Applying bag of words approach to determine remote sensing technology acceptance among smallholder plantations

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Abstract

Purpose – Technology acceptance is a measure of that technology's usefulness. Oil palm is one of the biggest contributors to Indonesia's revenues, thus fueling its economy. Using remote sensing would allow a plantation to monitor and forecast its production and the amount of fertilizer used. This review aims to provide a policy recommendation in the form of a strategy to improve the added value of Indonesia's oil palm and support the government in increasing oil palm production. This recommendation needs to be formulated by determining the users' acceptance of remote sensing technology (state-owned plantations, private plantation companies and smallholder plantations).

Design/methodology/approach – This review's methodology used sentiment analysis through text mining (bag of words model). The study's primary data were from focus group discussions (FGDs), questionnaires, observations on participants, audio-visual documentation and focused discussions based on group category. The results of interviews and FGDs were transcribed into text and analyzed to 1) find words that can represent the content of the document; 2) classify and determine the frequency (word cloud); and finally 3) analyze the sentiment.

Findings – The result showed that private plantation companies and state-owned plantations had extremely high positive sentiments toward using remote sensing in their oil palm plantations, whereas smallholders had a 60% resistance. However, there is still a possibility for this technology's adoption by smallholders, provided it is free and easily applied.

Research limitations/implications – Basically, technology is applied to make work easier. However, not everyone is tech-savvy, especially the older generations. One dimension of technology acceptance is user/customer retention. New technology would not be immediately accepted, but there would be user perceptions about its uses and ease. At first, people might be reluctant to accept a new technology due to the perception that it is useless and difficult. Technology acceptance is the gauge of how useful technology is in making work easier compared to conventional ways.

Practical implications – Therefore, technology acceptance needs to be improved among smallholders by intensively socializing the policies, and through dissemination and dedication by academics and the government.

Social implications – The social implications of using technology are reducing the workforce, but the company will be more profitable and efficient.

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Originality/value – Remote sensing is one of the topics that people have not taken up in a large way, especially sentiment analysis. Acceptance of technology that utilizes remote sensing for plantations is very useful and efficient. In the end, company profits can be allocated more toward empowering the community and the environment.

Keywords Sentiment analysis, Technology acceptance, Oil palm, Remote sensing

Paper type Research paper

1. Introduction

Oil palm is one of Indonesia's greatest revenue contributors and yields the highest revenue to the nation's economy (Ulfiah *et al.*, 2018). Indonesia's biggest crude palm oil (CPO) importers are India and China, each at US$4.57bn and US$4.39bn, respectively (BPS, 2021). Oil palm export value exceeds those of the oil-and-gas and non-oil-and-gas sectors; this sector's export value (excluding oleochemicals and biodiesel) reached US$15.57bn or around Rp220tn. Amid the COVID-19 pandemic that hit all sectors, such as oil and gas, coal and tourism, the oil palm sector actually managed to survive and still contributed approximately US$13bn (approx. Rp190tn) to the export revenue up to August 2020.

Nevertheless, oil palm's added value is still low. The government's DMO policy of 30% (while 70% is for export) leads to low added value (Irawan & Soesilo, 2021). While in fact, the market prospects for oil palm products, which fall into the category of downstream industry, are very promising, not to mention the bright prospects for palm oil alone (Indonesian Business Competition Supervisory Commission). This sector's demand increases significantly from year to year, whether domestic or international (Ulfiah *et al.*, 2018). Therefore, the government's counterproductive policy needs further review to meet the domestic requirement while still achieving maximum harvest productivity and downstream added value.

Indonesia is a tropical country with vast lands, and hence it is a great opportunity to develop oil palm plantations, whether by state-owned enterprises, private companies, foreign investments or smallholders (Arman & Sembiring, 2018). On an intensive level, remote sensing technology can be an alternative in monitoring and evaluating an oil palm plantation (Diana & Farida, 2021). Remote sensing technologies, using satellite and aerial data, could revolutionize the management of the oil palm industry and assist in decision-making for efficient plantation management, bringing both business and environmental benefits, such as in investigating the effects of oil palm plantations on the environment (Chong, Kanniah, Pohl, & Tan, 2017; Taylor & Francis Group, 2017). Remote sensing is a tool to provide timely, repetitive and accurate information about the Earth's surface at a large coverage (Chong, Kanniah, Pohl, & Tan, 2017). Remote sensing can even detect oil palm age. Some studies have revealed that identifying the age of various vegetation can be done using spectral information from remote sensing data (McMorrow, 2001; Buddenbaum, Schlerf, & Hill, 2005; Van Aardt & Norris-Rogers, 2008; Sirén & Brondizio, 2009; Franklin, Hall, Smith, & Gerylo, 2003). This benefit can surely improve oil palm productivity.

Optimizing CPO productivity can increase the quantity and quality of CPO and its derivatives, such as cooking oil, animal feed, basic oleochemicals and biodiesel, as well as support other industries of edible oil and vegetable oils. All these products have huge export potentials, besides their domestic market demand. They can create greater added value while stimulating the people's economies, as they are labor-intensive and can increase regional revenues and eventually improve national growth.

All these prove that technology is important in increasing productivity, as it acts as an enabler in improving oil palm's added value. Nonetheless, this would not materialize if the technology acceptance by the users is low. For that reason, this research aims to determine the acceptance of remote sensing technology by the user groups. The user groups in this study are divided by their oil palm plantation size in Indonesia; hence, there are three groups: private plantation companies (50.77%), smallholders (37.45%) and state-owned plantations

(11.67%). Technology acceptance is one of the supporting factors of the policy on productivity improvement to strengthen the upstream and downstream sectors through increased added value.

This study's result is a policy recommendation in the form of a strategy to improve the added value of Indonesia's oil palm and support the government in increasing oil palm production. Accurate information about an oil palm plantation's condition is essential to monitor the plantation's development. This indirectly prepares the industry for technology assimilation, which would cut costs, mitigate labor dependence and improve productivity. These can be achieved if there is positive technology acceptance from all three user groups.

2. Theoretical review

2.1 Remote sensing technology in the oil palm sector

Technology is one of the determining factors in an economic unit (Solow, 1956). For example, remote sensing technology is used to determine the right kind of plants in a certain season (Shivaprasad, ParthSarathi, Chakravarthi, Srinivasarao, & Bhanumurthy, 2017). Furthermore, remote sensing is an important tool for timely monitoring and acquiring an accurate representation of the agricultural sector through repetition frequency with high accuracy (Shanmugapriya, Rathika, Ramesh, & Janaki, 2019).

Remote sensing plays a significant role in the management of oil palm plantations. It provides valuable information and data about the plantation's health (Anisa, Rokhmatuloh, & Hernina, 2020), growth and overall condition. Here are some ways in which remote sensing is related to the management of oil palm plantations.

Monitoring plantation extent and expansion: Remote sensing techniques, such as satellite imagery (Li, Dong, Fu, & Yu, 2018; Srestasathiern & Rakwatin, 2014) and aerial photography (Rizky, Liyantono, & Solahudin, 2019; Zheng *et al.*, 2021), are used to monitor the extent of oil palm plantations and track their expansion over time. This information helps in assessing land use changes, identifying areas of deforestation or encroachment and ensuring compliance with regulations and sustainability standards.

Yield estimation and productivity assessment: Remote sensing can help estimate palm oil production and assess plantation productivity. By analyzing satellite data, such as vegetation indices, crop growth models and canopy reflectance, managers can determine the health and vigor of oil palm trees, identify areas of low productivity and optimize resource allocation for better yield.

Disease and pest detection: Remote sensing techniques can assist in the early detection of diseases and pests affecting oil palm plantations (Anuar *et al.*, 2021; Kurihara, Koo, Guey, Lee, & Abidin, 2022; Malinee, Stratoulias, & Nuthammachot, 2021). Hyperspectral and multispectral imagery can identify specific spectral signatures associated with diseases or pest infestations, enabling timely interventions and targeted control measures.

Water management: Remote sensing provides valuable information about soil moisture levels (Shashikant *et al.*, 2021), irrigation needs and water stress (Galvez-Valencia, Garces-Gomez, Lemus Rodriguez, & ArangoArgoti, 2021) in oil palm plantations. By using satellite data or ground-based sensors, managers can optimize irrigation schedules, improve water use efficiency and minimize the risk of water-related issues such as drought stress or flooding.

Environmental monitoring: Remote sensing helps in monitoring the environmental impacts of oil palm plantations. It can assess deforestation (Gaveau *et al.*, 2022), land degradation (Dubovyk, 2017; Wang *et al.*, 2023) and biodiversity loss (Geller *et al.*, 2017; Pettorelli, Safi, & Turner, 2014) by comparing historical and current satellite images. This information aids in identifying areas for restoration, implementing conservation measures and ensuring compliance with sustainability standards. Based on the interpretation of satellite imagery nationally, deforestation is correlated with palm oil prices (Gaveau *et al.*, 2022).

Planning and precision agriculture: Remote sensing data can support precision agriculture techniques (Huang, Chen, Yu, Huang, & Gu, 2018) in oil palm plantations. By analyzing vegetation indices and other data layers, managers can identify variations in crop health, nutrient deficiencies (Samreen *et al*., 2023; Walshe *et al*., 2020) and stress factors within the plantation. This information allows for targeted interventions, such as site-specific fertilizer application or pest control, leading to more efficient resource use and reduced environmental impact.

Compliance and certification: Remote sensing data can provide evidence of compliance with sustainability standards, such as the RSPO certification. Satellite imagery and geospatial analysis help verify land use practices, land cover changes and adherence to no-deforestation commitments, contributing to transparency and accountability in the industry.

Overall, remote sensing technology and analysis techniques are valuable tools in the management of oil palm plantations, providing crucial information for decision-making, sustainable practices and monitoring the environmental and social aspects of palm oil production.

2.2 Oil palm sector link

Economic activities related to the oil palm sector are divided into production, consumption and general distribution in a supply chain. The oil palm sector's potential is reflected in the aspects of earnings and labor (Christiani, Mara, & naenggolan, 2013). The economic potential of this sector lies in how the added-value flow starts in the oil palm supply system or from the procurement of fresh fruit bunch (FFB) at an oil palm plantation. The supply chain model of CPO is related to FFB procurement and is founded on two activities: harvesting and production. The harvesting function is related to forecasting the amount of FFB at every estate (*afdeling*) or even at every block. The production function is related to planning the resource usage (input) needed to produce CPO.

In economics, production is a combined effort that turns input into output (Case & Fair, 2004). Input refers to resource usage of land, labor and additional input (e.g., production tools and machines), whereas output is divided into products and services. Meanwhile, management would evaluate the use of production inputs and the output performance yielded for decision-making. The mathematical correlation can be defined as a function of production. According to Boediono (2000), a function of production is a function or equation that shows the correlations between production factors (input) and the yielded output.

2.3 National oil palm policy

One of the regulations that govern the oil palm sector's policies is Presidential Instruction No. 8/ 2018 on the Delay and the Licensing Evaluation of Oil Palm Plantations, and the Improvement of Oil Palm Plantation Productivity. This presidential instruction aims to improve sustainable plantation governance by preserving the environment by decreasing greenhouse gas emissions and increasing oil palm plantation productivity. Since 2011, Indonesia's oil palm plantations have been obliged to adopt sustainable governance and certifications, also known as the Indonesia Sustainable Palm Oil (ISPO) scheme. Previously, since 2008, there had been voluntary sustainable palm oil certification, that is, the Roundtable Sustainable Palm Oil (RSPO). The mandatory ISPO implementation should be accelerated so all oil palm plantations in the country can be managed sustainably (proven by an ISPO certification). The productivity improvement program for the national oil palm plantations should be integrated with the improved sustainable plantation governance, whether in the economic, social or ecological aspects.

It is worth noting that the management practices can vary among different oil palm plantations, and there are ongoing efforts in Indonesia to further improve sustainability and address the environmental and social challenges associated with oil palm cultivation. Better governance of socially sustainable community development will reduce conflict between affected communities and companies (Pasaribu, Vanclay, & Zhao, 2020).

The development of the oil palm industry aims to empower the upstream and downstream with the sustainability concept. The government has provided empowerment and mentoring for oil palm farmers so they can acquire ISPO certification, rejuvenate their independent oil palm plantations and gain access to funding. On the downstream, the government assists with opportunities to access markets of oil palm and its derivatives.

2.4 Technology acceptance

Basically, technology is applied to make work easier. However, not everyone is tech-savvy, especially the older generations. One dimension of technology acceptance is user/customer retention. New technology would not be immediately accepted, but there would be user perceptions about its uses and ease. At first, people might be reluctant to accept a new technology due to the perception that it is useless and difficult. Technology acceptance is the gauge of how useful technology is in making work easier compared to conventional ways.

Remote sensing technology can benefit all fields, including plantations. Remote sensing is measuring or acquiring information without direct contact with the object by using recording tools (American Society of Photogrammetry). Remote sensing in the oil palm sector monitors and forecasts the production volume and the amount of fertilizer used in order to be efficient (Diana & Farida, 2021).

Remote sensing in oil palm plantations is partly done in large plantations and would require using a satellite, such as Landsat (the USA), SPOT (France), MOS (Japan), Seasat (the USA), ERS (Europe) and Luna (Russia). Additionally, the staff operating the tool must have special skills and proper training. Despite these requirements, remote sensing at a plantation can actually save human resources, besides achieving greater efficiency in terms of the amount of fertilizer used (Diana & Farida, 2021).

3. Methodology

The study was done in North Sumatra, which was chosen because it is the second-largest oil palm producer at 5.76mn tons after Riau at 8.7mn tons. The total oil palm plantation areas in North Sumatra recorded 1.36mn ha in 2020 (BPS, 2021). This area is divided into smallholder plantations at approximately 440,000 ha or 32% (BPS, Plantation Office of North Sumatra Province, 2021), private plantations at 42% and state-owned plantations at 26%.

The study's primary data were from focus group discussions (FGDs), questionnaires, observations on participants, audiovisual documentation and focused discussions based on group category. The secondary data came from Indonesia's Palm Oil Research Institute (PPKS) and other literature. A total of 30 respondents were selected purposively to represent smallholders, private plantations, state-owned plantations, academics and researchers, associates and the government.

The applied method was text mining. Text mining in this study was used to analyze the text from interviews and FGDs that have been transcribed to 1) find words that can represent the content of the document; 2) classify and determine the frequency (word cloud); and finally 3) analyze the sentiment.

The data classification method in the sentiment analysis had three approaches (Thomas, Yuliana, & Noviyanti, 2021):

(1) The first approach alone had a series of three methods:

- Machine learning with the support vector machine method (Imamah, Husni, Rachman, Suzanti, & Mufarroha, 2020; Onwuegbuche, Wafula, & Mungátu, 2019; Ahmad, Aftab, & Ali, 2017);
- Neural network (Bangsa, Priyanta, & Suyanto, 2020; Ratnawati & Winarko, 2018; Thomas & Latha, 2018);

- Decision tree (Suresh & Bharathi, 2016; Saputra, Halomoan, Raharjo, & Syavira, 2020) and naïve Bayer (Normah, 2019; Ruger, Suyanto, & Kurniawan, 2021; Uma and Prabha, 2020).

(2) The second approach was lexicon-based (Jurek, Mulvenna, & Bi, 2015), which used various words that have been valued with the polarity score to determine the response of the users or the public. The lexicon sentiment calculated the sentiment from the semantic orientations of the words and phrases that came up in the text (Taboada, Brooke, Tofiloski, Voll, & Stede, 2011). Meanwhile, the study (Chopra, Prashar, & Chandresh, 2013) divides the lexicon-based approach into five phases: morphology analysis, syntax analysis, semantic analysis, writing integration and pragmatic analysis.

(3) The third approach is a hybrid of the previous two.

The sentiment analysis used in this study is the BOW (bag of words) model. BOW is a special text mining used to categorize or extract subjective behavior or sentiments from a community group that is expressed in text format into groups of positive or negative sentiments (Andreyestha, 2016). This simple and conventional model does not require a certain word order or syntax (Kolekar *et al.*, 2016). These unstructured data or words would then be processed with R studio assistance into a semi-structured or structured form, which would go through text transformation.

4. Data and analysis discussion

The questions in the FGD and in-depth interview would determine the technology acceptance of remote sensing technology applied at oil palm plantations to increase productivity and support policies on increasing productivity. The data processing results would strengthen the upstream and downstream sectors through higher added values. The data processing results from the FGD and in-depth interview transcripts can be divided into three groups based on BPS grouping (2019): state-owned plantations, private plantations and smallholders. By plantation size, they can be ranked as follows: private plantations (50.77%), smallholders (37.45%) and state-owned plantations (11.67%) (BPS, 2019).

The qualitative analysis results through text mining analysis are in the forms of sentiment analysis (bar chart) and word cloud. The bar chart indicator is based on the NRC emotion lexicon method.

4.1 State-owned plantations

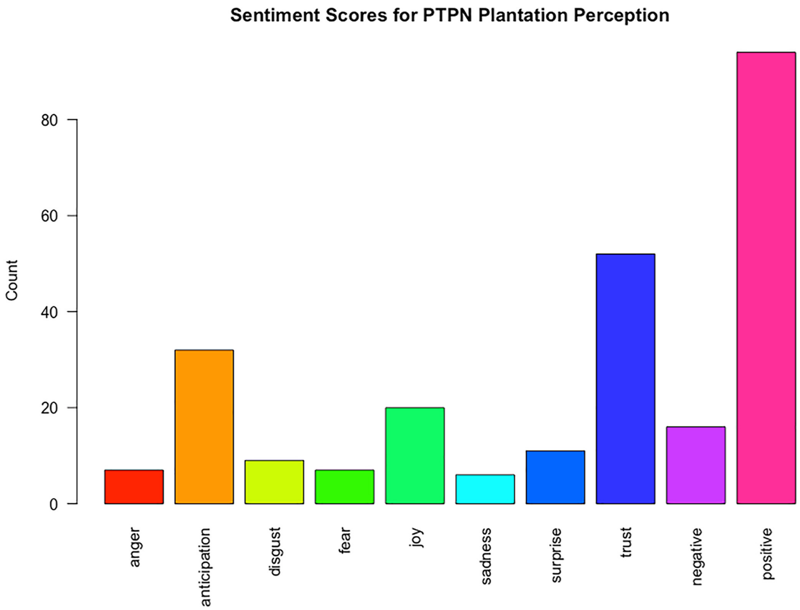
The state-owned plantations were represented by respondents from PT Perkebunan Negara IV (PTPN IV). The results showed the following word cloud and bar chart.

In the word cloud of state-owned plantations (Figure 1), the big words were *sudah* (already), *penggunaan* (usage), *bisa* (can), *ada* (existing), *pohon* (tree), *produksi* (production), *potensi* (potential) and so forth. These results showed that the state-owned plantation group had a positive sentiment about using remote sensing at oil palm plantations.

As seen in the bar chart (Figure 2), the state-owned plantation group showed an 80% positive sentiment, given that this group has already increased their productivity by using imaging data and drone technologies (as shown by the word cloud output). This result was further supported by the bar chart, wherein the indicators of *trust*, *anticipation* and *joy,* or positive emotion words, were relatively higher than those of negative emotion words, such as *anger*, *disgust*, *fear* or *sadness*. The relatively higher percentage of the word *anticipation* showed the acceptance of the new technology (SPOT 6/7 imaging) in increasing productivity or production. Currently, the technology has indeed increased productivity, saved costs and optimized human resources. Unfortunately, the hurdle is the lack of human resources that can analyze the image as a monitoring tool.

Note(s): Wordcloud output of state-owned plantations
Source(s): Primary data

Figure 1. Word cloud or TAG cloud of state-owned plantations



Note(s): Sentiment analysis (bar chart) output of state-owned plantations
Source(s): Primary data

Figure 2. Sentiment analysis (bar chart) state-owned plantations

4.2 Private plantation companies

The word cloud and bar chart results from the private plantation company group are as follows.

Based on the private plantations' word cloud (Figure 3), the words that tended to show up were *petani* (farmer), *ada* (existing), *pupuk* (fertilizer), *bibit* (seed), *hasil* (result), *harga* (price), *subsidi* (subsidy) and *aturan* (regulation). These words tend to accept the use of remote

Figure 3.
Word cloud or TAG cloud of private plantation companies

Note(s): Wordcloud output of private plantation companies
Source(s): Primary data

sensing among private companies. There was no big word that connoted rejection, but the big private plantations instead tended to bring up words like *subsidy*, *aid*, *fertilizer* or *seed*.

The sentiment score and bar chart results (Figure 4) showed that private plantations also had positive acceptance. The sentiment score of the bar chart from private plantations was similar to the score from state-owned plantations, that is, >80% positive sentiment (even higher than state-owned plantations' score). The positive emotion word outputs were also similar to those of state-owned plantations, wherein the values of *trust, anticipation* and *joy*,

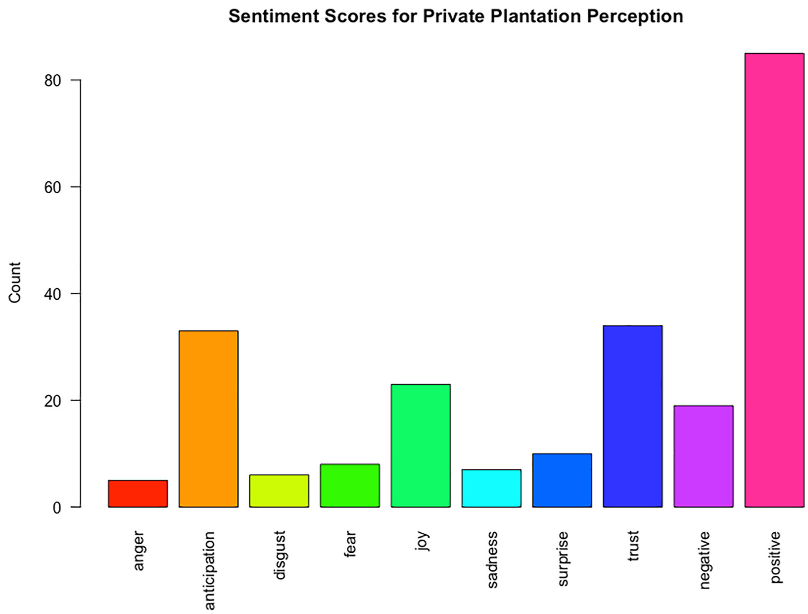


Figure 4.
Sentiment analysis (bar chart) private plantation companies

Note(s): Sentiment analysis (bar chart) output of private plantation companies
Source(s): Primary data

or positive emotion words, were relatively higher than those of negative emotion words, such as *anger, disgust, fear* or *sadness*.

Indeed, this group has also applied monitoring from its initial process, which comprises selecting superior seeds (including those from the Palm Oil Research Institute/PPKS) and monitoring fertilizer usage. The industrial or private plantations also employ farmers from the community. These plantations' governance is very careful regarding pricing and cost management (including maintenance cost) while also optimizing their results.

For increasing production technology adoption must also be considered; in this case, the private plantations have indeed used remote sensing technology (imaging data). This technology leads to efficiency, including efficient fertilizer usage. Currently, the technology is used to monitor planted areas, the planted populations, rejuvenation areas that have been planted (with nuts) and heavy equipment usage. However, future challenges would require a technology that can balance needs and usage, meaning that the amount needed must be equal to the amount used, hence avoiding inefficiency (for example, to avoid wasting fertilizer).

4.3 Smallholders

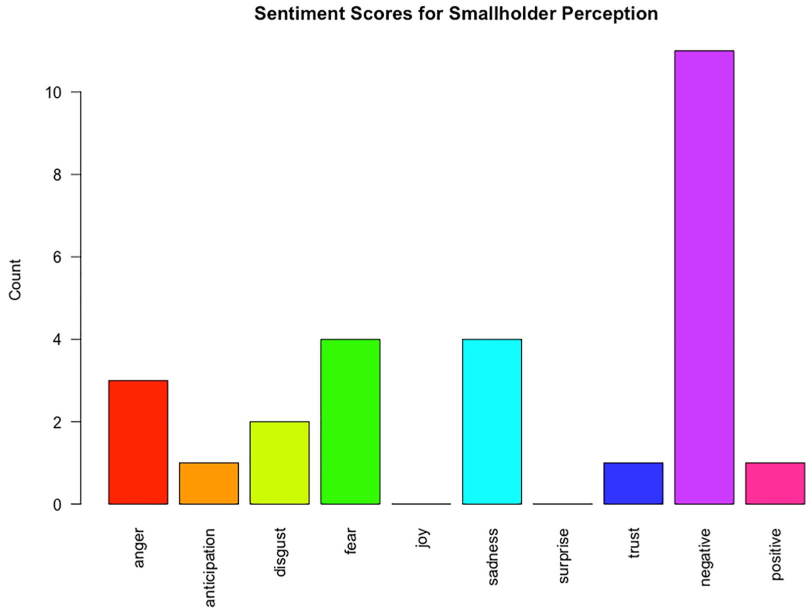
The word cloud and bar chart results from the smallholder group are as follows.

The word cloud from the smallholder group (Figure 5) showed negative sentiment, as indicated by the emergence of the big words *Tidak* (No), *petani* (farmer), *jika* (if), *harga* (price), *pupuk* (fertilizer), *bibit* (seed) and so forth. The rejection shown by the word "*no*" toward using remote sensing among smallholders showed non-acceptance of technology.

Smallholders are relatively resistant to using remote sensing to increase productivity. Farmers are often slow to adopt agricultural technology due to lack of understanding, even though they recognize that technology is important for eradicating poverty in most developing countries (Mwangi and Kariuki, 2015). This is reflected in their bar chart result (Figure 6), which contradicted the other groups' results. Their sentiment analysis also showed negative sentiment. This result is also supported by the fact that the percentage of negative emotion words was higher than that of the positive emotion words. Although technology adoption is not limited to remote sensing, in the context of smallholder farmers there is often a mismatch between the technology introduced and the needs of farmers who have to make complex decisions in reallocating their limited resources. Smallholders in sub-Saharan Africa (SSA) face significant challenges in agricultural intensification (Iiyama *et al.*, 2018).

Note(s): Wordcloud output of smallholders
Source(s): Primary data

Figure 5.
Word cloud or TAG cloud of smallholders



Note(s): Sentiment Analysis (Bar Chart) output of smallholders
Source(s): Primary data

Figure 6.
Sentiment analysis (bar chart) smallholders

The word cloud output also showed that, let alone caring about government policies, this group is used to unideal conditions related to basic things, such as not using superior seeds and not caring about (or not even using) fertilizer. Suggestions to use technology to help monitor their oil palm plantation areas will not be welcome. Therefore, almost certainly, their production has not been optimum. However, there is still a chance to use technology already embedded in apps that are given for free to this group, so there is still hope for the future.

The condition above applies to oil palm farmers with plantations of <5-6 ha (small and medium holdings). Meanwhile, for farmers with lands >6 ha (large holdings), their FGD results were similar to those of state-owned and private plantations, in which they did not show resistance toward using remote sensing technology (including in monitoring fertilizer usage). Based on a study on Sumatra Island (one of the centers of oil palm production), the group that showed no resistance toward increasing production by using remote sensing technology was approximately 40% of the people's independent plantations. This means that 60% are resistant.

Resistance among farmers toward remote sensing technology in monitoring oil palm plantations is common. A study by the Indonesian Oil Palm Research Institute (IOPRI) in other regions on farmers with plantations <2 ha showed the following results (Table 1).

A qualitative test showed that the private and state-owned plantation groups had a positive view about using remote sensing technology (SPOT 6/7) in monitoring oil palm plantations (including fertilizer usage) to increase productivity. Currently, both groups have used remote sensing technology and reaped the benefits of real-time monitoring, faster decision-making and more accurate decisions (in terms of time and human resource efficiencies).

On the other hand, the people's independent plantations are split into two (2) groups, wherein 40% have accepted and started using remote sensing and may accept other new technologies as long as they could increase productivity. Conversely, 60% resist the policy;

Table 1. Independent plantation categories based on plantation size

Groupings based on land ownership	Aceh Range(Ha)	Aceh Average(Ha)	Aceh (%)	Bengkulu Range(Ha)	Bengkulu Average(Ha)	Bengkulu (%)	West Sumatra Range(Ha)	West Sumatra Average(Ha)	West Sumatra (%)
Small holdings (≤2 Ha)	0.5-2	1.2	21	0.5-2	1.5	26	1-2	1.8	11
Medium holdings (>2-6 Ha)	2.1-5.5	3.4	23	2.5-6	3.8	49	2.25-6	3	31
Large holdings ((>6 Ha)	7-20	12.3	56	6.5-11.5	8.3	25	7-32	12.6	58

Note(s): Profile of Sumatran oil palm smallholders
Source(s): Indonesian Oil Palm Research Institute (IOPRI)

let alone managing inputs to increase productivity, they are not even using fertilizers properly. However, this group can still accept technology to help manage their oil palm plantations if the technology is given for free and is easy to use.

4.4 Strategy to increase the added value of Indonesia's oil palm

Regarding the results above, we see the need for more intensive socialization or dissemination among people's independent plantations to increase their acceptance of technology, thus improving productivity. Hopefully, doing so will indirectly increase the added value of the oil palm plantation sector, which also comprises small-medium enterprises (SMEs). Optimization in CPO and its derivatives penetrates as far as their downstream industries (cooking oil, animal feed, basic oleochemicals, biodiesel and other industries related to cooking and vegetable oils), thus potentially stimulating SMEs. Currently, SMEs amount to 64.2mn units and contribute 61.07% to the GDP or Rp8,573.89tn. SMEs contribute to the nation by absorbing 97% of the total workforce and comprising up to 60.4% of the total investments.

Another data that highlight the need for technology acceptance among the people's independent plantation sector is that this sector's share is on the rise and has reached 52% of the total planted areas. Currently, independent plantations are estimated to have reached 9mn ha, not 6mn ha anymore, whereas state-owned plantations are relatively tiny at 515 ha. The total oil palm plantations can absorb 4.2mn workforces for the people's oil palm, but they are related to 8.2mn people in total industry. Oil palm is also the source of livelihood for 1.5mn small farming families. Economy-wise, oil palm has contributed to the regional economies of at least 31 regencies and cities in Indonesia.

All in all, there is a need to improve technology acceptance in people's independent plantation sector by intensively conducting approaches in policy socialization and dissemination or through the dedication from academics and the government. The level of farmers' technological knowledge varies widely. It is important to provide education and training on its use at the community level, although in actual operation it may use the services of a remote sensing expert. Research (Wu, Gao, Wang, & Zhao, 2022) found that education is the key to a strong understanding of accepting and adopting technology. In parallel, this would prepare the industry to assimilate technologies that can cut costs, reduce workforce dependence and increase productivity. Therefore, oil palm will be the biggest contributor to the state revenues by not only its increasing exports, but also by fueling regional economies, absorbing the workforce and fighting poverty in rural areas.

5. Conclusion and suggestion

5.1 Conclusion

The state-owned and private plantation groups showed extremely positive sentiment or acceptance of using remote sensing in oil palm plantations. On the contrary, smallholders tend to resist using remote sensing technology. However, there is still a chance for technology to be accepted, provided it is free and easily applicable. Meanwhile, the fact on the ground reveals limited experts to operate remote sensing tools to monitor oil palm plantations.

The acceptance of remote sensing technology in state-owned and private plantations in general also supports research by Diana, Hidayat, Rafikasari, Ibrahim, and Farida (2019), which proved that directly using remote sensing technology can yield high economic values.

Using conventional text mining with the lexicon method in this study poses a limitation, which is the spectrum of vocabulary in the Indonesian language, which often includes slang.

5.2 Suggestion

Based on this study, the people's independent plantation group is resistant to the policy. Hence, further research should be conducted by focusing on this group, especially the small and medium holdings. Training and mentoring should be provided to increase their employees' skills. For text mining tests by other researchers, it is suggested to avoid neutral words; instead, lean toward positive or negative words.

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