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Improving Indonesia's Plantation Data Quality: Coffee, Sugar, and Cocoa

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GLOSSARY

BIG:
Geospatial Information Agency.

BPS:
Statistics Indonesia.

BPPT:
Agency for the Assessment and Application of Technology.

BUMN:
State-Owned Enterprises.

GPS:
Global Positioning System.

GPPI:
Indonesian Plantation Association.

ICCRI:
Indonesian Coffee and Cocoa Research Institute.

KSA:
Area Sampling Frame.

LAPAN:
National Institute of Aeronautics and Space.

NASS:
National Agricultural Statistics Service.

OPT:
Plant-Disturbing Organisms.

PBN:
State-Owned Large Plantation.

PBS:
Private-Owned Large Plantation.

PTPN:
PT. Perkebunan Nusantara III (Persero).

USDA:
United States Department of Agriculture.

EXECUTIVE SUMMARY

To date, the plantation subsector is still faced with the structural issue of a poor plantation data collection system. There are two main sources of plantation data, which are the large plantations managed by the state and private-owned companies and plantations managed by community groups or smallholder plantations. Until now, smallholder plantation data are still collected using a lengthy and stage-by-stage business process, carried out manually using an administrative product compilation method that is vulnerable to errors and the subjectivity of the data collection officers. Meanwhile, the quality of data collected from large plantations is undermined by the suboptimal participation of the plantation companies (response rate).

These factors undermine the accuracy of data related to the planted area, production, and productivity. There is an indication that data on production and planted area for coffee, cocoa, and sugarcane that have been reported by the Directorate General of Estate Crops, Ministry of Agriculture, and Statistics Indonesia is higher than the actual conditions (overestimated).

The data collection system must be refined to develop policies related to the plantation subsector based on accurate data. The improvement of plantation data quality requires a national collaboration that involves ministries/government agencies and plantation companies. In regard to this, with a mandate from the Presidential Staff Office, for example, the Ministry of Agriculture can serve as the coordinator of a team comprising the Statistics Indonesia, Agency for the Assessment and Application of Technology (BPPT), Ministry of State-Owned Enterprises, Indonesian Plantation Association (GPPI), and other relevant ministries/government companies. In principle, the actualization of data collection system refinement relies heavily on various considerations regarding the desired level of accuracy, frequency and level of data presentation, availability of the budget for data collection activities, quality and skills of the data collection officers, and the characteristics of the plantation crop's cultivation.

By considering these aspects, in the short and medium run, the refinement of data collection system with large-scale companies as the respondents can be focused on the modernization of business process, such as through the digitization of data reporting process, that is to expedite the data reporting flow and increase the plantation companies' participation in the data collection activities that are conducted by compiling the administrative products of each company.

For data collection with smallholder plantations as the respondents, in addition to the business process modernization, its methodologies should be improved by implementing an integrated household-based survey for several strategic plantation commodities, such as coffee, cocoa, and sugarcane to replace the current administrative product compilation methods. This survey can combine interview and objective measurement to correct the harvested area using GPS and productivity measurement experiments. This can be done by replicating the Plantation Strategic Commodity Survey (*Survei Komoditas Perkebunan Strategis* or Komstrat) conducted by Statistics Indonesia on cocoa in 2018 and on sugarcane in 2019 by taking advantage of the momentum of the Agricultural Census, which is going to be held in 2023, as a benchmark and basis for the development of the sampling frame.

In the long run, a data collection method that is based on an objective measurement, such as the remote sensing method using satellite images, should be developed to improve the quality of data on planted area and productivity collected from smallholder and large plantations. This requires a large number of investments, a road map, long-term commitment and collaboration, and political support.

INTRODUCTION

As with other agricultural subsectors, the plantation subsector is still faced with the classical issue of the suboptimal quality of plantation crop production data that have been used as the basis in developing the government's policies. High-quality data are of paramount importance to ensure that the economic outputs of the plantation subsector are captured accurately.

This paper reviews the issue of the suboptimal plantation data collection system in Indonesia. It is prefaced by a review of the collection of plantation statistics, followed by a discussion about various efforts that can be done to increase the quality of plantation statistics.

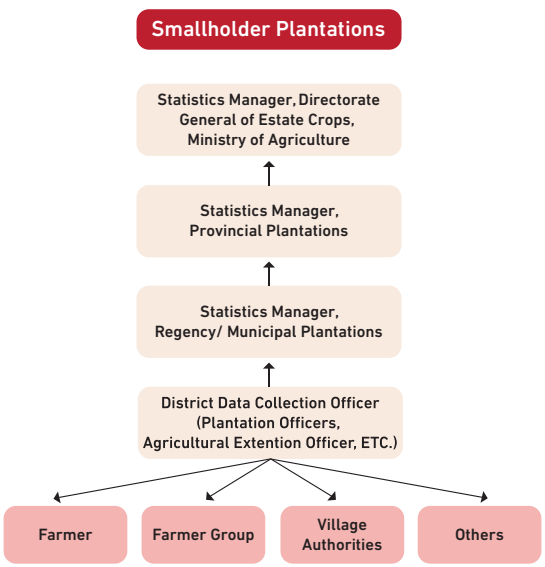
The discussion focuses on coffee, cocoa, and sugarcane, both cultivated by smallholder and large and private-owned plantations. At the end of the discussion, several policy recommendations related to the refinement of the plantation data collection system are presented to enhance the quality of plantation data in Indonesia, both collected from smallholder and large plantations.

REVIEW OF THE COLLECTION OF PLANTATION STATISTICS IN INDONESIA

The collection of plantation statistics in Indonesia has a long history. Data collection activities have been carried out since the colonial era by compiling administrative products. Thus far, the collection of plantation statistics still relies on the administrative data reports that are collected in stages from the district to central level.

The activities of developing plantation crop cultivation[1] in Indonesia are done by community groups or smallholder plantations and large companies (state/private-owned). Therefore, data of the plantation subsector are collected from those two sources. Data from community groups or smallholder plantations are collected by the Directorate General of Estate Crops, Ministry of Agriculture, and categorized into two, which are the data from community independent activities and data from plantation units managed using other sources of funding. Meanwhile, the data of large plantations, both State-Owned Large Plantations (PBN) and Private-Owned Large Plantations (PBS) are obtained from the regular reports submitted by the companies to Statistics Indonesia.

Figure 1.
Flow of Data Collection Process in Smallholder Plantations



Source: Directorate General of Estate Crops

[1] Plantation crops consist of perennial and annual crops. Perennial crops are plantation crops that live for more than a year. These crops are harvested more than once and not replanted each year, such as coffee and cocoa. Annual crops are plantation crops that live for less than a year. These crops are harvested more once or in several harvest seasons, such as sugarcane.

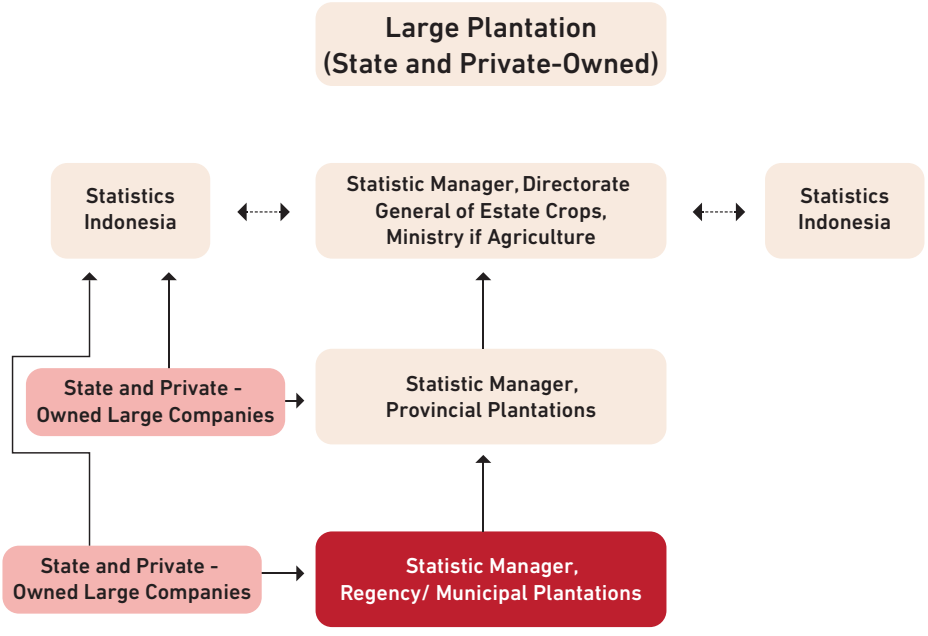
Smallholder Plantation Data Collection

Smallholder plantation data are collected by district data collection officers, which are the appointed district Plantation Officers (*Manbun*) or officers responsible for the statistical data collection at the district level. The collected data are then reported in stages to the Office that handles the plantation statistical data in the regency/municipality, province, and the Directorate General of Estate Crops (Central), Ministry of Agriculture. With this data collection method, smallholder plantation data are essentially a compilation of administrative products. One of the main issues in the compilation of administrative products, which are generally used as a tool to monitor and evaluate the performance and success of the programs carried out by the data collection institutions, is the objectivity of the officers in recording and reporting the data. The experiences in food crop data show that collecting data of harvested area through a compilation of administrative products tends to result in an overestimated harvested area. In addition to the poor data collection method, such a condition is also caused by the conflict of interest between the data collection officers.

> The experiences in food crop data show that collecting data of harvested area through a compilation of administrative products tends to result in an overestimated harvested area.

This lengthy data flow process might potentially increase the probability of error in the data collection and reporting. This risk can increase more when the recording and reporting process is not conducted using the same standards at every level. To prevent this, the data update and validation are done manually from the district, regency/municipality, province, to the central level in stages.

Figure 2.
Flow of Data Collection Process in Large Plantations



Source: Directorate General of Estate Crops

State-Owned and Private-Owned Large Plantation Data Collection

Data of State-Owned and Private-Owned Large Plantations are collected by Statistics Indonesia by compiling their reports, both quarterly and annual, through the Plantation Company Survey (*Survei Perusahaan Perkebunan* or SKB)[2]. The collected data include the planted area and production of each plantation commodity. Planted area consists of area of immature plants (TBM), mature plants (TM), non-yielding plants (TTM), and damaged plants (TR). From the planted area information, the productivity can be obtained by dividing the production by the planted area of mature plants.

In its practice, there is a data synchronization process to produce a single plantation statistical number. This synchronization involves the relevant agencies and institutions in charge of producing the data, which are Statistics Indonesia, Industry and Trade Office, and plantation associations and companies. In the synchronization process, a set of analyses are performed to elucidate the cause of changes (ups and downs) in the data, compare the data over time, and spot check through on-field sampling.

[2] The Plantation Company Survey is conducted annually on all plantation companies, both private and state-owned, that operate within the jurisdiction of the Republic of Indonesia. The quarterly Plantation Company Survey collects information of the planted area and production of palm oil, cocoa, coffee, rubber, tea, sugarcane, tobacco, coconut, pepper, and clove for the current year. Meanwhile, the annual Plantation Company Survey collects information of the planted area, production, and income structure per commodity for strategic plantation commodities and other commodities, such as clove, coconut, areca nut, lemongrass, cashew nut, kapok, nutmeg, pepper, sago, and abaca/manila for the previous year (y-1).

ISSUES IN COLLECTING DATA

Data Collection Challenges in Smallholder Plantations

The issue in collecting plantation data lies in the quality of data on planted/harvested area and production, which generally are not solely based on an objective measurement, but also secondary information from various parties, both from households and companies, whose accuracy cannot be verified. One of the weak points is in the data of smallholder plantations collected by the Directorate General of Estate Crops, Ministry of Agriculture. This is due to the poor records of planted/harvested area and production of smallholder plantations.

Normally, household-based data collection relies on the farmers' declaration that is based on the respondents' estimation or memory recollection. In the case of Indonesia, accurate and well-documented records from the farmers are rare. Consequently, the information given by the farmers is based on their subjective estimation. This condition affects the accuracy of the collected data. However, there are several measures that can be taken to improve the accuracy of information from the farmers, especially on the planted area. This will be further discussed in the next section.

"In the case of Indonesia, accurate and well-documented records from the farmers are rare. Consequently, the information given by the farmers is based on their subjective estimation."

In estimating the planted/harvested area of smallholder plantations, the variety of cultivation characteristics becomes a challenge for the data collection officer on the field. In its practice, the plantation crop cultivation as practiced by community groups is not always in the form of monoculture cultivation, the area of which can be easily determined by means of land certificate or measurement approaches using GPS.

In reality, many community groups cultivate plantation commodities using mixed and scattered croppings. Table 1 shows that, in 2014, around 30% of coffee and cocoa were cultivated by plantation households using the mixed cropping system[3]. As a result of this condition, the measurement of planted area must use several approaches that are vulnerable to errors. Additionally, estimating planted area requires expertise and specific experiences. Unfortunately, the data collection officers of smallholder plantations keep changing, thus affecting the quality of the collected data.

[3] Data presented in Table 1 are the results of the Plantation Household Survey conducted in 2014 as an additional survey of the 2013 Agricultural Census. Since then, there have not been any similar surveys conducted as of the time of writing this paper.

Another challenge in collecting data on planted areas of smallholder plantations in Indonesia is the scale of cultivation that is relatively small. In many cases, relatively small-scale cultivations are practiced on nonextensive plots of land with irregular shapes and spaces between the plants. The results of the 2013 Agricultural Census suggest that the average planted area of coffee, cocoa, and sugarcane cultivated by plantation households were 0.54 hectares, 0.5 hectares, and 0.55 hectares respectively.

Regarding the process of data flow as presented in Figure 1, the main challenge is to calculate the aggregated estimation of planted area and production for every plantation commodity at the district level. Data collection officers rely on multifarious secondary information from several parties, which are the farmers, farmer groups, village authorities, and other informants. Producing an accurate estimation of planted area and production that describes the potential of each district indeed proves to be anything but simple. The lack of standard methods and clear guidelines in estimating renders the subjectivity of the data collection officers more dominant in estimating the planted area and production at the district level. Thus, there is a huge probability of overestimation.

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Table 1.
Percentage of Coffee, Cocoa, and Sugarcane Plantation Households by Cultivation Profile, 2014

Cultivation Characteristics	Coffee	Cocoa	Sugarcane
Planting method			
- Regular	70.07	81.85	98.31
- Irregular	29.93	18.15	7.69
Planting system			
- Monoculture	48.75	55.98	99.14
- Intercropping	14.92	13.07	0.37
- Mixed	36.33	30.95	0.49

Source: Results of the Plantation Household Survey, 2014

For coffee, cocoa, and sugarcane, improving data collection, both in its business process and methodology, is of crucial importance because most of these commodities' production are from smallholder plantations (Table 2). The contribution of smallholder plantations to the national coffee, cocoa, and sugarcane production in 2018 reached 96.28%, 97.97%, and 58.71% respectively[4].

Table 2.
Cocoa, Coffee and Sugarcane Crops Production by Commodity and Manager, 2018 (ton)

Commodity	Smallholder Plantation		State-Owned Large Plantation (PBN)		Perkebunan Besar Swasta (PBS)		Total
	Production	Share (%)	Production	Share (%)	Production	Share (%)	Production
Cocoa	751,685	97.97	7,715	1.01	7,880	1.03	767,280
Coffee	727,916	96.28	13,267	1.75	14,868	1.97	756,051
Sugarcane	1,275,053	58.71	279,854	12.89	616,819	28.40	2,171,726

Source: Coffee, Cocoa, and Sugarcane 2020 Outlook, Directorate General of Estate Crops

Smallholder plantations involve millions of households. According to the results of the 2018 Inter-Census Agricultural Survey (*Survei Pertanian Antar Sensus* or SUTAS), the total number of households that cultivated cocoa, coffee, and sugarcane were 1.37 million, 1.62 million, and 224.86 thousand households respectively. This condition illustrates the challenges faced in the current efforts of collecting smallholder plantation data using the complete enumeration approach through the compilation of administrative products in district areas. The probability of recording and reporting errors is considerably high, especially given that the process has no clear guidelines and is not well-standardized.

[4] The indication of overestimation in smallholder plantation data might cause these proportional numbers to not describe the actual conditions of the level of smallholder plantations' contribution towards the total national production for each commodity. Nevertheless, the dominance of the share of smallholder plantations in the total national production is sufficiently captured by the existing data.

Table 3.
Total Number of Cocoa, Coffee and Sugarcane Crops Households, 2013-2018

Commodity	Total Households		Change from 2013 to 2018	
	2013	2018	Absolut	%
Cocoa	2,186,755	1,370,428	-816,327	-37.33
Coffee	1,962,044	1,616,459	-345,585	-17.61
Sugarcane	287,099	224,856	-62,243	-21.68

Source: Statistics Indonesia, 2013 Agricultural Census, and 2018 SUTAS

Data Collection Challenges in Large Plantations

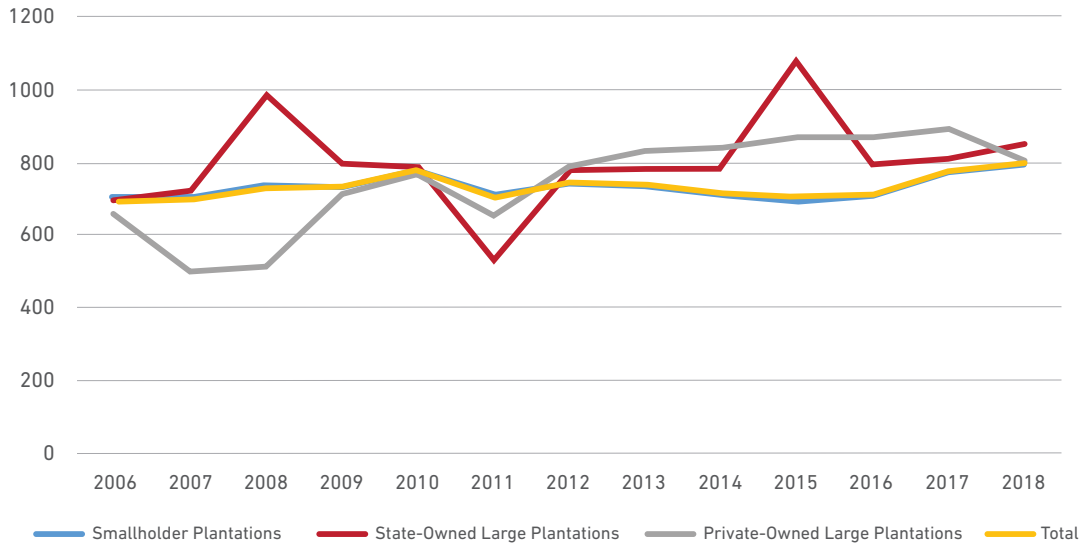
For the data of large plantations collected by Statistics Indonesia, the issue lies in the completeness of the documents or the companies' participation in providing the information needed in the Plantation Company Survey. Plantation companies are often reluctant to give information related to their plantation crop cultivation activities due to several reasons, one of which is the concern of being associated with tax affairs.

However, the quality of plantation data collected from companies, especially its accuracy, tends to be better than smallholder plantations because most companies have a more improved recording and documentation system . Moreover, companies generally possess information regarding their planted area that they obtain from measurements. Ergo, the key to improving the quality of data on planted area and production for plantation commodities that are dominantly cultivated by large plantations is to foster the companies' participation in the Plantation Company Survey conducted by Statistics Indonesia.

It should be noted that the fluctuation of productivity data of coffee, cocoa, and sugarcane cultivated by large plantations (private and state-owned), presented in Figure 3, 4, and 5, might have been caused by the scope and completeness of data that are still suboptimal, both for the planted area and production. This marked fluctuation over time can be affected by the response rate dynamics of the plantation companies in the Plantation Company Survey. In Aceh, for example, out of 200 plantation companies in 2017, only 58% participated in the Plantation Company Survey (TribunPekanbaru.com, 15th of August 2018). However, a more in-depth study is required to confirm this. For coffee and cocoa, the scope and completeness of data are not an issue because most of these two commodities are cultivated by smallholder plantations. The main issue for coffee and cocoa is the accuracy of data collected by the data collection officers at the district level that employ various unstandardized approaches.

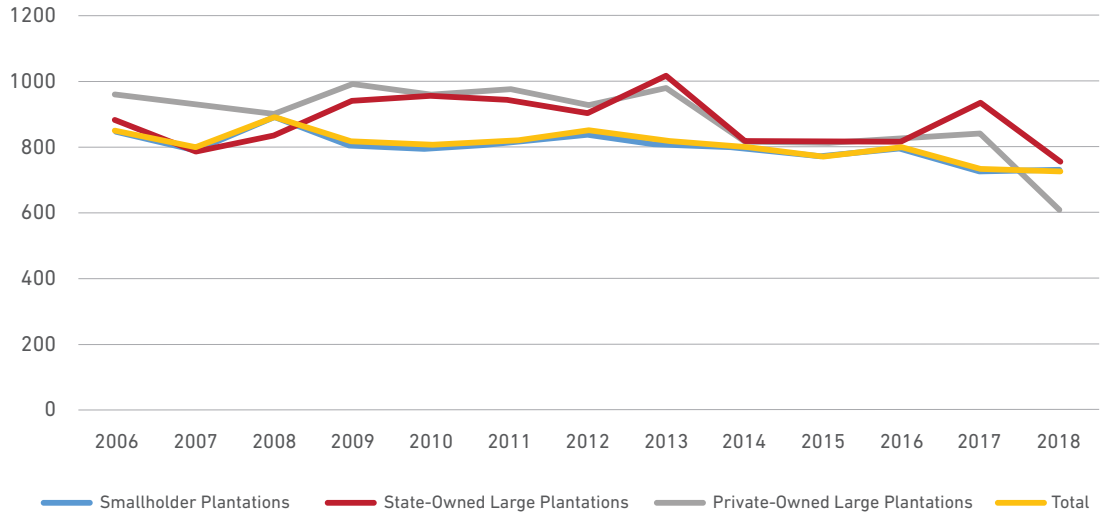
[5] Plantation data collected from companies are more likely underreported (lower than the actual condition) because they tend to not report all of their activities. This is not an issue for coffee and cocoa because most of these two commodities are cultivated by smallholder plantations.

Figure 3.
Coffee Productivity Development by Type of Cultivation, 2006-2018 (Kg/hektar)



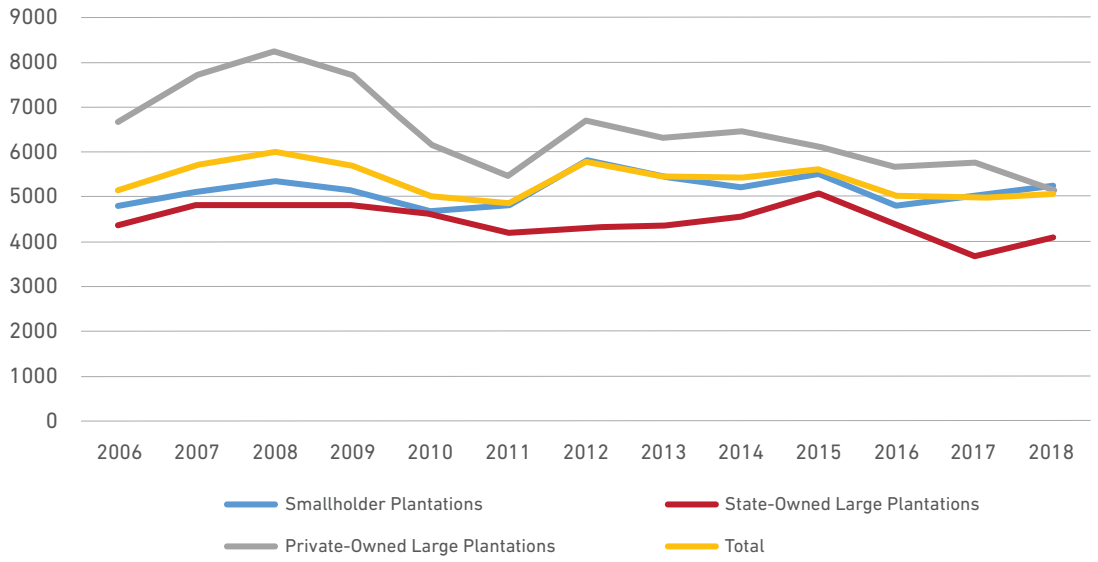
Source: 2020 Coffee Outlook, Directorate General of Estate Crops

Figure 4.
Cocoa Productivity Development by Type of Cultivation, 2006-2018 (Kg/hectare)



Source: 2020 Cocoa Outlook, Directorate General of Estate Crops

Figure 5.
National Sugarcane Productivity Development by Type of Cultivation, 2006 – 2018 (Kg/hectare)



Source: 2020 Sugarcane Outlook, Directorate General of Estate Crops

In general, the accuracy of data related to the production of several plantation commodities like coffee, cocoa, and rubber from the Ministry of Agriculture and Statistics Indonesia is questioned by some, such as the industry players (Gloria & Nugraha, 2019). In the case of data of cocoa, for example, Gloria and Nugraha's (2019) interviews with the players in the cocoa industry (Nestle and ICCRI) revealed that the production rate of cocoa published by the government is considered too high, even twice the number recorded by them.

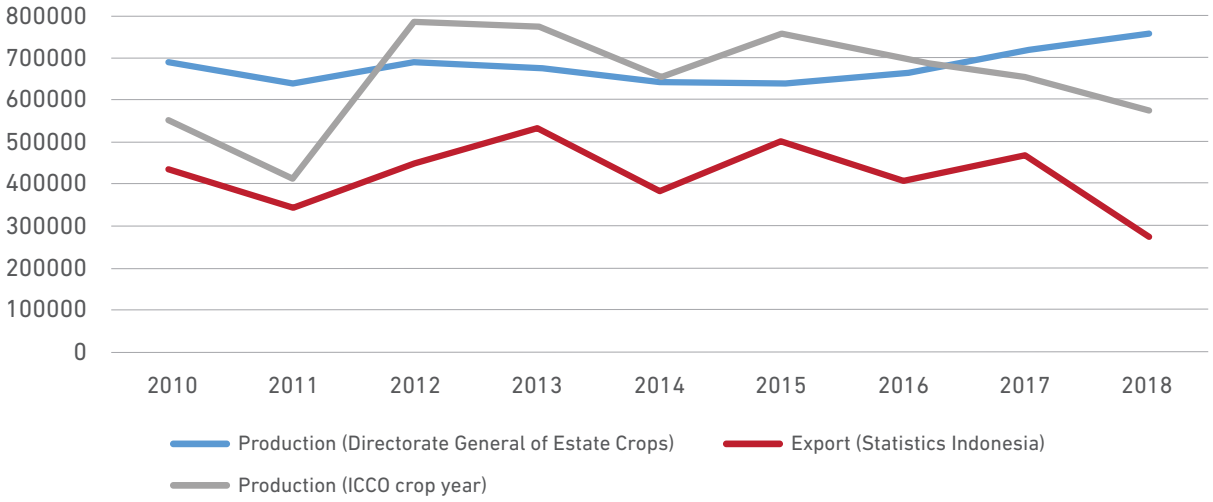
> "The huge data discrepancies between the government and industry players might be an indication that data published by the government tend to be overestimated."

The considerable data discrepancies between the industry players and government might be caused by the difference in the calculation approach used. Data from the industry players seem to be obtained using production inputs that might not cover all plantation commodities that are produced domestically. In other words, not all production of plantation commodities is absorbed by the domestic processing industry. Meanwhile, data published by the government use supplies produced by farmers and companies. Ideally, by taking into account exports and imports, there is a consistency between the usage and supplies. The huge data discrepancies between the government and industry players might be an indication that data published by the government tend to be overestimated.

The accuracy issue in the production data of Indonesian coffee was also reviewed by the World Bank (2015). The data collection of coffee in Indonesia was considered to have used unstandardized methods that are different between the provinces and regencies. This condition not only causes the generated data to be inaccurate, but also becomes misleading that programmes and policy formulation that use those data as a basis will result in a poor policy-making process. Hence, refining the data collection system is of an urgent matter.

According to Neilson et al. (2013), the productivity of Arabica coffee as reported by the Directorate General of Estate Crops tends to be overestimated. The reported productivity could be up to 800 kg per hectare, whereas the results of on-field observations and interviews with the farmers suggested that the productivity is significantly lower. For example, their study in South Sulawesi revealed that the productivity of Arabica coffee is less than 200 kg per hectare. Furthermore, the productivity of Arabica in Aceh and North Sumatra, the two production center regions, is unlikely to be more than 500 kg per hectare.

Figure 6.
Coffee Production and Export Development in Indonesia, 2010-2018 (ton)

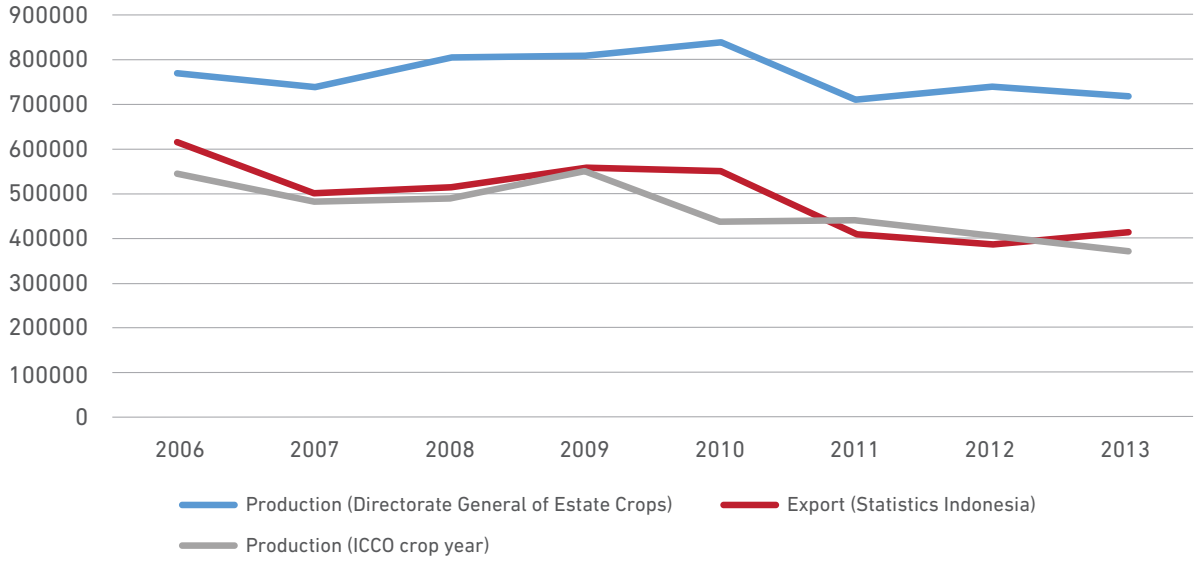


Source: Directorate General of Estate Crops, Statistics Indonesia, and ICO

The indication of the coffee production data's poor accuracy is also illustrated by the data movement that tends to be flat (less fluctuation) over the years, albeit the fact that plantation crop production is supposed to fluctuate from year to year due to the weather conditions. The movement of production data published by the Directorate General of Estate Crops is also not in line with the production data published by the International Coffee Organization (ICO) and export volume data published by Statistics Indonesia.

For cocoa, the annual movements of production data published by the Directorate General of Estate Crops tend to fluctuate and are in line with the export data published by Statistics Indonesia (Figure 7). Compared to the production data published by the International Cocoa Organization (ICCO), the data from the Directorate General of Estate Crops makes more sense compared to the cocoa export volume reported by Statistics Indonesia. In this case, the export volume is always lower than the domestic production. This can be seen as an indication that the quality of data of cocoa is better than that of coffee.

Gambar 7.
Cocoa Production and Export Development in Indonesia, 2006-2013 (ton)



Source: Directorate General of Estate Crops, Statistics Indonesia, and ICCO

EFFORTS TO IMPROVE DATA QUALITY

Efforts to improve data quality should be done on smallholder and large plantation data by targeting two essential aspects, which are the business process of data collection and methodologies. In relation to this, the utilization of information and communications technology must be optimized to enhance the accuracy, as well as expediting the process and eliminating unnecessary stages in recording and reporting the data.

Based on the previous review, the main issues in collecting plantation statistics are the poor business process and methodologies employed in estimating the planted area and production of plantation commodities. Regarding the business process, the main issues are the limited participation of the companies in the plantation statistical compilation and the standardization in collecting smallholder plantation data. Meanwhile, regarding the methodologies, the main challenge that should become the central focus, especially in smallholder plantations, is the lack of objective measurement implementation in collecting data on planted area and production.

In the case of plantation commodities that are cultivated by companies, a compilation of administrative data can be considered reliable. This is because companies normally have a relatively good system to record and document the cultivation activities, including information regarding the planted area and production (FAO, 2010). Contrastively, in smallholder plantations, a compilation of administrative data as shown in Figure 1 cannot be as reliable due to the poor records and documentation of cultivation activities done by the community groups (farming households). Therefore, other methods of collecting data should be considered, such as using a household survey with interviews (recalling), objective measurement using GPS or remote sensing, Area Sampling Frame Survey (*Survei Kerangka Sampel Area* or KSA), or a combination of the household survey and objective measurement approaches.

In principle, the choice of methods to collect data heavily depends on considerations regarding the desired level of accuracy, frequency and data presentation level, budget allocation for data collection activities, quality and expertise of the data collection officers, and the size of the estimated plot of land. By taking those into account (Table 4), it seems that, to improve smallholder plantation data, a combination of farmers' declaration and objective measurement to produce a correction factor of planted area and productivity estimation using a household survey is worth considering, when the main considerations are convenience and costs. This can be carried out by conducting an integrated survey for several strategic plantation commodities whose cultivation is dominated by smallholder plantations, especially coffee, cocoa, and sugarcane.

> A combination of farmers' declaration and objective measurement to produce a correction factor of planted area and productivity estimation using a household survey is worth considering, when the main considerations are convenience and costs.

Table 4.
Comparisons of Methods to Collect Data on Planted Area of Plantation

Method	Cost Effectiveness	Accuracy
Farmers' declaration through a household survey	Low cost and quick	Fairly accurate. Farmers might intentionally give overestimated or underestimated information or might not give any information at all.
Remote sensing	Estimation can be done quickly, although relatively more costly because this method requires high-resolution satellite images	Fairly accurate for large plantations when high-resolution satellite images are available. The smaller the plantation area, the lower the accuracy.
Area Sampling Frame (KSA)	Estimation can be done quickly, although relatively more costly because this method requires on-field observations and sampling frame development.	Fairly accurate when all information needed to develop the sampling frame is available (high-resolution satellite images and other spatial data)
Measurement using GPS	Fairly costly for a wide area, but this method is quicker	Very accurate for a relatively wide area. The smaller the size of the land plot, the lower the accuracy. Tends to produce an underestimated result for irregularly shaped plots of land.

Source: Food and Agriculture Organization, 2010

Remote Sensing and Area Sampling Frame

Technically, one of the choices of objective measurement method that can be used in measuring planted area and productivity of plantation crops in Indonesia is remote sensing[6] using satellite image data. There are a number of study results that can be replicated in regard to this method[7].

Remote sensing, albeit easier and relatively more accurate, is plagued with the challenge of the model's accuracy in identifying the vegetation of plantation crops[8]. This means that the application

[6] The planted area of a plantation can be estimated using a remote sensing image that represents a portion of the earth surface visible from space. The image can be in the form of analog images, such as sky photographs captured by a drone, or digital images, such as satellite images. A digital image comprises pixels that have intensity values and location address in a two-dimensional image.
[7] The development of remote sensing is very possible to be implemented in tea (Tripathi & Kiyoshi, 2015), coffee (Bernardes et al., 2011), and sugarcane tebu (Rao et al., 2002), both to estimate planted area and productivity. Meanwhile, the application of remote sensing to estimate the planted area and productivity of cocoa is still very limited.
[8] In estimating the area of a plantation, the plantation coverage of every pixel of the digital image from the satellite image needs to be analyzed. The produced estimation is often biased, and a decent estimation of plantation area can only be obtained when each pixel is identified clearly. This proves to be difficult in relatively small plantations. For smallholder plantation crops, such as coffee and cocoa, the use of this method seems to produce an inaccurate estimation due to the cultivation characteristics that are generally practiced on small and scattered plots of land.

of the mixed and intercropping planting system on coffee and cocoa poses its own challenges. Not to mention the sizes of plots of land that are generally small. Producing a reliable model for this requires long-term development.

The development of remote sensing to estimate the planted area and productivity of plantation crops requires a roadmap with clear deliverables. Lessons can be learned from China and Canada's experiences that took more than ten years to develop remote sensing to estimate crops planted area until it was ready to be implemented. For plantation commodities, the challenges will be more significant considering the wider range of commodities. Given the advantages and limitations of remote sensing, the development of this method in the long run can be focused and prioritized on several strategic plantation commodities and production center regions of each commodity. At the same time, the data collection of other plantation commodities and regions, whose contribution to the total national production is small, should be continued using the existing method (compilation of administrative products) with a business process that is enhanced by the use of information and communications technology, such as through the digitization of data recording and reporting process using a web-based system or Android application.

Besides remote sensing, a replication of the Area Sampling Frame method that has been implemented to estimate the planted area of rice can be also taken into consideration in the long run for annual crops, such as sugarcane. As a matter of fact, the use of the Area Sampling Frame method to estimate the planted area of plantation crops (rubber, coffee, pepper, and clove) has been developed by Statistics Indonesia in cooperation with the United States Department of Agriculture (USDA) since a long time ago. In 1980, an initial survey was conducted in Lampung Province with an assistance from the USDA (Willet, 1981).[9]

[9] The Area Sampling Frame method developed by the USDA is slightly different than that implemented by Statistics Indonesia on rice. The USDA's method uses plot of land area as a unit of observation/enumeration by collecting all information on the selected sample plots (planted area, production, information about the farmers and cultivation). With this method, the USDA's Area Sampling Frame can be implemented in annual and perennial crops. Meanwhile, Statistics Indonesia's method uses the grid approach to observe the condition of vegetation at the midpoint of the grid. With this method, Statistics Indonesia's method can only be used to estimate the planted area of annual crops. Therefore, the replication of Statistics Indonesia's Area Sampling Frame method on annual crops must be accompanied by productivity measurements that can be accomplished by conducting crop-cutting experiments on rice and secondary crops (palawija). An in-depth discussion on the implementation of the Area Sampling Frame method by Statistics Indonesia can be read in Ruslan, K. (2019) (rice) and Prasetyo et al. (2020) (maize).

Household Survey

For the data collection of smallholder plantations, especially coffee, cocoa, and sugarcane, the use of farmers' declaration through a household-based survey as a method deserves consideration[10] (FAO, 2010). Regarding this, since 2018, Statistics Indonesia has conducted a household-based Plantation Strategic Commodity Survey. In 2018, the survey was conducted on cocoa, whereas in 2019, it was conducted on sugarcane[11].

The variety of information that can be collected through a household-based survey is enormous, for it is done by interviewing the farmers. For example, the Plantation Strategic Commodity Survey collects information about the total production, total number of plants/planted area, general information of the cultivation that is being practiced (types of seeds), fertilizer use, pest/OPT (plant-disturbing organisms) control, etc.), farmer institutions, and other supplementary information. Because data on the number of plants and production are collected simultaneously, the productivity estimation, which is the results of dividing production by planted area, can also be obtained at the same time.

Unfortunately, the sustainability of this survey greatly depends on the availability of budget and data collection priority. Nevertheless, with the success of the 2018 and 2019 surveys, an integrated survey of strategic agricultural commodities, which combines the data collection of several plantation commodities, is worth considering as an alternative to improve the quality of smallholder plantation data collection system.

Combining Household Survey with Measurement

Operationally, the implementation of the farmers' declaration method through a household-based survey is inexpensive and easier to implement compared to the remote sensing and Area Sampling Frame[12] methods that are relatively costly and require a long-term development. Therefore, the budget can instead be allocated to increasing the accuracy of the estimation results by increasing the number of sample households and honorarium for the data collection officers.

Reflecting from the experiences in implementing the Area Sampling Frame method in collecting rice data, the implementation of this method in plantation crops will be relatively costly due to the big size of samples and number of officers employed in the on-field observations. Moreover, the development of sampling frames will require spatial data, especially large-sized high-resolution satellite images that need to be processed using special techniques to identify the vegetation of the plantation crops and administer a stratification process. Irs procurement undoubtedly requires a large number of investments.

[10] Household surveys can always be conducted as long as using the probability sampling method. In relation to this, a sampling frame that contains information about all household populations that cultivate plantation crops is required as the basis of taking the sample. In the case of Indonesia, this is not an issue because it can be obtained from the Agricultural Census that is conducted once every ten years. To improve the quality of data collected, the use of GPS to measure the farmers' lands can be considered as a replacement to the memory recalling method. The advantage of a household-based survey compared to the Area Sampling Frame method and remote sensing is the variety of data collected that can be obtained from the household interviews.

[11] The results of the Plantation Strategic Commodity Survey, both on cocoa and sugarcane, suggest that the estimated planted area from the survey is lower than that of the Directorate General of Estate Crops' administrative product compilation. This indicates that data on planted areas that have been used so far tend to be overestimated.

[12] Using the grid sampling method as implemented on rice.

On the other hand, the weakness of the farmers' declaration method compared to remote sensing and Area Sampling Frame is in the accuracy of the planted area data, which might not be better. The accuracy of this method has been examined in several studies (FAO, 2012) and implemented by some countries by comparing it to measurement methods or objective measurement. A study in the Philippines, for example, revealed that the farmers' declaration method tends to overestimate the results by as much as 6-8%. Meanwhile, other studies show the opposite, in which this method was found to have the tendency to underestimate the results.

Such contradictory results can be explained by the farmers' estimation that tends to overestimate relatively small lands and underestimate relatively large lands. The roundings of numbers by the farmers in reporting the planted area also contribute to the data accuracy because they tend to round the numbers up to a memorable unit, such as one hectare, half a hectare, or a quarter hectare. Concerns over being associated with tax affairs might also affect the quality of information given by the farmers to the data collection officers.

There are several things that can be done to improve the accuracy of data collected using the farmers' declaration from the household-based survey. The accuracy of the farmers' estimation will be better when they know the exact size of their lands from a measurement. Hence, the area of land as registered in the land certificate can be used as a control to improve the accuracy of the farmers' estimation. Asking for the farmers to show the plot of land that is going to be estimated to the data collection officers can also help increase the data accuracy.

The use of a correction factor obtained from the objective measurement, such as a measurement that uses GPS, can increase the accuracy of planted area estimation from the farmers as well. A correction factor can be obtained through an area measurement, such as by using GPS, of a portion of the observed household samples. In 2015, Statistics Indonesia employed this by conducting the Harvested and Planted Area of Food Crop Survey to confirm the suspicion over the overestimation of planted areas of rice, maize, and soybean that were collected using the eye-estimate method[13].

Another weakness of the household-based survey (single visit) to estimate the planted area and production of plantation crops that should be considered is that the data obtained will only present a snapshot of the previous year's condition. In fact, data users often need information on the current year's condition. This happens because the time reference of the data collection is the condition in the past year. However, this issue can be overcome by increasing the frequency of the survey (multiple visits), such as by conducting the survey four times in a year to capture the condition quarterly. Consequently, this requires higher costs than a single visit. Nevertheless, the data accuracy will improve due to the shorter period to recall the information. Study results revealed that the accuracy of data that are collected by relying on the farmers' recollection is heavily influenced by when the event concerned happened in the past. The longer the range of time, the lower the data quality (Wolburg, P., 2021).

[13] The survey was conducted in seven provinces, which are all of the Provinces in Java Island, except DKI Jakarta, North Sumatra, and South Sulawesi. A measurement of harvested area was also conducted on 10% of the total 300 thousand samples using GPS, in addition to interviews (farmers' declaration). The accuracy of GPS used is noteworthy. In general, it has a poor accuracy in measuring the area of relatively small and irregularly shaped plots of land.

Combining household-based surveys with interview and objective measurement can also be implemented by conducting productivity measurement experiments on the household samples. By using this approach, production can be estimated by multiplying the planted area by productivity. The use of corrected planted area and productivity as the results of the measurement can produce a more accurate production estimation. The results of a study by Statistics Indonesia in 2010 in six provinces (Riau, South Sumatra, Lampung, Bangka Belitung, South Kalimantan, and South Sulawesi) show that productivity measurement through a household-based survey can be implemented in palm oil, pepper, coconut, coffee, and cocoa (Statistics Indonesia, 2010).

“Combining household-based surveys with interview and objective measurement can also be implemented by conducting productivity measurement experiments on the household samples.”

Companies' Data Reporting

The key to improving plantation statistics collected from companies lies in the enhancement of the quality of administrative data compilation that has been used so far. Regarding this, Statistics Indonesia has taken several improvement efforts that are focused on reforming the business process of data collection by utilizing information and communications technology, as well as increasing the participation of plantation companies in the Plantation Company Survey through various persuasive efforts and intensive communication.

Since 2016, Statistics Indonesia has developed an online Plantation Company Survey data collection using a web-based application. Since 2018, data has been collected using the Computer-Assisted Web Interviewing (CAWI) method. With this method, plantation companies input the data independently via the web-based application from Statistics Indonesia. Until 2020, 377 State-Owned Large Plantations and 80 Private-Owned Large Plantations had participated. This indicates that their participation needs to be further encouraged because there are 2,500 State-Owned and Private-Owned Large Plantations as the respondents of the Plantation Company Survey. In other words, the realization of plantation company data collection via the online Plantation Company Survey so far until 2020 is still below 20%.

To enhance the quality of sugarcane and sugar data, the Ministry of Agriculture collaborated with the Government of South Korea through the Korea Agency of Education, Promotion and Information Service in Food, Agriculture Forestry and Fishery (EPIS) to develop an online sugarcane and sugar data reporting system (web and Android-based) that collects data directly from the sources, which are the sugar companies. The system was named e-Tebu or the National Agri-food Information System (NAIS)-Indonesia. It contains information related to sugar and sugarcane production, sugarcane planted area, and stock and distribution of sugar in Indonesia. This system is a digital data management innovation that needs to be replicated in other strategic plantation commodities. Unfortunately, this e-Tebu application is not yet connected to the online Plantation Company Survey developed by Statistics Indonesia. At the same time, Statistics Indonesia also collects sugarcane data from plantation companies through the Plantation Company Survey using the Sedia Data Perusahaan Perkebunan (SEDAPP) application.

This means that there is a dualism in the data collection process. Data collection activities for sugarcane and sugar in companies are supposed to be done in an integrated manner in one single data collection system.

Improvement efforts through the digitization of data collection activities are also carried out by PT Perkebunan Nusantara III by developing the *e-Farming* application (Android and web-based) that can be used by all PTPNs that cultivate sugarcane. This application allows for regular data reporting for sugarcane and sugar cultivated by PTPN. Unfortunately, this data collection system is not integrated with the online Plantation Company Survey as well.

"This means that there is a dualism in the data collection process. Data collection activities for sugarcane and sugar in companies are supposed to be done in an integrated manner in one single data collection system."

The sugarcane and sugar data collection activities that are carried out independently by the companies and Ministry of Agriculture should be integrated with the online Plantation Company Survey. This will be a challenge for Statistics Indonesia in the future as the governing agency of sectoral data to make the data collection effective and efficient.

Essentially, the quality of plantation data collected by companies heavily relies on the awareness and participation of these companies per se, both state and private-owned, in reporting the data through the Plantation Company Survey. Hence, the promotion and collaboration between Statistics Indonesia and the companies play a significant role in increasing their awareness and participation in reporting plantation data. Simultaneously, a legal umbrella should be prepared to bolster their participation in reporting their data[14].

[14] Law No. 16 of 1997 on Statistics as the only law and regulation that regulates the data (statistical) collection activities in Indonesia has yet to specifically stipulate about this matter. Data collected from the Plantation Company Survey are sectoral data as regulated under the said regulation, in which the respondent (company) has no obligation to report their data. The obligation to report data to Statistics Indonesia only applies in basic statistical data collection activities. In this case, the refusal from the respondent can be charged by criminal law. The legal umbrella in this context can be in the form of regulation that obliges companies to report the data required in the Plantation Company Survey and a sanction in the event of a violation. However, its implementation may not be an easy matter and can be a loophole for rent-seeking. The existing legal umbrella should be kept from becoming counterproductive and undermining the development of the plantation sector.

Long-Term Development

In the long run, the development of objective measurement-based data collection methods, such as remote sensing using satellite images, GPS, and productivity measurement experiments, should be done to improve the quality of data on planted area and productivity of plantation crops collected from smallholder and large plantations. This requires a considerable number of investments and political support. Such efforts are of urgent importance, including for coffee, sugarcane, and cocoa, the planted area and production of which are mostly from the smallholder companies.

Essentially, both expertise and infrastructure resources needed in developing measurement-based methods to collect plantation data are already available. Regarding this, a collaboration model for ministries/government agencies that have the required expertise and infrastructures as those in the development of the Area Sampling Frame method in improving the national paddy/rice data can be replicated[15].

> "Considering the wide scope of commodities and actors in plantation crop cultivation that consist of the public and companies, the enhancement of plantation data quality (planted area), production, and productivity) requires a national collaboration that involves the ministries/government agencies and private parties (plantation companies) with the needed expertise and resources to support each other."

Considering the wide scope of commodities and actors in plantation crop cultivation that consist of the public and companies, the enhancement of plantation data quality (planted area), production, and productivity) requires a national collaboration that involves the ministries/government agencies and private parties (plantation companies) with the needed expertise and resources to support each other. In this case, with a mandate from the Presidential Staff Office, for example, the Ministry of Agriculture can take a role as the coordinator of a team that consists of Statistics Indonesia, Agency for the Assessment and Application of Technology (BPPT), Ministry of State-Owned Enterprises (BUMN), Indonesian Plantation Association (GPPI), and other relevant ministries/government agencies.

Enhancing Sectoral Statistics

Fundamentally, plantation data are sectoral data as stipulated under Law No. 16 of 1997 on Statistics[16]. Therefore, the administration of statistical activities to collect data is the domain and responsibility of the Ministry of Agriculture, with the assistance and guidance from Statistics Indonesia as the coordinator of the National Statistical System (SSN)[17].

[15] The development of Area Sampling Frame method to estimate the planted area of rice is a collaboration between Statistics Indonesia and Agency for the Assessment and Application of Technology (BPPT), Geospatial Information Technology (BIG), Ministry of Agrarian Affairs and Spatial Planning/National Land Agency, and National Institute of Aeronautics and Space (LAPAN).
[16] Sectoral Statistics is statistics that is used to fulfill the needs of a certain government institution in performing its main governmental and developmental tasks.
[17] The National Statistical System Sistem is a structure that consists of elements of statistical data needs, resources, methods, facilities and infrastructures, science and technology, legal devices, and inputs from the Statistics Community Forum that are systematically related to each other, forming a totality in administering statistics.

In the long run, the independence in the conduct of sectoral statistics needs to be actualized[18]. In the context of collecting agricultural data, including plantation, this can be done by bolstering the capacity of the Center for Data and Information System (*Pusat Data dan Sistem Informasi Pertanian* or Pusdatin) of the Ministry of Agriculture. The capacity enhancement includes the development of human resources, which are the statisticians and computational statisticians; organizational structures; information technology infrastructures to support the administration of sectoral statistics through census, survey, and administrative product compilation; legal umbrella to ensure the independence and impartiality in conducting sectoral statistical activities; and budgetary support to conduct studies, methodology developments, and massive nation-wide agricultural data collection.

In the future, the Center for Data and Information System should be able to independently conduct agricultural censuses and surveys with the basis of strong statistical methodologies with a national scope and estimation up to the province level without having to rely on Statistics Indonesia. This is very possible considering the abundance of budgetary resources of the Ministry of Agriculture. The budget allocation should not be solely focused on increasing the production capacity, but also to improve agricultural data quality, including plantation data.

In relation to this, Indonesia can take lessons from the decentralization of sectoral statistical activities, including in agriculture, as done by India[19] and the United States. Indeed, it should be supported by robust and accountable institutional aspects to obtain high-quality data that are free from any sectoral interests. For example, the USDA has a special unit that is tasked with independently developing the methodologies and collecting agricultural data through censuses and surveys that are free from interventions. The said unit is called the National Agricultural Statistics Service (NASS), which becomes the primary reference in the development of agricultural statistical methodologies at the global level. The Center for Data and Information System of the Ministry of Agriculture should be developed, and its institutional capacity should be enhanced like NASS.

[18] To date, some statistical activities of collecting sectoral data are conducted by Statistics Indonesia. This has put a considerable burden for Statistics Indonesia in a condition where the human resources and budget are not proportional to the workload. This condition also renders the space for Statistics Indonesia limited to conduct research and development on data collection methodologies.

[19] India has the National Statistical System (SSN) that is well-decentralized under the coordination of the Ministry of Statistics and Programme Implementation/MOSPI. The activities of collecting agricultural statistics in India, including the Agricultural Census, are conducted by the Ministry of Agriculture and Farmers Welfare assisted by the Indian Agricultural Statistics Research Institute (IASRI). Data regarding the estimations of agricultural commodity production, for example, which are produced by the Directorate of Economics and Statistics, Ministry of Agriculture (DESMOA) can be accessed publicly from this site: https://eands.dacnet.nic.in/

CONCLUSION AND POLICY RECOMMENDATIONS

A serious attention should be put into improving the quality of the plantation data collection system. It involves the refinement of the business process and methodologies. For long-term development, one of the efforts that can be done is developing the use of remote sensing using satellite images to estimate the planted area and productivity of strategic plantation commodities. Regarding this, the collaboration of ministries/government agencies with expertise that is supplemental to each other is very necessary. The experiences in developing the Area Sampling Frame method to improve the quality of rice production data as seen in the collaboration of Statistics Indonesia, Agency for the Assessment and Application of Technology (BPPT), Geospatial Information Agency (BIG), and National Institute of Aeronautics and Space (LAPAN), and Ministry of Agriculture can be used as an example. The use of the Area Sampling Frame method as implemented in rice can deserve consideration to be implemented in collecting data on planted area of annual crops, such as sugarcane, in the long run.

The long-term development of remote sensing and Area Sampling Frame methods requires a considerable number of investments, yet it is a measure of urgent matter. Hence, the budget needs to be allocated for the research and development of objective measurement-based data collection methodologies, especially to collect the data on the planted area and productivity. To accomplish this, a roadmap that involves relevant ministries/government agencies with expertise and large plantation companies (state and private-owned) is required. From the experiences in implementing the Area Sampling Frame method to improve the national rice production data, the development of such a roadmap should be carried out by a team coordinated by the Presidential Staff Office or directly by the Vice President.

Regarding the improvement of data collection with large companies as the respondents, short and medium-term efforts that can be done are refining the business process of collecting/reporting plantation data, focusing on the compilation of secondary data from plantation companies (administrative reports). This can be achieved through the utilization of information and communications technology in the data collection/reporting system and by strengthening the collaboration and communication with the plantation companies, both state and private-owned companies.

For data collection with smallholder plantations as the respondents, the implementation of an integrated household-based survey on several strategic plantation commodities, such as coffee, cocoa, and sugarcane, that is combined with an objective measurement is highly recommended for short and long terms. This effort can be attempted by replicating the Plantation Strategic Commodity Survey conducted by Statistics Indonesia in 2018 on cocoa and 2019 on sugarcane. Improving the data collection methods for coffee, cocoa, and sugarcane cultivated by smallholder plantations can take advantage from the momentum of the Agricultural Census that is going to be held by Statistics Indonesia in 2023. The census was designed to collect information about planted area and production using a household approach. Thus, the results can be used as a sampling frame, especially for the data collection of smallholder plantations using a household-based survey.

In summary, by considering several data collection methods, there are two recommendations to improve the plantation data collection system in Indonesia in the short and long term. First, the administrative data compilation method with state and private-owned large plantation companies as the respondents should be continued, as long as it is accompanied by the modernization of the data collection business process using information and communications technological advances. With the modernization, the process of collecting data can be more effective and integrated. Additionally, companies' participation as the respondents can be increased by improving collaborations, persuasive efforts, and effective communication.

Second, a household-based survey can be considered as the vehicle for data collection with smallholder plantations as the respondents to replace the current method of compiling administrative products. This survey can combine the methods of farmers' declaration to obtain information regarding the planted area, productivity measurement experiments, and measurement using GPS on a portion of the samples to correct the planted area data. It should be conducted on several strategic plantation commodities simultaneously in an integrated manner for efficiency and cost reduction purposes.

REFERENCES

Bernardes, T., Rosa, V.G., Rudorf, B.F., dan Adami, M. (2012). Monitoring Coffee Yield Using Modis Remote Sensing Imagery. Remote Sensing: www.mdpi.com/journal/remotesensing

FAO. (2010). Handbook on crop statistics: improving methods for measuring crop area, production and yield. Diakses dari: fao.org.

Glorya, Mercyta J., and Arief Nugraha. (2019). Private Sector Initiatives to Boost Productivity of Cocoa, Coffee, and Rubber in Indonesia. Center for Indonesian Policy Studies, doi:10.35497/291601

ICO - International Coffee Organization. (2019).Trade Statistics. Accessed: 19/05/2021, www.ico.org, London: International Coffee Organization (ICO).

Ministry of Agriculture. (2012). *Pedoman Pelaksanaan Pengelolaan Data Komoditas Perkebunan*. Jakarta: Ministry of Agriculture.

Ministry of Agriculture. (2020). *Buku Outlook Komoditas Perkebunan Kakao*.

Ministry of Agriculture. (2020). *Buku Outlook Komoditas Perkebunan Kopi.*

Ministry of Agriculture. (2020). *Buku Outlook Komoditas Perkebunan Tebu.*

MOSPI. (2009). Statistical System in India 2009. Government of India, Ministry of Statistics and Program Implementation: New Delhi.

Neilson, J. Hartatri, D. S. F. and Lagerqvist, Y. F. (2013). Coffee-based livelihoods in South Sulawesi, Indonesia, Appendix B to the Final Report for ACIAR PROJECT SMAR/2007/063, Available at www.aciar.gov.au

Nitin K. Tripathi, S. S. Rajapakse & Kiyoshi Honda .(2004). Tea Yield Modeling Based on Satellite Derived LAI, Geocarto International, 19:3, 51-54, DOI: 10.1080/10106040408542317

Prasetyo, Octavia Rizky, Kadir, and Amalia, Ratna Rizki. (2020). A Pilot Project of Area Sampling Frame for Maize Statistics: Indonesia's Experience, Statistical Journal of the IAOS, 36(4): 997 – 1006.

Rao, Krishna P.V., Rao, Venkateswara V., dan Venkataratnam, L. (2002). Remote Sensing: A Technology for Assessment of Sugarcane Crop Acreage and Yield. Sugar Tech 4(3):97-101. DOI:10.1007/ BF0294689

Ruslan, Kadir. (2019). *Memperbaiki Data Pangan Indonesia Lewat Metode Kerangka Sampel Area*. Center for Indonesian Policy Studies. Jakarta. https://doi.org/10.35497/287781

Statistics Indonesia. (2010). *Laporan Hasil Studi Produktivitas Perkebunan Tahun 2010*. Jakarta: Statistics Indonesia

Statistics Indonesia. (2013). *Sensus Pertanian 2013: Angka Nasional Hasil Pencacahan Lengkap*. Jakarta: Statistics Indonesia

Statistics Indonesia. (2014). *Hasil Survei Rumah Tangga Usaha Perkebunan 2014*. Jakarta: Statistics Indonesia

Statistics Indonesia. (2018). *Hasil Survei Pertanian Antar Sensus (SUTAS) 2018*. Jakarta: Statistics Indonesia

Statistics Indonesia. (2018). *Pedoman Pencacah: Survei Komoditas Strategis Perkebunan untuk Implementasi Pengumpulan Komoditas Pertanian Strategis Melalui Rumah Tangga 2018.* Jakarta: Statistics Indonesia

Statistics Indonesia. (2019). *Pedoman Pencacah: Survei Komoditas Strategis Perkebunan untuk Implementasi Pengumpulan Komoditas Pertanian Strategis Melalui Rumah Tangga 2019*. Jakarta: Statistics Indonesia

Statistics Indonesia. (2020). *Statistik Kakao Indonesia 2019. Jakarta: Statistics Indonesia.*

Statistics Indonesia. (2020). *Statistik Kopi Indonesia 2019. Jakarta: Statistics Indonesia*.

Statistics Indonesia. (2020). *Statistik Tebu Indonesia 2019. Jakarta: Statistics Indonesia*.

TribunPekanbaru.com. (2018). *Wujudkan Data Berkualitas, BPS Ajak Perusahaan Perkebunan Tingkatkan Response Rate*. Diakses pada 19 Mei 2021, avilable at https://pekanbaru.tribunnews.com/2018/08/15/wujudkan-data-berkualitas-bps-ajak-perusahaan-perkebunan-tingkatkan-response-rate

Joseph W. Willet. (2018). Area Sampling Frames For Agriculture in Developing Countries. The US Department of Agriculture, 1981.

Wollburg, P., Tiberti, M., & Zezza, A. (2021). Recall Length and Measurement Error in Agricultural Surveys. 50x2030 Working Paper Series: February 2021.

World Bank. (2015). *Towards A More Competitive and Dynamic Value Chain for Indonesian Coffee. - Working Paper*

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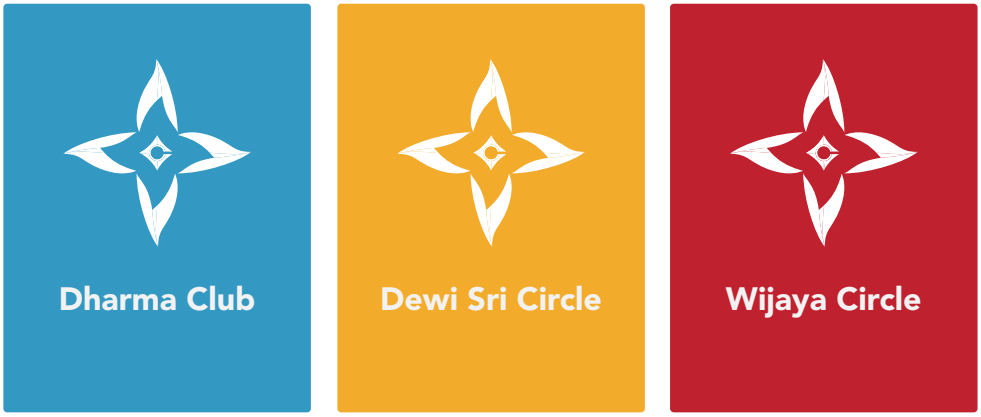

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