by multiplying the data of harvest areas with the data of productivity. For rice paddy commodity in particular, the production quality is displayed in dry unhusked paddy or *Gabah Kering Giling* (GKG)[4]. The calculation of rice production is carried out by multiplying rice paddy production with several converted figures which capture the change in quantity from rice paddy into rice due to the change of the water content in rice paddy during the drying process, the change in form from grain to rice, the use of rice for non-food needs (seeds, animal feed, and raw material for non-food industry), and the shrinkage or shattering during the drying and milling processes.[5] Hence, the quantity of rice produced is rice that is ready to be consumed by the people.

The flow of calculation process of the rice paddy and rice production is summarized in Appendix 1, while the calculation process of the production of rice that includes the converted figures is given in Appendix 2. The calculation of production can be done for each province, since data on the converted figures from grain to rice is available for each province.

[3] The current use of *galengan* conversion figures may not be representative due to a survey conducted in 1969/1970. The conversion figures of *galengan* vary for each district/city. On average, the galengan conversion is below 5 percent.
[4] In implementing the Cross-Cutting Survey, the weight of grain is measured in harvested unhusked paddy or *Gabah Kering Panen* (GKP) with water content between 25-30%. To obtain the weight in dry unhusked paddy or *Gabah Kering Giling* (GKG) with water content around 14%, converted figures from GKP to GKG are used.
[5] Before 2018, although BPS had carried out rice production calculation, it never officially released data on national rice production. BPS released data on rice paddy production in GKG quality.

Information about food crops production can be displayed per subround and total for one year.[6] Production on the provincial level is obtained by aggregating the production figures of all districts/cities in one province, while the national production figure is obtained by adding the production figures of all the provinces. In carrying out calculation of production figures until they are officially released to the public, BPS works together with the District/City Agriculture Office, the Provincial Agriculture Office, and MoA.

The business process of food crop data collection shows that the accuracy of food crop production figures published by BPS is largely influenced by information on the size of harvest areas provided by the District/City Agriculture Office. Since 2016, BPS has temporarily withheld data on food crop production until the latest studies and method for estimating the size of harvest areas based on objective measurements are complete. Since then, official statistics for food crop production are no longer available. However, the process of collecting data on the size of harvest areas and the level of productivity as well as the calculation of production continue until this very day. Estimated results on production are solely used to meet the needs of MoA with regard to program planning and evaluation and are not officially released to the public. For rice paddy/ rice commodity in particular, the latest studies and method, which is the ASF method, have been completed. Data on rice harvest areas and rice production generated from this new method were released on October 2018. The subsequent part of this paper will discuss the ASF method and its results in more details.

"Since 2016, BPS has temporarily withheld data on food crop production until the latest studies and method for estimating the size of harvest areas based on objective measurement are complete."

[6] In practice, the results of SP and Crop-Cutting Survey were also used by BPS to calculate forecasted figures (ARAM) of food crop production. This needs to be done, because the realization of the size of the harvest areas and the level of productivity from SP and Crop-Cutting Survey activities display temporary images per subround, meanwhile for policy purposes, particularly planning, the government requires information that shows a portrait for one year. Within one year, there are three forecasted figures, namely prognosis (January-December forecasted figure), ARAM I (subround II and III forecasted figures), and ARAM II (subround III forecasted figures).

THE PROBLEM OF OVERESTIMATION

> Many parties have long assumed that data on food crop production suffer from overestimation.

Many parties have long assumed that data on food crop production suffer from overestimation. To date, studies conducted on this issue have focused more on rice paddy/rice commodity, while in fact the same issue also occurs for data on other food crop commodities that are collected using the same method, namely corn and soybeans.

For data on rice paddy/rice, according to a study carried out by the Indonesian Community Statistics Forum or *Forum Masyarakat Statistik* (FMS) there are three main sources of weaknesses behind data accuracy of production (FMS, 2015). First, collecting tens of thousands of Cross-Cutting Survey samples opens up chances of sampling errors and non-sampling errors. Sampling errors might occur as every sample plot that measured by 6.25 m^2 represents 140-150 hectares of rice areas. In this case, the representation of variations in the productivity value for paddy fields of this size becomes a problem. On the other hand, non-sampling errors can occur due to measurement inaccuracies carried out by the officer in duty upon implementing the Cross-Cutting Survey.

Measurement inaccuracies can have a quite significant contribution on production calculation, because in essence production figures are the result of the multiplication of the level of productivity with the size of harvest areas reaching a dozen million hectares on the national level. With 10 million hectares of harvest areas, the measurement excess of 0.1 kilograms will contribute to the excess of estimated production of 1,000 tons. Several studies also reveal that the results of the estimated productivity using the Cross-Cutting Survey method tend to lead to overestimation (Rosner dan McCulloch, 2008). BPS has taken extra measures to improve the accuracy of the Cross-Cutting Survey which included adding the number of plot samples, refining the sampling selection method to minimize sampling errors, revitalizing Cross-Cutting Survey equipments , and the routine training of officers to reduce measurement inaccuracies.

Second, eye-estimate observations done by KCD tend to be biased (upwards)[7]. This is due to a number of factors. Based on several encounters in the field, KCD often do not possess sufficient experience and knowledge to calculate the size of harvest areas. At the same time, conflict of interests is inevitable, as KCD are subordinates of the Head of Food Crop Office who is supervised by a politician, a Regent/Mayor, with various interests. Another issue also came up, as the collected data was used to evaluate the achievement performance of a number of programs focused on increasing production.

Third, there is bias in the Cropping Intensity Index or Indeks *Pertanaman* (IP) which still uses a methodology that is not updated according to the recent developments and actual challenges in the field. Hydrologists believe that, considering the current condition of irrigation

[7] Globally, based on the experience in many countries, the use of this method creates prediction on areas that are overestimated. Nevertheless, this method works quite well in capturing the change of data level from time to time (relative growth) (Rosner and McCulloch, 2008).

channels, the logical IP is 1.3 – 1.4. With 8 million hectares of paddy fields and more than 16 million hectares of harvest areas in 2018, the IP reached 2. This means that on average paddy fields in Indonesia are planted twice a year.[8]

In general, overestimation of data on production can be traced to the data on productivity and the size of harvest areas. However, the issue has been mostly linked to the data on the size of harvest areas, particularly the eye-estimate method, where the data collection is not based on measurement. A number of studies carried out by BPS confirms doubts over the data accuracy of the size of harvest areas and the production of rice paddy/rice.

"A number of studies carried out by BPS confirms doubts over the data accuracy of the size of harvest areas and the production of rice paddy/rice."

The first study on the potential overestimation of data on the size of rice harvest areas that were not collected using measurement (henceforth called routine data) was carried out by BPS in 1996/1997. The study employed a household survey approach. The results of the study show that the data on the size of harvest areas collected by KCD from May 1996 to April 1997 in Java Island (except the Special Capital Region of Jakarta) was overestimated by 17 percent (BPS, 1998). The results of hypothesis testing with the t-test support the hypothesis that the size of rice harvest areas based on the study was lower compared to the routine data with a 5 percent significance level. The results of the study also demonstrate that the estimated productivity obtained from the Cross-Cutting Survey tend to be higher by 21 percent compared to the estimated productivity from the results of the study. These findings indicate that the estimated productivity acquired from the Cross-Cutting Survey tends to be overestimated.[9] For more details, a summary of the survey results is provided in Appendix 3.

In 2012, upon request of the Coordinating Ministry for Economic Affairs, BPS carried out a census for the rice mill industry that called *Pendataan Industri Penggilingan Padi* (PIPA). One of the main information that was collected was the production of rice paddy/rice during May 2011-April 2012. The PIPA results indicated that the national production of rice paddy during this period went up to 32.87 million tons of dry unhusked paddy (GKG) or equivalent to 20.62 million tons of rice. This figure was significantly lower compared to the data on rice paddy production based on the routine data which reached 67.26 million tons of dry unhusked paddy (GKG) in the same period or equivalent to 42.2 million tons of rice for consumption.[10]

The results of a further study, conducted by calculating household rice reserves, the national food logistic agency (Bulog), merchants, and many others, as well as rice import for a year, show that the rice availability for one year was merely 30.96 million tons. This figure was significantly

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[8] The data on the size of raw land areas used by MoA is sourced by administrative reports collected through the enumeration of Agricultural Statistics using the SP-Lahan form. The data has long been believed to have low accuracy in capturing the conversion of rice paddy fields to non-agricultural functions. Data on the size of raw land areas published by the Ministry of Agrarian and Spatial Planning/the National Land Agency or *Kementerian Agraria dan Tata Ruang/Badan Pertanahan Nasional* (KATR/BPN) based on the results of high-resolution satellite imagery which has been verified to be 7,105,145 hectares in 2018.

[9] The finding needs to be examined carefully, because the experience in many countries show that the estimated productivity obtained from interview results tend to be underestimated.

[10] Information of the production of grain and rice obtained from PIPA has weaknesses which may influence the accuracy of data obtained. PIPA respondents (companies/rice mill industries) mostly (particularly small businesses) do not have daily or monthly notes about the amount of grains used as inputs and the rice produced. In addition, the relatively long observation period (May 2011-April 2012) may have effects on information accuracy given by respondents through the method of recalling. On August 2018, BPS carried out matching and research and discovered that the PIPA results tend to be underestimation by 7-12 percent. Based on this information, the production of rice based on the PIPA results is revised into 22.68 million tons. The production of rice based on the PIPA results still includes rice for non-food purposes.

lower compared to the production of rice which was calculated from the routine data by around 10 million tons.

PIPA results can actually be an alternative for collecting data on national rice production using objective measurement. It is known that most rice on the national level are produced in rice paddy mills. The database (by name by address) of companies/mill industries obtained from PIPA results can actually be an alternative for collecting data on national rice production using objective measurement. It is known that most rice on the national level are produced in rice paddy mills. The database (by name by address) of companies/mill industries obtained from PIPA results could have been used as a sampling frame for the implementation of the Survey of Rice Milling Industry periodically (quarterly). Unfortunately, the survey has never been carried out.

The database was also never updated, so it is most likely outdated for the current conditions.

In 2012, BPS also calculated rice consumption on the national level. Based on the results of the National Socio-Economic Survey or *Survei Sosial-Ekonomi Nasional* (Susenas) and the National Rice Consumption Survey or *Survei Konsumsi Beras Nasional* (SKB), the demand for national rice in 2012 reached 27.96 million tons or 114.78 kg/capita/year[11]. This means that based on the PIPA results the surplus of rice availability in 2012 was only around 3 million tons, which is significantly lower than the results of the calculation using routine data and the same consumption figure, which is more than 12 million tons.

Indication of overestimation was also evident from results of the study on the data of the Agricultural Census or *Sensus Pertanian* in 2013 (ST-2013). The results of the study show that the estimated data of rice harvest area based on the ST-2013 data is around 9.93 million hectares, which is significantly lower by 4 million hectares from the routine data gathered using the eye-estimate method which reached 13.84 million hectares in 2013. The consequence of the difference in harvest area estimation is the difference in rice paddy production data which reached up to 20.13 million tons GKG. This figure was calculated from the difference of paddy field production with routine data that reached 71.28 million tons, with the rice paddy production of a revised ST-2013 results which was noted to only be at 51.15 million tons.

In 2015, BPS replicated the study conducted in 1996/1997 by carrying out the Harvest Area and Area of Food Crop Survey or *Survei Luas Panen dan Luas Lahan Tanaman Pangan* (SLPLLTP). The survey's coverage was expanded to include all the provinces in Java (except the Special Capital Region of Jakarta) and two provinces outside Java, namely North Sumatera and South Sulawesi. The coverage of commodities was also expanded to include corn and soybeans. In carrying out the survey, with a 10 percent household sample, the measurement of the harvest area using the Global Positioning Survey (GPS) was also carried out as a comparison.

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[11] Susenas captures the consumption of rice processed in households, while SKB captures the consumption of rice outside the household (food stalls, shops, big restaurants, hotels, and food industries). Since 2011, BPS has several times calculated the national rice consumption. The consumption of rice per capita from various surveys is 113.72 kg/year (2011), 114.80 kg/year (2012), 114.13 kg/year (2014), dan 111.58 kg/year (2017). These figures are for the consumption of rice for food purposes.

Results of the study show that, based on household interviews, the rice paddy areas in the seven provinces included in the survey were significantly lower by 35.5 percent compared to the routine data. Meanwhile, according to the interviews, the harvest areas was underestimated by 16 percent compared to the measurement results using GPS. Similar results were also obtained for corn and soybeans. In the seven provinces included in the survey and based on the interview, the harvest area on average was lower by 63 percent and 86 percent for corn and soybean respectively.

In 2015, BPS also carried out the Rice Reserve Study Survey or *Survei Kajian Cadangan Beras* (SKCB) to estimate the rice reserve in household producers and consumers, traders, mills, horeka, and Bulog, at three time points, namely March 31, June 30, and September 30.

The results of SKCB demonstrate that by using a rice consumption per capita of 114.8 kg/year and without considering carry over stock from the previous year, the reserve difference between the survey results and the calculation based on the routine data reached around 4 million tons on September 30, 2015. The results of further studies on the survey results show that the estimation of the rice production throughout April-September 2015 was only 15.43 million tons, which is significantly lower by 9 million tons from rice production based on the routine data which only reached 24.48 million tons. In addition, it was estimated that the surplus of national rice production in 2015 was around 5 million tons which was significantly lower than the results of the calculation based on the routine data which was above 10 million tons.

Indication of overestimation is also seen from the government's attempt to disassociate between rice production data and rice import policy in order to stabilize the fluctuating price of rice. Based on the author's results, using the rice consumption per capita figure of 114.8 kilograms per year, throughout 2005-2015 the production surplus experienced an escalating trend in which the surplus accumulation throughout the period reached around 100 million tons, while at the same time Indonesia was a net importer of rice with a quite significant quantity of imports. If the production data was accurate, the huge rice reserves should be able to reduce price increases. But what happened was not the case.

A similar case also occurred for corn comodity. The import of corn continues, despite data pointed out that there is excess in domestic production. In 2018, corn import on the national level reached 731 thousand tons or equivalent to USD 154.7 million. Meanwhile, at the same time the corn production was estimated to reach 30.05 million tons of dry shells with the national consumption figure reaching only 15.5 million tons. This means the import of corn was carried out at a time when production surplus was quite high, namely around 14.6 million tons. For this reason, a number of parties have indicated that data on corn production is not in accordance with the situation in the field. It is believed that the actual production figure is only 16.5 million of dry shells.

In addition, government policy which limited corn import since 2016 due to the belief in the sufficiency of domestic production also triggered price increases for chicken, chicken meat, and eggs in 2018 due to the price surge for animal feed. It is known that around 50 percent of the total demand for national corn is raw materials for the animal feed industry. The limited amount of domestic corn supply also forces animal feed industries to substitute it with imported wheat that is costly due to the weakening of rupiah.

THE AREA FRAME SAMPLING SOLUTION

> The main problem in calculating food crop production is the low level of data accuracy for the size of harvest areas, because the data collection was not carried out through measurement of a subjective manner.

The main problem in calculating food crop production is the low level of data accuracy for the size of harvest areas, because the data collection was not carried out through measurement of a subjective manner. Unfortunately, although indication of overestimation in the data of the size of harvest areas and the production of food crops has been identified for quite some time, measures to improve data for the size of harvest areas and production have not been taken until the Jokowi-JK administration. Besides strong commitment for a more accurate food data, the availability of technology and human resource, such as the mapping out of paddy fields from high resolution satellite imagery and geospatial information system (GIS), also supported the development of a method of estimating the size of harvest areas with objective measurement. Since 2016, BPS also temporarily withheld data of food crop production to defuse the debate and polemic on data accuracy until a new method of development that is measurement-based is complete.

Since 2015, BPS worked together with the Agency for the Assessment and Application of Technology or *Badan Pengkajian dan Penerapan Teknologi* (BPPT) to develop the Area Sampling Frame (ASF) method for estimating the size of rice paddy harvest areas. The first pilot project was carried out in two regencies that were rice production centers in the West Java Province, namely Garut District and Indramayu District. The results show that the estimation of rice paddy harvest areas in Garut District have a significant difference with the routine data. However, the results of the estimated rice paddy harvest area in Indramayu District during the observation period of March-December 2015 indicates an overestimation by 9.10 percent. The size of harvest areas calculated using the routine method of eye-estimate is 201.2 thousand hectares, while the size of harvest area calculated using the ASF method is 182.9 thousand hectares.

This part of the paper will briefly explain the ASF method implemented by BPS. Area sampling frame can be defined as the list of areas, often called segments, which have clear borders and can be identified. Within a census or survey, the segments are treated as statistic units to be observed (Muchlis, 2018). Meanwhile, Wigton and Bormann (1978) defines ASF as a statistic design which is based on the partition of an area into more smaller N sub-areas called unit samplings. From the unit sampling, n unit are randomly selected as the area of enumeration and called as segment samples. The use of ASF for agricultural statistics had actually began since the 1950s in the United States.

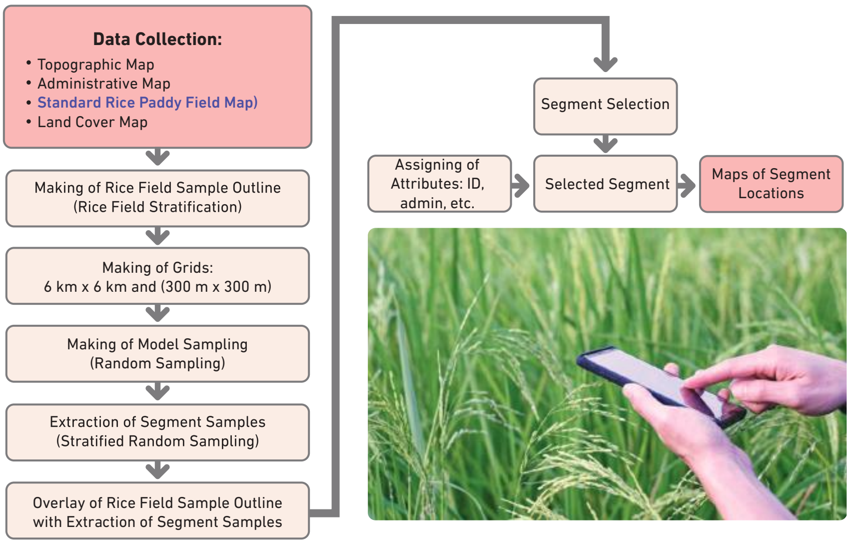
For almost 70 years, the National Agricultural Statistics Service (NASS) has implemented ASF to generate agricultural statistics, such as the production of seeds, crop areas, and animal inventory (Davies, 2009). In Indonesia, implementation of ASF as means of collecting agricultural statistics had already been carried out in 1979. At that time, with funds from the American government, ASF was introduced for the first time to collect statistics for rubber, coconuts, and rice paddy. A preliminary survey was carried out in the Lampung Province in 1980 (Willet, 1981). Morever, there were no significant follow-up actions developed out of this preliminary survey.

As a breakthrough in predicting rice harvest areas, implementation of ASF in Indonesia combined the map of paddy field areas obtained from remote sensing technology (satellite imagery) as a sampling frame and utilised Android equipment for field observation. ASF results provided rich information about the growing phases of rice paddies every month. This information could then be used to obtain an estimation of rice paddy areas on every growth phase, including the size of harvest areas. The implementation of ASF to estimate the size of harvest areas is summarized in Figure 1.

Implementation of ASF began with the development of the sampling frame by making use of a number of spatial data, namely the administration map, the paddy field map, the land cover map, and the topography map. The sampling frame was set-up by overlaying the maps simultaneously. The sampling frame was then grouped into four strata, as follows:

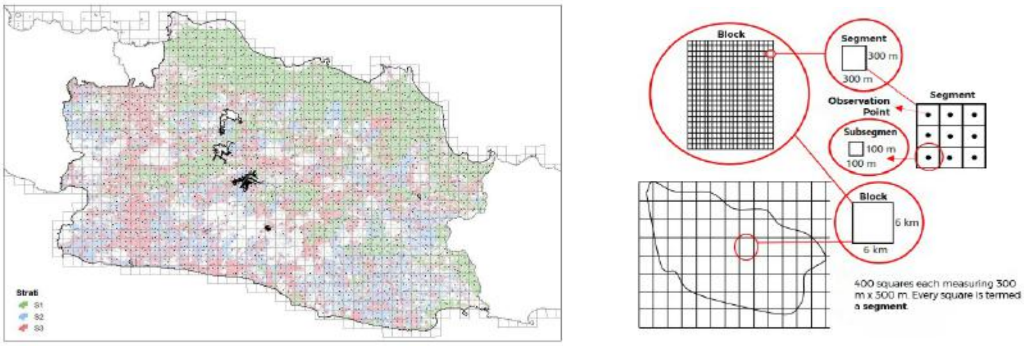
- Strata-0 (S-0) which contains polygon from land that could not be planted, such as forests, plantations, ponds, bodies of water, and housing. This stratum will be removed from the sampling selection.
- Strata-1 (S-1) contains polygon from irrigated rice paddy fields, which includes those cultivated once a year, twice a year, and more. Segments in this stratum will be selected as samples.
- Strata-2 (S-2) contains polygon from non-irrigated or rainfed rice paddy fields. The segment in this stratum will also be chosen as samples.
- Strata-3 (S-3) contains polygon that are believed to be rice paddy fields, which in practice is dryland polygon.

Figure 1.
The development of the sampling frame



Source: Statistics Indonesia (BPS)

Figure 2.
Illustration of the Formation of the Sampling Frame and Griding



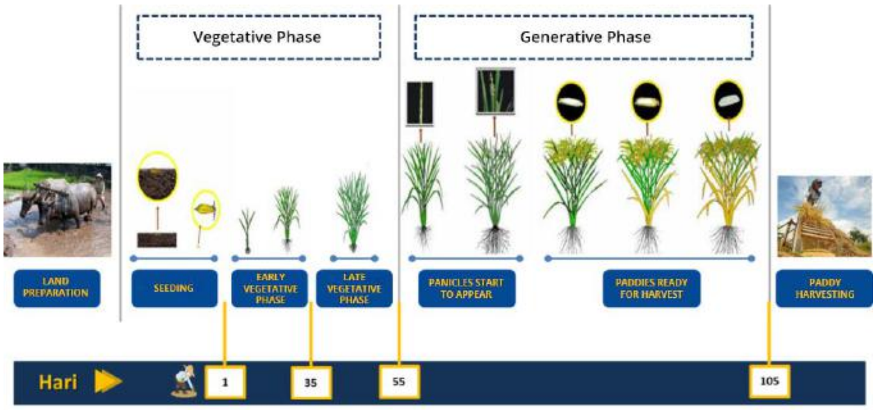
Source: Statistics Indonesia (BPS)

After stratified, the sampling frame is then divided into grids and sub-grids with measurements of 6 km x 6 km dan 300 m x 300 m. Random sampling is then applied to obtain segment samples. The selected segment samples are equipped with georeference information and ID information (codes for province, regency, district as well as the code for randomization) which is then observed periodically (monthly) by a surveyor. Illustration of the segments and sub-segments are displayed in Figure 2. The ASF Survey field observation can be considered as a panel study, because the same segment sample will be observed every month without any sample replacement.

In carrying out the field observation, the surveyor used their smartphones which were equipped with Android applications especially developed for ASF. The surveyors observed the growth phases and took pictures at the central point for all sub-segments in the selected segments. There are nine sub-segments in every segment measuring 100 m x 100 m that were observed by one surveyor. Information about the growth phases and the images obtained from each sub-segment were then sent to the center of data management (server) online. This procedure could minimize subjectivity in identifying the growth phase of rice paddy fields.[12] The final result is the estimation of the size of rice paddy areas that is in line with the growth phases, namely land preparation, vegetative phase, generative phase, and harvest. Illustration of the growth phases of rice paddy fields observed by the field officer is displayed in Figure 3. Besides the growth phases, the officer also gathered other observation results on damaged areas, non-rice paddy fields, and rice paddy fields that were not planted.

[12] Observation results, especially its consistency and fairness, that are submitted by the surveyor to the server will be checked by the controller through the website.

Figure 3.
Growth Phases of Rice Paddy Observed in ASF



Source: Statistics Indonesia (BPS)

ASF output enables us to make predictions (forecasts) on the potentials of the size of harvest areas for the next three months. This information is very valuable for decision-making processes that are anticipatory in nature, for instance the absorption of grain/farmer's rice by Bulog and price control. The forecast for the upcoming month can be obtained from the total size of rice paddy areas during the generative phase. Meanwhile, the forecasts for the next two and three months can respectively be determined from the total size of the areas during the vegetative II phase and vegetative I phase. This procedure can be applied because rice paddies in the generative phase will be harvested in the upcoming month, while crops in vegetative II phase and I phase will each require 2 and 3 months to be ready harvested. For example, from observations in January, prediction of harvest areas for February is obtained from the generative phase in January, while prediction for March and April respectively are obtained from vegetative II and vegetative I areas in January. The same pattern applies consecutively for the upcoming months.

> ASF output enables us to make predictions (forecasts) on the potentials of the size of harvest areas for the next three months.

The rice production figures obtained from ASF results were announced to the public for the first time in 2018[13]. The new figure confirmed that the forecasts of production data obtained from the old method was too high by 32 percent due to the subjectivity in measuring the size of the harvest areas. In other words, overestimation of the prediction of national rice production reached around 15 million tons.

When further observed, the ASF results are consistent with the results of the study using the results of ST-2013. The difference of rice paddy harvest areas between the ASF results and the routine data reached 5 million hectares. This quite significant difference contributed to the difference of rice paddy production data between the ASF results and the routine data which

[13] Information released by BPS on November-October 2018 are temporary figures which consist of the realization of January-September and the prediction of the potential November-December. Information of the ASF results displayed on Table 1 is the realization of data from January-December 2018.

reached 27 million tons GKG. In addition, rice consumption in 2018 reached 29.57 million tons or 111.58 kg/capita. For this reason, the surplus in production in 2018 based on the ASF results reached 2.85 million tons. This figure in significantly lower compared to the production surplus calculated from the routine data using the same consumption figure, which reached 18 million tons.

Table 1.
The Comparison Results Between ASF and Routine Data for The Production and The Size of Rice Paddy/Rice Harvest Areas (2018)

	ASF	Routine Data	The difference between routine data and ASF results	
			Absolut	%
Rice paddy production (million tons GKG)	56.54	83.04	26.5	32
Rice production for food purposes (million tons)	32.42	47.61	15.19	32
Harvest area (million hectares)	10.90	15.99	5.1	32
Rice consumption for food purposes (million tons)	29.57	29.57	-	-
Surplus rice production (million tons)	2.85	18.04	15.19	84

Source: 2016-2018 data is from the Ministry of Agriculture. 2018 data is Forecast Number I (ARAM I).

One of the strengths of ASF is the production of rice paddy/rice can be displayed per month. In relation to this, according to ASF results the pattern of the movement of rice paddy production per month is also in line with the pattern of the movement of the price of dry unhusked paddy grains on the farmer's level. The price surge of grain occurs when the production of grain drops. On the other hand, the decline of the price of grain occurs when there is an excess in grain production (Figure 4). The lowest price occurs during the peak season on April-May, while the highest price occurs in the low season on October-January. This consistency shows that the ASF results have illustrated the actual conditions in the field.

The size of the area of paddy fields used in ASF to estimate the size of harvest areas was 7.1 million hectares. This means that with the size of the harvest areas reaching up to 10.9 million hectares, the IP is around 1.5. This figure is more reasonable when considering the conditions of the irrigation infrastructure today.

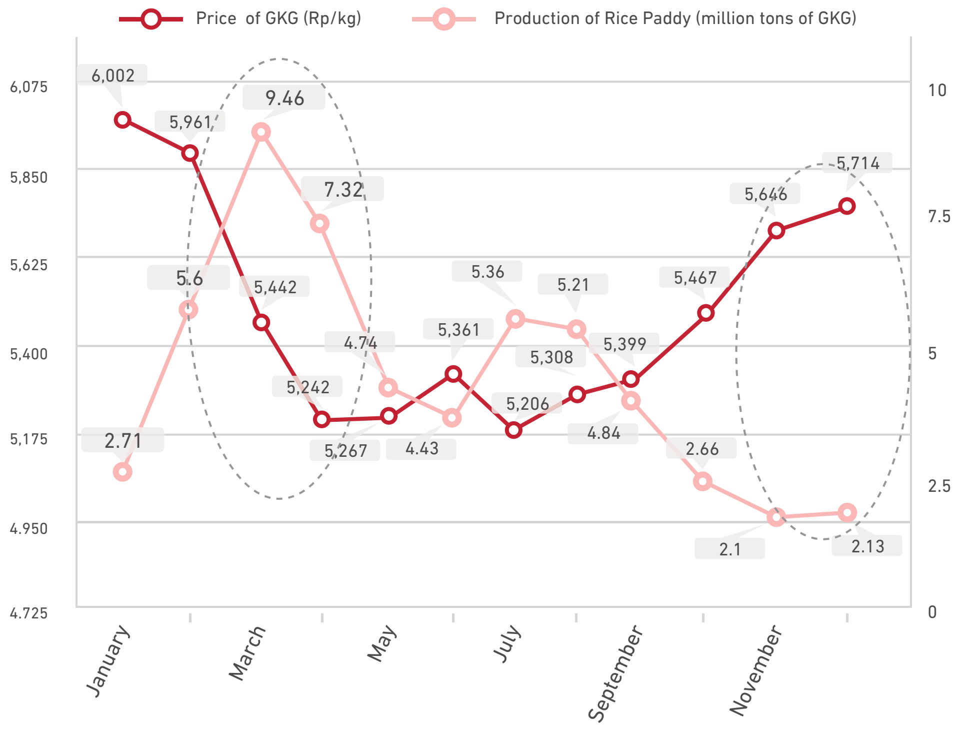
The ASF results were also close to the calculation results carried out by USDA. Based on the USDA calculation results, the annual production of rice in Indonesia is around 36-37 million tons. The rice production figures apparently did not yet remove losses and non-food purposes. The rice production figure was obtained from the rice paddy production of around 58 million tons GKG with a milling yield of around 63 percent. The size of the harvest area obtained from ASF results also approached the harvest area that was the results of the USDA calculation which was around 12 million hectares.

Table 2.
The Production and Rice Paddy/Rice Harvest Areas in Indonesia based on The USDA Data (2018)

	2014/2015	2015/2016	2016/2017	2017/2018 *(preliminary)*	2018/2019 *(projection)*
Rice paddy harvest area (million hectares)	11.83	12.10	12.24	12.25	12.24
Productivity (tons/ha)	4.73	4.71	4.78	4.76	4.80
Rice paddy productivity (million tons of GKG)	56.00	57.01	58.51	58.27	58.74
Rice production (million tons)	35.56	36.20	36.86	37.00	37.30
Milling yield (%)	63.5	63.5	63.5	63.5	63.5
Consumption and residues (million tons)	38.30	37.85	37.80	38.10	38.10
Initial reserves	5.50	4.11	3.51	2.92	4.11
Final reserves	4.11	3.51	2.92	4.11	4.11

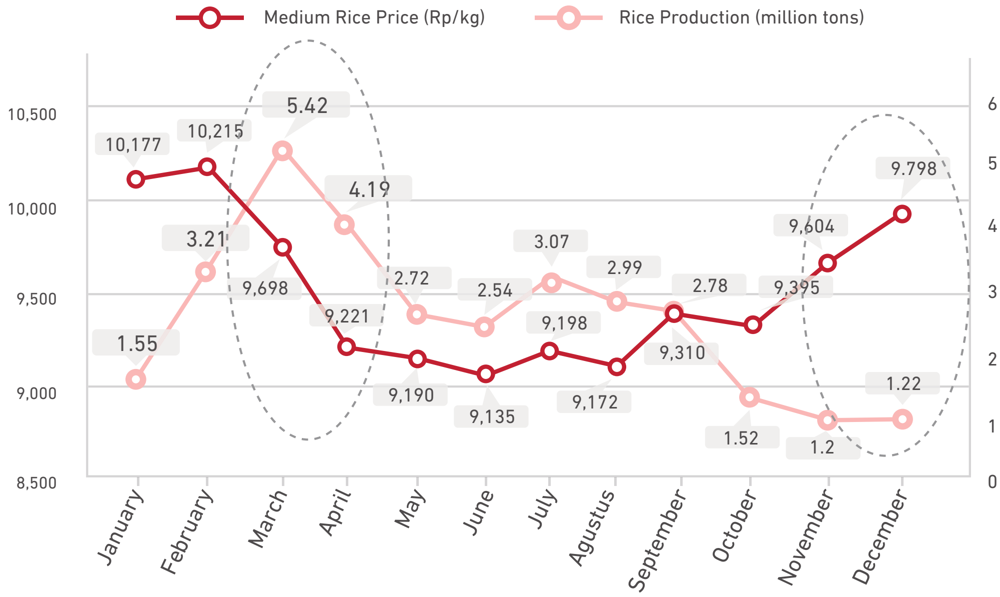
Source: USDA; *Indonesia Grain and Feed Annual Report.*

Figure 4.
GKG Price Development on The Farmer's Level and Rice Production Throughout 2018 (Rp/kg)



Source: Statistics Indonesia (BPS)

Figure 5.
The Development of Medium Rice Costs and Rice Production Throughout 2018 (Rp/kg)



Source: Statistics Indonesia (BPS)

> Despite the fact that ASF results have resolved the prolonged debate on the accuracy of national rice production data and marked a new era for rice data in Indonesia, there are still a number of issues regarding food crop statistics that must be tackled.

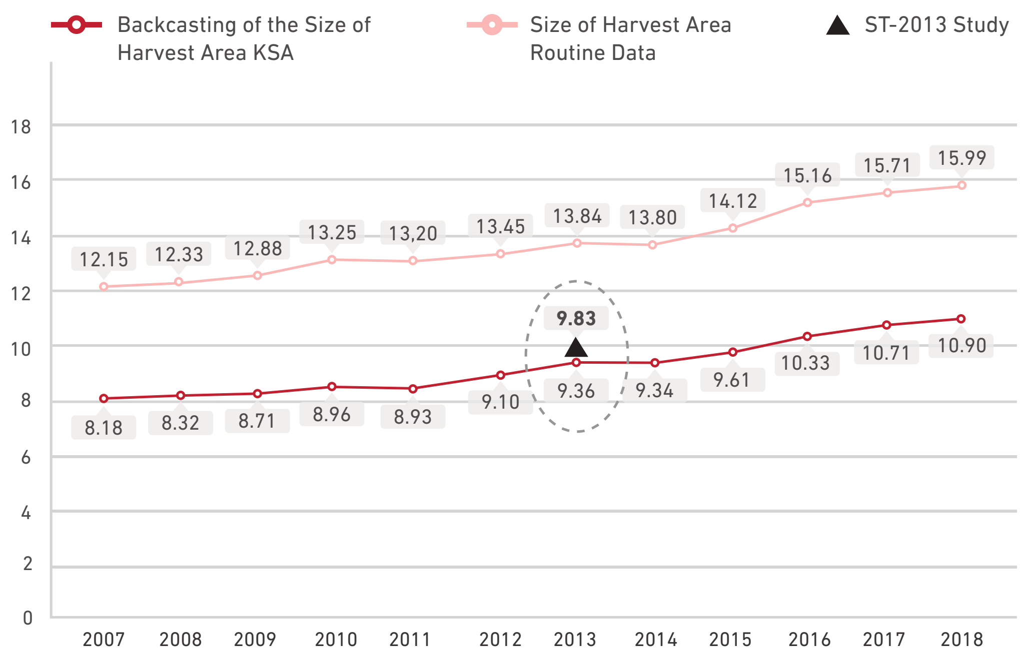
Despite the fact that ASF results have resolved the prolonged debate on the accuracy of national rice production data and marked a new era for rice data in Indonesia, there are still a number of issues regarding food crop statistics that must be tackled. First, since ASF results have confirmed overestimation in the rice paddy production data as demonstrated in previous studies, the question is then what must be done about the previous data prior to the implementation of ASF on harvest areas and production? This is an urgent question that must be addressed, as correct historical data from the past is very important for post analysis. This is also a matter about revising our history in the form of numbers. We must also remember that the success story of Soeharto in achieving self-sufficiency in rice that led to the award from FAO in 1986 is believed to be based on data that is possibly overestimated. In addition, in order to maintain consistency, all economic indicators, such as Gross Domestic Product (GDP) in the agricultural sector, that employs old data as part of the calculation input in the past must also be adjusted.

Although there have been initiatives for "data amnesty"[14], it remains insufficient in resolving the existing problem. In order to obtain a reasonable rice production data, inevitably backcasting must be carried out for at least the past ten years. In this case, BPS can invite academicians or researchers who have the expertise to tackle this problem. Of course, this is not an easy task, as there is limited information to carry out scientific studies in the past.

If the argument stating that the eye-estimate method is sufficient enough to capture the development of harvest areas from time to time is acceptable, the problem can be resolved by implementing the relative growth of the harvest area data obtained from the routine data of the past ten years toward ASF data.

For this reason, in this section of the paper, the author will perform a simple simulation by carrying out backcasting based on ASF results in which recalculation of the production of national rice paddies/rice for the past ten years will be done by making use of the growth of the size of rice paddy harvest areas for the past ten years from the routine data. The results of the USDA calculation in Table 2 and a number of studies done by BPS are used as a comparison.

Figure 6.
Results of the Backcasting of the Size of Rice Paddy Harvest Areas Based on ASF data, 2007-2018
(Million ha)



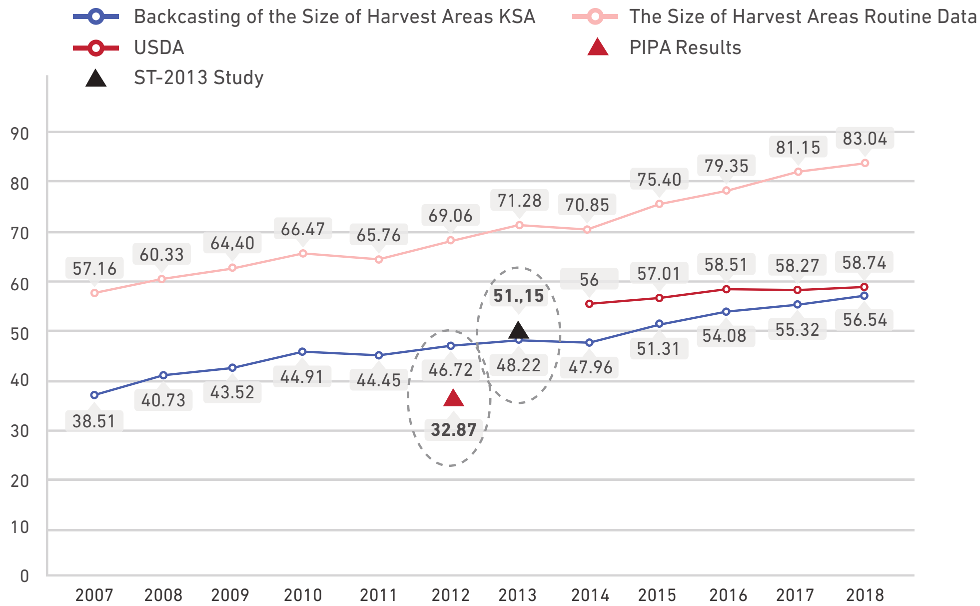
Source: 2016-2018 data is from the Ministry of Agriculture. 2018 data is Forecast Number I (ARAM I).

[14] One of the persons who proposed this initiative is Deputy Chairman of the House of Representatives (DPR) for the service term of 2014-2019 from the Gerindra Party, Fadli Zon. The term amnesty data is not completely accurate, since in the past it was caused by the weakness in the methodology used to estimate the size of harvest areas. This occurred due to limitation in methodology and resource in producing more accurate data.

The results of backcasting using ASF results data and the growth of routine data throughout 2007-2018 in Figure 6 show that the projection results of backcasting are close to the results of the ST-2013 study. The difference of the size of harvest areas between the projection and the ST-2013 study is around 450 thousand hectares. It must be noted that the size of the harvest areas from the ST-2013 study tends to be underestimated, because the method used to collect the data of the size of the areas is interview (recalling). In fact, the projection results are lower than the results of the ST-2013 study and this indicates that the size of the harvest area of the results of ASF probably was an underestimation. In general, the routine data is higher by 4-5 million hectares from the data of the projection for the past ten years. The results of the projection confirmed that overestimation in the estimation of the data of the size of harvests area tend to increase from year to year. This shows that there is an accumulation of estimation errors due to the use of the same method in measuring the size of harvest areas.

The same condition is also observed in the results of the backcasting projection for data on rice paddy production[15] in Figure 7. For this reason, the projection results are slightly higher compared to the PIPA results. The explanation is due to the fact that the rice paddy production captured by PIPA is the quantity of grains in companies/mill companies and has not yet included grains in the producer's households (farmers). The projection results are also not much different with the results of the USDA calculation in the past five years. In general, the difference between the rice paddy projection and the routine data reached around 20-25 million tons GKG in the past ten years.

Figure 7.
Results of Backcasting Rice Paddy Production Based on ASF Data (2007-2018)

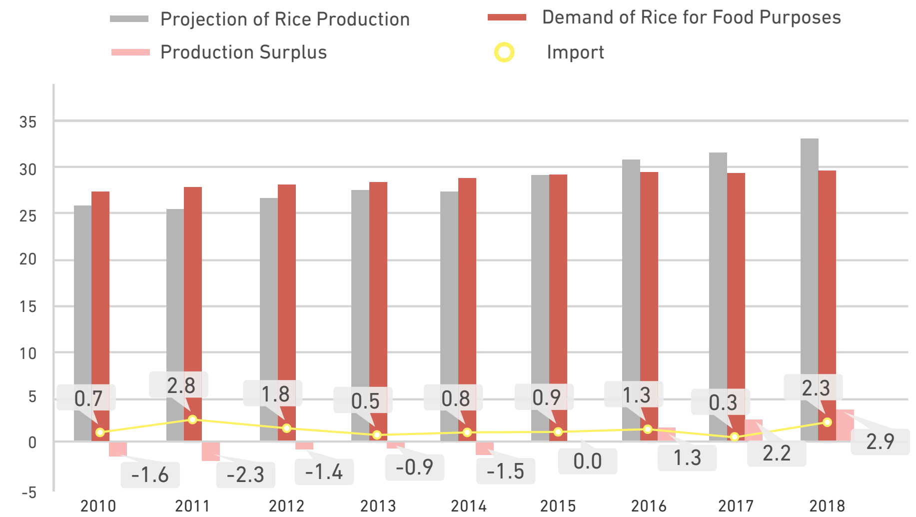


Source: 2016-2018 data is from the Ministry of Agriculture. 2018 data is Forecast Number I (ARAM I).

[15] Production is calculated by multiplying data on the size of harvest areas from the backcasting projection with the data on productivity. In this case, revision on the calculation is only done on the data on the size of the harvest areas.

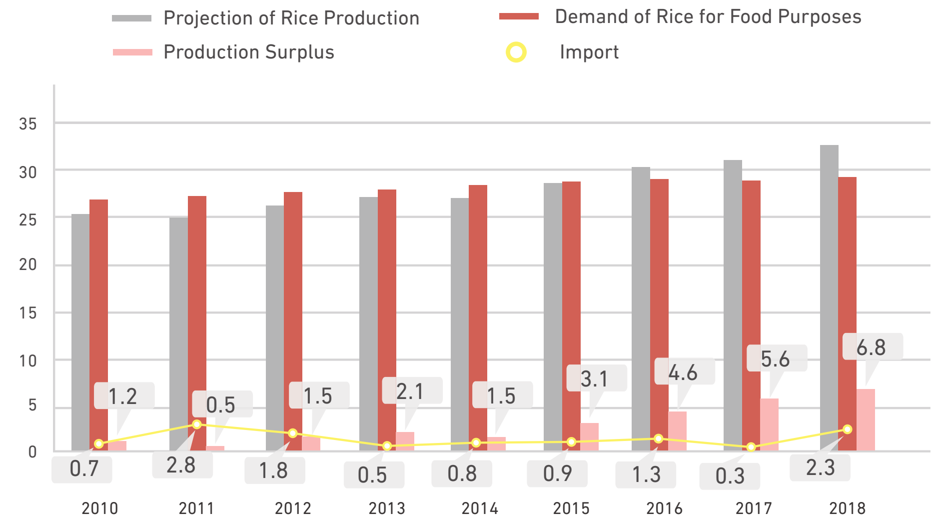
The projection results also demonstrate that throughout 2010-2018 surplus in rice production only occurs in the last three years (Figure 8). Meanwhile, the development of rice import throughout 2010-2014 is consistent with the movement of the amount of deficit in the availability of national rice from domestic production. Import increased when the deficit in the availability in national rice increased. Meanwhile, since 2015 the development of rice import is slightly inconsistent with the development of the surplus of national rice production, especially in 2016 and 2018, where import in great amounts are carried out even though there is quite a large surplus in domestic production.

Figure 8.
Results of Backcasting Production and Surplus, Consumption, and Rice Import, 2010-2018 (Million Tons)



Note : Rice imports are sourced from Statistics Indonesia. Rice consumption calculations throughout 2010-2017 use average rice consumption per capita of 113,56 kg/year multiplied by the number of population in the middle of the year. Rice imports include rice for non-food needs.

Figure 9.
Results of Backcasting Production and Surplus, Consumption, and Rice Import Using the Upper Threshold, 2010-2018 (Million Tons)



To anticipate chances of an underestimation in the harvest area ASF results, a simulation using the upper bound of ASF results (added by around two times coefficient variance) is displayed in Figure 9. By using the upper bound of ASF, the surplus of the national production of rice in 2018 reached around 6.8 million tons. Throughout 2010-2018, national rice production experienced surplus every year. A quite significant surplus occurred throughout 2016-2018, while the lowest surplus happened in 2011 when rice import reached 2.8 million tons, the highest point throughout the 2010-2018 period. It would appear that a simulation using the upper threshold creates a projection figure that makes more sense. In other words, it is an indicator that estimated resuls of harvest areas with the ASF method is likely an underestimate.

NOTES ON ASF METHOD

As a breakthrough in estimating the harvest area, ASF actually holds a number of weaknesses. For instance, the calculation of the size of net harvest area still relies on the conversion rate of constructed bunds or *galangan* from the survey results in 1969/1970 which probably is no longer in line with current conditions due to a shift in the function of constructed bunds today.

A number of experts also assume that the estimated results of the size of harvest areas with ASF method tend to be underestimate or is lower than the conditions in the field by 20 percent. However, the results of the study can be used as a scientific reference related to the accuracy of harvest area data which is obtained from ASF data is not yet available. Thus, this assumption must be proven empirically. In relation to this, empirical tests on the accuracy of ASF results must be done. One of the options that can be considered is the use of drone technology to estimate harvest areas in which the results will then be compared with ASF results. From here we can also obtain the corrective factor if the estimated results of the harvest area with the ASF method is underestimate.

A number of experts also assume that the estimated results of the size of harvest areas with ASF method tend to be underestimate or is lower than the conditions in the field by 20 percent.

The problem is a crucial issue, because the variables of harvest areas can be used as the basis of executing various strategic programmes in food crops agricultural sectors, for instance in determining the amount of allocation of subsidized fertilizers. Nowadays, there is a discourse that the determination of fertilizer subsidy should be based on output (output-based farm subsidy), and one kind of the output is the harvasted area. Therefore, it is very crucial to come with a sound estimation of the harvested area. If the figure is overestimated as happened in the past, there will be over subsidy. This condition can be used by certain parties to do economic rent hunt. On the other hand, the estimation of harvest areas that is too low can lead to the scarcity of subsidized fertilizers on the farmers' level.

The results of backcasting shows the tendency that the estimated results of harvest areas with ASF method is underestimate. This should be considered by the government when using ASF results as input for policy, especially determining the amount of subsidized fertilizer. In this case, the harvest area from the ASF results should first be adjusted before used for policy input, for example by using the estimated results of upper bound.[16]

[16] In 2018, estimation of the upper threshold for the size of harvest areas obtained using the ASF method was about 12 million hectares.

> The implementation of ASF is relatively costly in terms of field operations.

Another crucial aspect is that the implementation of ASF is relatively costly in terms of field operations. In order for it to be well implemented on the national level, this method requires surveyors in great amount to supervise the growth phase of rice paddy fields in the selected segment. Non-sampling errors also still occurs due to the officer's subjectivity in deciding the growth phase of rice paddy fields. Ideally, the photos which were the results of observation carried out on the growth phase of rice paddy fields sent by officers to the processing servers—with a certain algorithm—can be used to decide the growth phase of rice paddy fields automatically. Unfortunately, this ideal condition cannot yet be actualized due to some reasons. For this reason, there is still space for improvement and new innovations in implementing ASF method in the future.

The issue of the high costs in implementing the ASF method can be overcome through the application of remote sensing technology by making use of high-resolution satellite imagery data. Globally, there are many lessons learned from a number of countries which have successfully implemented this method, such as the actions carried out by Canadian Statistics and several countries in Africa. In relation to this, there are at least three scenarios that can be considered. First, completely using remote sensing to replace ASF method. Second, combining ASF method and remote sensing. In this case, ASF method is only applied to 17 provinces that are the main producers of national rice paddies. Meanwhile the other 17 provinces use remote sensing. The third scenario is the opposite of the second scenario.[17]

As mentioned previously, the issue of overestimation due to measurements carried out on harvest areas using the eye-estimate method is also relevant with other food crop commodities, especially corn and soybean. For this reason, the development of a measurement-based estimation method for harvest areas using the most updated technology for both commodities, such as the one carried out for rice paddies, are also of high importance.

At present, BPS is working together with the Agency for Assessment and Application of Technology (BPPT) to develop ASF for corn. However, this is not an easy task because of a number of issues regarding the plantation of corn especially the availability of a map of agricultural field specifically dedicated for maize cultivation as the sampling frame. The main challenge is the characteristic of the cultivation of corn itself. Most of the corn crops in Indonesia are cultivated in areas that are not too large and are scattered throughout Indonesia. Crops are also planted seasonally depending on farmer's preference, which can be determined by many factors. As a result, the availability of reliable information on specific areas which are dedicated for the permanent plantation of corn becomes an issue. For this reason, another option that also uses remote sensing technology, such as radar technology, must also be considered.

[17] Most of the national rice paddy production (91 percent) in 2018 were contributed by 12 provinces as follows: East Java, West Java, Central Java, South Sumatera, North Sumatera, West Sumatera, South Sulawesi, the Special Region of Yogyakarta, West Kalimantan, Central Sulawesi, Aceh, West Nusa Tenggara, Lampung, Riau, Bali, Southeast Sulawesi, and Jambi.

Final notes are with regard to the calculation of rice production. As previously explained, the calculation of rice production involves many conversion numbers throughout the journey of grain with GKP quality so that it becomes rice consumed for food purposes by the people. Although the conversion figure of GKP to GKG and the conversion figure of GKG to rice has been refined in 2018, the converted figures which capture the quantity of grain and rice for non-food needs and those which are scattered/depreciated have not yet been refined. These figures are obtained from the Food Balance Sheet or *Neraca Bahan Makanan* (NBM) compiled by the Food Security Agency-MoA in 2008 which needs to be evaluated in terms of its origin and refinement level. The accuracy of these figures is very crucial. For illustration, the use of GKG for non-food purposes is assumed to reach 7.3 percent while the use of rice for non-food purposes reaches 3.33 percent.

> "The calculation of rice production involves many converted numbers throughout the journey of grain with GKP quality so that it becomes rice consumed for food purposes by the people."

CONCLUSION

The issue of food crop data is only the tip of the food data iceberg. Most of the data on strategic food commodities (the production of horticulture commodity, plantation, fishery, and farms) rely on conventional methods and administrative reports from secondary data. In this case, the quality and the objectivity of data becomes the issue. For horticultural commodity and plantations, the issue is more or less the same with food crop commodities, namely the data gathering process is not based on measurement but relies on administrative report. For this reason, data gathering that is based on objective measurement also needs to be developed, especially for horticultural commodities and strategic plantation. Meanwhile, for other agricultural commodities, efforts that can be done is to reinforce the National Statistic System or *Sistem Statistik Nasional* (SSN)[18] related to the providing of sectoral data[19] by positioning BPS as the coordinator.

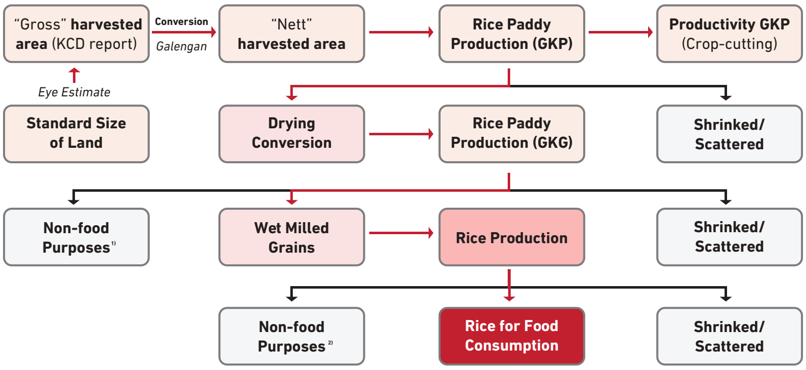
The providing of agricultural data cannot be completely burdened on BPS, which is only responsible for providing basic statistics[20]. Instead, it requires integrated collaboration between BPS and all data-generating institutions (ministries, agencies, and local governments) within the SSN framework.

The function and role of BPS in Statistics Law No. 16 Year 1997 must be highlighted and reinforced to increase the quality of sectoral data gathered through administrative reports. As the coordinator, BPS functions in carrying out mentorship, assistance, standardization of concept and definition of the collected data as well as developing a system to gather data of administrative reports which use the most updated technology, especially paperless and web-based information technology.

[18] SSN is a system consists of the elements of statistical data need, resource, method, facility and infrastructure, knowledge and technology, law system, and input from FMS that are structurally inter-connected, hence forming maximum effort in statistic application.
[19] Sectoral statistic is statistic which utilization aims to suffice specific government institution's need in performing governmental and developmental tasks which are the main duty of the respective government institution.
[20] Basic statistic is statistic that is used for a broader scope, for the government as well society, that has certain characteristics like cross-sectoral, national scale, macro, and which implementation falls under BPS responsibility.

APPENDIX

Appendix 1. The Calculation Process of Rice Paddy and Rice Production



Appendix 2. The Calculation of Rice Production for Resident Food

No.	Description	Conversion
1.	**The production of rice paddy GKP**	**Non-published**
2.	**The production of rice paddy GKG**	**ASF results (83.38% from R1)**
3.	**The use of GKG for non-food [% from R2]**	**7.30%**
	a. Livestock feed/poultry	0.44%
	b. Seeds	0.90%
	c. Raw materials for non-food industry	0.56%
	d. Scattered/depreciated	5.40%
4.	**GKG processed into rice**	**R2-R3**
5.	**The production of domestic rice [conversion from GKG to rice: % from R4]**	**64.02%**
6.	**The use of rice for non-food [% from R5]**	**3.33%**
	a. Livestock feed/poultry	0.17%
	b. Raw materials for non-food industry	0.66%
	c. Scattered/depreciated	2.50%
7.	**The production of domestic rice for resident food**	**R5-R6**

Appendix 3. Survey Results of the Size of Rice Paddy

A. The Size of Rice Paddy Harvest Areas According to Province and Data Source

Province	Survey of the Size of Rice Paddy Areas (ha)	Routine Data (SP)	Difference	
			Absolute	Percentage
West Java	1,705,469	1,963,080	-257,611	-13.12
Central Java	1,290,233	1,550,985	-260,752	-16.81
Yogyakarta	78,906	102,352	-23,446	-22.91
East Java	1,204,673	1,543,385	-338,712	-21.95
Java	4,279,281	5,159,802	-880,521	-17.07

B. Rice Paddy Productivity According to Province and Data Source

Province	Survey of the Size of Rice Paddy Areas (Quintal GKG/ha)	Routine Data (SP)	Difference	
			Absolute	Percentage
West Java	50.12	63.30	-13.18	-20.82
Central Java	47.46	59.33	-11.87	-20.01
Yogyakarta	47.34	60.51	-13.17	-21.76
Java	48.68	61.62	-12.94	-21.00

C. Area of Farmland Standard by Province

Province	Survey of the Size of Rice Paddy Areas (ha)	Routine Data (SP)	Difference	
			Absolute	Percentage
West Java	1,152,753	1,103,030	-49,723	-4.31
Central Java	998,263	860,590	-137,673	-13.79
Yogyakarta	60,622	54,551	-6,071	-10.01
Java	1,147,539	1,059,494	-88,045	-7.67

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Kadir Ruslan is a researcher and observer in agricultural sector. He had experiences in collecting and analyzing food crop data in Indonesia. Kadir also actively writes Op-Ed columns in several mass media. A number of his writings related to socio-economic issues, especially in the agricultural sector, have been published in national newspapers, such as Kompas, The Jakarta Post, Koran Tempo, and Koran Sindo. Kadir is an alumni of School of Statistics (STIS) with the specialization in Applied Statistics and he obtained his master degree in Applied Econometrics from Monash University, Australia.

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Economic Opportunities: CIPS advocates for policies that expand economic involvement and opportunities for Indonesian entrepreneurs and businesses; as well as for policies that open wider opportunities for low-income Indonesians to access decent incomes and create wealth.

Education Policy: The future of Indonesia's human capital need to be prepared with skills and knowledge relevant to the 21st century. CIPS advocates for policies that drive a climate of healthy competition amongst education providers. Such competition will drive providers to constantly strive to innovate and improve education quality for the children and parents they serve. In particular, CIPS focuses on the improvement of operational and financial sustainability of low-cost private schools who serve the poor.

Community Livelihood: CIPS believes that strong communities provide a nurturing environment for individuals and their families. They must have the rights and capacities to own and manage their local resources and to ensure healthy and sound living conditions for the development and prosperity of the community.

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