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Analysis of the Effects of Digital Image Recognition, Quality, SOP Compliance, and Soil Control on the Enhancement of Oil Palm Yield (Tons/Ha) and CPO Output Per Hectare Using Structural Equation Modeling – Partial Least Squares (SEM-PLS)

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Keywords
cpo, yield, sem-pls, compliance, quality

Abstract ;
This study investigates the factors influencing oil palm productivity and Crude Palm Oil (CPO) output per hectare through the integration of digital image recognition mitigation systems, operational quality, SOP compliance, and soil control management. The increasing demand for palm oil, combined with limitations on plantation expansion, requires plantation companies to optimize productivity through intensification and efficient operational management. Therefore, this research aims to analyze the direct and indirect effects of mitigation practices, operational quality, SOP compliance, and soil control on yield and CPO/ha production at PT XYZ. The study employed a quantitative approach using secondary data collected from 67 plantation areas during the 2024–2025 period. Data analysis was conducted using Structural Equation Modeling–Partial Least Squares (SEM-PLS) with SmartPLS 4.0 software. The findings indicate that SOP compliance has a significant positive effect on yield ($\beta = 0.464$; $p = 0.000$) and indirectly affects CPO/ha through yield mediation. Yield also demonstrated the strongest direct influence on CPO/ha ($\beta = 0.713$; $p = 0.000$). Operational quality showed a moderate positive relationship with yield, while digital image recognition mitigation and soil control did not exhibit statistically significant direct effects. The study concludes that improving SOP compliance, harvesting quality, and operational discipline are essential strategies for enhancing oil palm productivity and increasing CPO output per hectare sustainably.

INTRODUCTION

Crude Palm Oil (CPO) is a processed product from oil palm plants, through a processing process in palm oil mills. The amount of oil contained in oil palm fruit, known as Oil Content, is greatly influenced by standard agronomic practices, starting from the selection of superior seedlings, standard oil palm planting, routine and scheduled maintenance, fertilization carried out according to the recommended dose, to the time of fruit harvest and delivery of the fruit to the Mill (palm oil mill). Research by Hidayatullah (2023) shows that palm oil production and the price of Crude Palm Oil (CPO) complement each other in improving the welfare of farmers, which means that an effective distribution system can be the key to obtaining optimal results. During processing at the mill, it is also very important to pay attention to CPO losses due to non-standard processing processes (residual fruit, leaks in the machine and low quality of processed fruit) and high FFA (free fatty acids). Based on a study conducted by Levia & Mhubaligh (2023), the importance of testing free fatty acid levels as a quality indicator in CPO shows how vital the distribution stage is in maintaining product quality in order to meet market standards.

The existence of the palm oil industry in Indonesia is one of the important sectors because it contributes to state revenue, creates jobs, and supports farmers/plantations (Awalludin & Heikal, 2024; Billa & Iswarini, 2021; Hafif et al., 2014). Domestic CPO consumption continues to increase, in 2024 the consumption of CPO and its derivative products will be recorded at around 23.85 million tons, and this number is expected to increase in 2025. The government targets Indonesia's CPO production to reach around 60 million tons by 2030 to meet the needs of food, biodiesel, and oleochemicals Indonesia is the largest palm oil exporting country in the world to date, according to BPS statistical data in 2024 Indonesia will export 24,254.8 tons of palm oilto several countries such as India, China, and Pakistan. Palm oil commodities still have good prospects in the future when viewed from the large demand for processed palm oil products both for domestic consumption and export abroad (Ishak & Raflis, 2022; Karosekali, 2018; Kettipusem & Heikal, 2024).

The graph above shows the percentage of CPO production with FFB production in Indonesia from 2022 - 2024 of approximately 20 percent. If optimization is carried out in palm oil productivity (maximizing *yield*), the percentage of CPO that can be obtained is 25-26 percent (according to IOPRI)

The main use of CPO in Indonesia is for the food sector (cooking oil, household food, food industry, margarine, processed cake products, and other foods); Raw materials for the oleochemical industry, cosmetics and hygiene products (soaps, shampoos, cosmetics, moisturizers and others); Biodiesel and renewable energy which are currently being encouraged by the Government to use CPO for biodiesel blends (B40, B50 programs); and Export to many countries. According to research by Sulistiawati, P. (2023), simultaneously domestic consumption variables, rupiah exchange rates, and international Crude Palm Oil (CPO) prices have a significant effect on the volume of palm oil exports in Indonesia (Journal of Economics, vol.7, no.4, November 2023).

To achieve the target demand for CPO, the productivity and quality of palm oil must be maintained to be high. Several studies show that efficient transfer of FFB to a processing plant is very important to prevent fruit quality from deteriorating, such as an increase in free fatty acid (FFA) levels that can occur due to suboptimal transportation time (Dianto et al., 2017; Iskandar et al., 2023; Panggabean et al., 2023). Efforts to increase the amount of oil palm production with the addition of new planting areas are currently very difficult due to Government regulations that limit forest clearing for the expansion of oil palm plants. Efforts that can be made by XYZ palm oil companies and oil palm farmers are to maximize the *yield* or productivity of existing plants, with intensification efforts.

The problems in achieving yield are high crop losses caused by fruit theft, submerged areas due to floods/inundation and burning of oil palm plantation areas due to land fires (Ningsih et al., 2021; Pradiko et al., 2023; Romadhoni et al., 2022). Oil palm theft continues to increase from year to year, due to social problems around the plantation location, so there are individuals who deliberately steal oil palm fruits in an organized manner. The high rate of fruit theft is also due to the establishment of many mills that do not have a mother garden, so that to meet the FFB process, they buy fruit from fruit collectors some of whose fruit comes from theft.

Prevention of oil palm loss with Theft Mitigation, Fire Mitigation and Flood Mitigation, is a mandatory activity for companies and farmers, so that high crop losses do not occur. Theft mitigation is carried out by making boundary trenches, installing portals, and making guard posts. Fire mitigation is carried out by the formation of a fire fighting team in each estate, the creation of reservoirs for water reserves, and the regulation of water levels in fire-prone areas.

Meanwhile, flood / flood mitigation is carried out by making embankments, making *water management* systems and installing sluice gates.

Another problem is that the quality of work, especially *Harvesting*, *Manuring* and *Spraying*, is still low, so that the vegetative and generative growth of oil palm plants is not up to standard. Several studies show that efficient transfer of FFB to a processing plant is very important to prevent fruit quality from deteriorating, such as an increase in free fatty acid (FFA) levels that can occur due to suboptimal transportation time (Dianto et al., 2017; Iskandar et al., 2023; Panggabean et al., 2023). *Harvesting Quality* is measured based on the achievement of the quality of the harvested fruit, the quality of the harvest and the quality of the transportation of the harvest. *Manuring Quality* or fertilization quality, measured based on the quality of fertilizer peeling, the accuracy of fertilizer application in the field and the accuracy of fertilizer retailing as needed. Meanwhile*, Spraying Quality* or spraying quality for weed control is measured based on the weed mortality rate after spraying, *ground management conditions* and the accuracy of using *nozzles* and herbicides according to the target weeds.

Problems of labor quality or worker behavior are also still found, especially discipline and compliance with the Standard Operating Procedure (SOP) index of harvesting, manuring (fertilization) and spraying (weed control). In addition, suboptimal labor management is also an important issue; Lack of training on the importance of distribution efficiency can lead to human error that has an impact on the quality of FFB (Ridha et al., 2022). The value of SOP compliance at PT. XYZ, for Harvest SOP by 82%, Fertilization SOP by 87% and SOP Spraying by 86%. The SOP Index assessment includes 4 important parts of harvesting, fertilizer and spraying work, namely discipline towards Planning/Plan, Implementation/Do, Supervision/Check and Follow-up improvements/Action. The better the value of compliance with SOPs, it is expected to correlate with higher production achievements in the field.

Compliance with SMK3 (Occupational Safety and Health Management System) has also not reached the standard, so it must be improved because it is related to risk mitigation in daily activities in order to create a safe, efficient and productive work environment. The value of SMK3 PT XYZ is 80%, consisting of SMK3 harvesting 69%, SMK3 fertilization 82%, SMK3 spraying 85% and SMK3 slashing 88%. Compliance with SMK3 is especially an assessment of the completeness of the use of personal protective equipment (PPE), considering that work in oil palm plantations has a high risk of work accidents.

The availability of nutrients in the soil is also still a problem because there is still the availability of nutrients that have not reached the standard. At PT. XYZ the availability of nutrients in the soil for C-organic of 1.96% is still below the standard (>3%), while for C/N the ratio is 7.79% (from the standard <30%) and the soil pH is 4.3% (from the standard >4%). To meet the lack of nutrients in the soil, fertilization is carried out with a total dose of 7 to 8 kg per tree. The types of fertilizers are divided into 2 namely inorganic fertilizers, namely fertilizers produced by fertilizer factories (e.g., NPK, Urea, MOP, Rock Phosphate, Dolomite, Kieserite, etc.) and organic fertilizers, namely fertilizers derived from oil palm processing residues, including: empty floors, composting, land applications, solids, etc.

Productivity or yield (ton/ha) of oil palm is obtained from the amount of production tonnage divided by the area harvested. In order to get a high production tonnage, it is very important to pay attention to the amount of harvest losses (loss of tonnage), both measured and immeasurable losses. Measurable harvest losses are due to the presence of ripe harvests that are not harvested so that they become rotten, oil palm patches that are not collected clean in the field and the presence of harvest harvest leaves that are not sent to the Mill (or restan). Meanwhile, immeasurable crop losses are caused by areas that are not harvested due to claims (controlled by other parties), areas that are not harvested because access conditions are heavy (cannot be entered or passed) and are not harvested because the area is flooded or flooded.

CPO/ha is the final product that after the palm fruit is processed in the mill, it produces crude palm oil (CPO). The amount of CPO tonnage is determined by the tonnage of the processed grain, the quality of the harvested fruit and the presentation of processing losses in the mill. The quality of the fruit sent to the Mill is divided into 5 groups, namely: ripe fruit (Ripe), raw fruit (unripe), underripe fruit (underripe), overripe fruit (overripe) and Empty bunch (empty bunch). Each ripeness criterion has different oil content, the highest in Ripe fruit, so that the minimum standard for the quality of fruits processed in the mill is more than 75%, Underripe <15%, Overripe <10%, for raw fruits and 0% empty bunches.

Based on the existing background and factors that can affect productivity in oil palm plantations, this study aims to determine the direct and indirect influence of mitigation *(digital image recognition*), quality, compliance with SOPs and SMK3 (X4), and *soil control* on increasing production (*Yield*) and CPO/ha.

RESEARCH METHODS

This research was conducted at PT XYZ to test the factors that affect palm oil production, including mitigation *(digital image recognition),* quality, compliance with occupational safety and *soil control*.

All sample data are taken from secondary data from PT XYZ's internal. Data was taken from a total of 67 plantation areas from the 2024 and 2025 periods (to September 2025). The data taken are in the form of Mitigation *(digital image recognition),* Operational Quality, Operational Compliance with SOPs and SMK3, Soil Control, Yield and CPO / Ha.

Table 1 Variable Operational Definition

Variable		Operational Definition	Indicator	References
X1	Mitigation/ *digital image recognition*	Mitigation is an action taken to reduce, minimize, and mitigate the negative impact of an unwanted risk	- Theft Mitigation - Fire Mitigation - Flood Mitigation	
X2	Quality	The quality of work that supports vegetative growth and fruit formation (generative), consists of the quality of harvesting/fruit harvesting, the quality of plant fertilization (manuring) and the quality of plant maintenance and soil management system (spraying). Meanwhile, the quality of CPO is judged from: low levels of free fatty acids (FFA), water, and impurities.	- Harvesting Quality - Manuring Quality - Spraying Quality	
X3	Standard Operating Procedure (SOP)	Management that constructively increases oil palm production includes Planting SOPs, Fertilization SOPs, Watering SOPs and compliance with occupational health and safety in the company environment	- Harvesting SOP - Manuring SOP - Spraying SOP - SMK3 Compliance	Marpaung, R. (2013)
X4	Soil Control/Soil *Control*	Nutrients are a set of chemical compounds (nutrients) that are needed by oil palm trees to support fruit growth and formation. The nutrients in the soil measured are C/N ratio, C-organic and soil pH.	- Fertilization - C/N Ratio - C. Organic - Soil pH - Rainfall	Adzani, R. R., & Arif, M. (2023) Harahap, A. F. S., & Munir, M. (2022)

		The lack of nutrients in the soil is met by fertilization. Rainfall also greatly determines the amount of soil moisture content that is suitable for nutrient absorption.	
Y1	*Yield*	Harvest yields that refer to palm fruits or oil palm fruit bunches (FFB)	- Tonnage - Ton/Ha - % Losses
Y2	*Crude Palm Oil*	Palm oil processed from palm fruit bunches (FFB)	- Quantity CPO - Quantity FBB - % Losses

At its core, palm oil productivity is the result of a complex relationship of various factors, as previously identified by researchers. Broadly speaking, these factors can be grouped into technical factors of cultivation, environment, and management. The security system in oil palm plantations is important considering that oil palm plantations have a very wide area coverage so that they require a security management system so that oil palm crops are not stolen, the security system has a significant influence on oil palm productivity (Afner Liber S et al., 2024.

Oil palm trees on flooded land have an effect on oil palm productivity, oil palm trees on normal land have superior productivity, therefore it is important to keep oil palm land normal and not flood, Nugraha et al. (2023). (Lydiasari & Santoso, 2022)

Fires in oil palm plantations, both sabotage and elnino, have a significant impact on the productivity of oil palm plantations up to 28-41%, the haze produced by the fire indirectly disrupts the growth process of oil palm fruits, therefore it is important to mitigate all potential fires in oil palm plantations (PASPI Research Team, 2015).

In the technical aspects of cultivation and production inputs, the availability of production facilities and the application of innovation have proven to have a positive and significant effect (Yazid Bustomi, 2023). This is supported by other findings that affirm the importance of basic inputs such as land area, use of superior seeds, fertilizer application, and plant age (Yudi Siswanto, 2020; Rohmat et al., 2022).

In the aspect of management and human resources, it plays a crucial role. Labor effectiveness (Yudi Siswanto, 2020; Rohmat et al., 2022) as well as harvest management arrangements, such as the number of harvest working days and permanent output, have a real effect on total production (Firdaus Lubis, 2018). Awareness of occupational safety and commitment to occupational safety and health behaviors and creating a safe work environment so that it is more productive and reduces *downtime* due to work accidents (Yusmaini et al., 2025) (Rizki Khaurina, 2023). All of these factors will build a yield component at the crop production level, where the weight of the bunches is a significant determinant of final production (Imelda Putri et al., 2022).

Data analysis was conducted using the Structural Equation Model (SEM) with the help of SmartPLS software version 4.0. The SEM-PLS analysis on SmartPLS consists of an outer *model* and an inner *model*. In the measurement model, how much of the manifest variable is able to explain the exogenous latent variable (X) and the endogenous latent variable (Y) is used.

RESULTS AND DISCUSSION

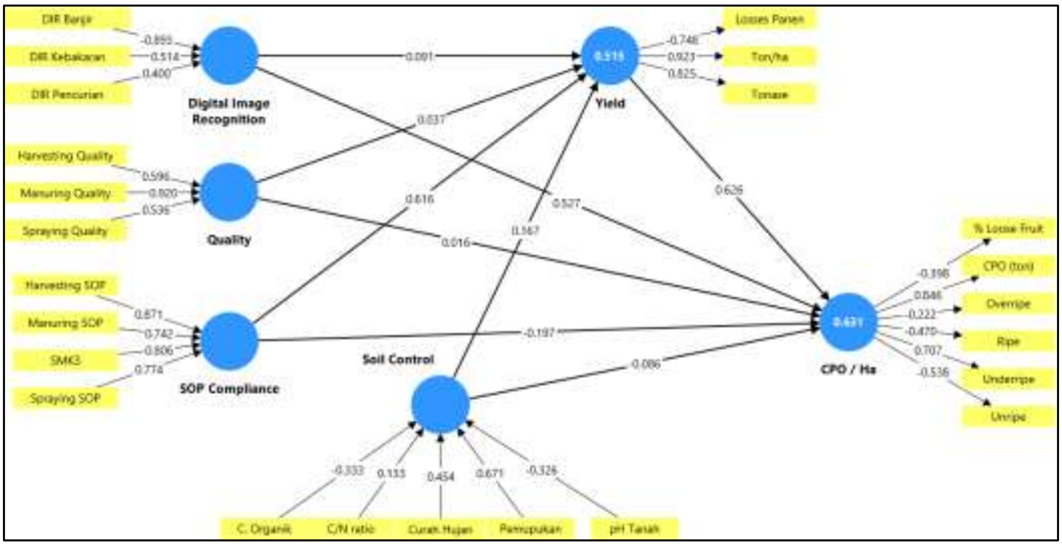

Figure 2 PLS Algorithm Analysis Results (validity test)

From the results of analyzing all existing data using the PLS Algorithm, the loading factor values of each existing indicator (outer model) are obtained. The loading factor value is a parameter used to perform the initial validity test, where for a factor value smaller than 0.6, the indicator is declared invalid. We will then remove these invalid indicators from the analysis output model**.** For models that are already valid with a loading factor value of each indicator that is above 0.6, then the validity of the existing data will be tested such as Cronbach's alpha Reliability Test, AVE, Discriminant Validity.

After data validation for indicators that do not meet the criteria, a valid model is obtained as shown below.

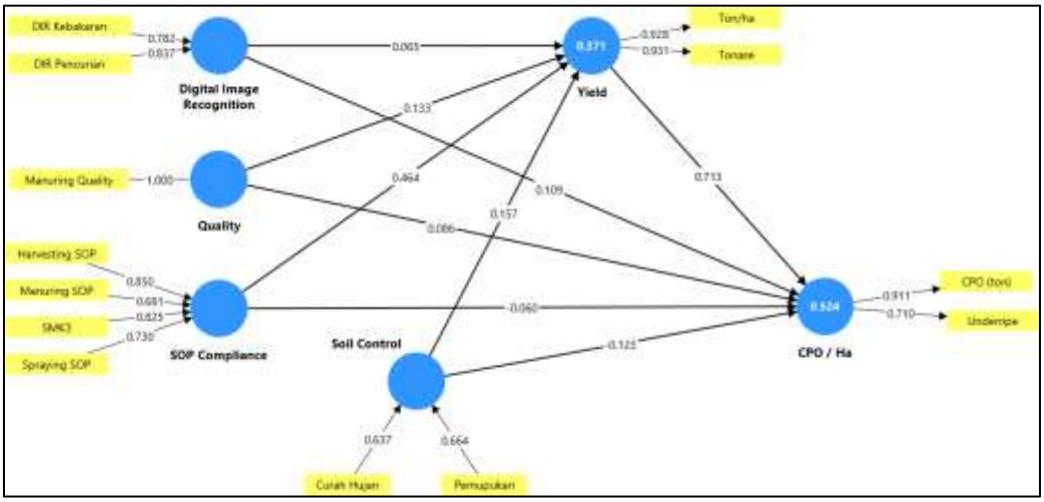

Figure 3 Results of PLS Algorithm Analysis, after validation

Data Validity Test

Table 2 Table of Loading Value Indicator Factors

Indicator	CPO / Ha	Digital Image_Recognition	Quality	SOP Compliance	Soil Control	Yield
CPO (ton)	0.911					
Rainfall					0.637	
DIR Fire		0.782				

DIR Theft	0.837				
Harvesting SOP			0.850		
Manuring Quality		1.000			
Manuring SOP			0.681		
Fertilization				0.664	
SMK3			0.825		
Spraying SOP			0.730		
Ton/ha					0.928
Tonase					0.931
Underri					

The results of the convergent validity test were evaluated through an outer loading matrix, showing that all indicators used in this study were valid. In accordance with the recommended criteria, all indicators had a loading factor value above the threshold of 0.6. Specifically, the Mitigation/digital image recognition variable is supported by the indicators of Fire Mitigation (digital image recognition) with a loading factor value of 0.782 and Mitigation (digital image recognition) Theft with a value of 0.837. The Quality variable is supported by a Manuring Quality indicator with a loading factor value of 1,000. Furthermore, the SOP Compliance variable is supported by the indicators of Harvesting SOP, Manuring SOP, SMK3 Compliance and Spraying SOP with loading factor values of 0.850, 0.681, 0.825 and 0.730 respectively. For the Nutrient variable, it is supported by the Rainfall indicator with a loading factor value of 0.637 and the Fertilization indicator with a loading factor value of 0.664. The Yield dependent variable is valid with supporting indicators of Ton/Ha and Tonnage with loading factor values of 0.928 and 0.931, respectively. The final dependent variable CPO/Ha is valid with the CPO (ton) and Underripe indicators with loading factor values of 0.911 and 0.710 respectively. These results confirm that all measurement indicators adequately represent the planned latent construct.

Table 3 Reliability and Validity Tests

Construct	Cronbach's Alpha	Composite Reliability (rho_a)	Composite Reliability (rho_c)	Average Variance Extracted (AVE)
CPO / Ha	0.525	0.622	0.798	0.667
Yield	0.842	0.843	0.927	0.864

The next validity test is *Construct Reliability and Validity*, which is by looking at *Cronbach's Alpha* and *Average Variance Extracted* (*AVE)* values. *Cronbach's Alpha* value obtained is 0.842. This value already meets the criterion >0.7 (Hair et al, 2015). The AVE value obtained was 0.864. This value already meets the criterion >0.5 (Hair et al, 2015).

Table 4 *Discriminant Validity*

Construct	CPO / Ha	Quality	Yield
CPO / Ha			
Quality	0.436		
Yield	1.013	0.396	

The next validity test is by looking at the *Discriminant validity - Heterotrait-monotrait ratio* (HTMT). The HTMT value obtained is almost all below <0.9, except for Yield with a value of 1.013. The criterion of good validity is <0.9 (Henseler, J., J. Sarstedt, M. J. Ringle, and D. D. H. Ringle, 2015).

Hypothesis Test Results

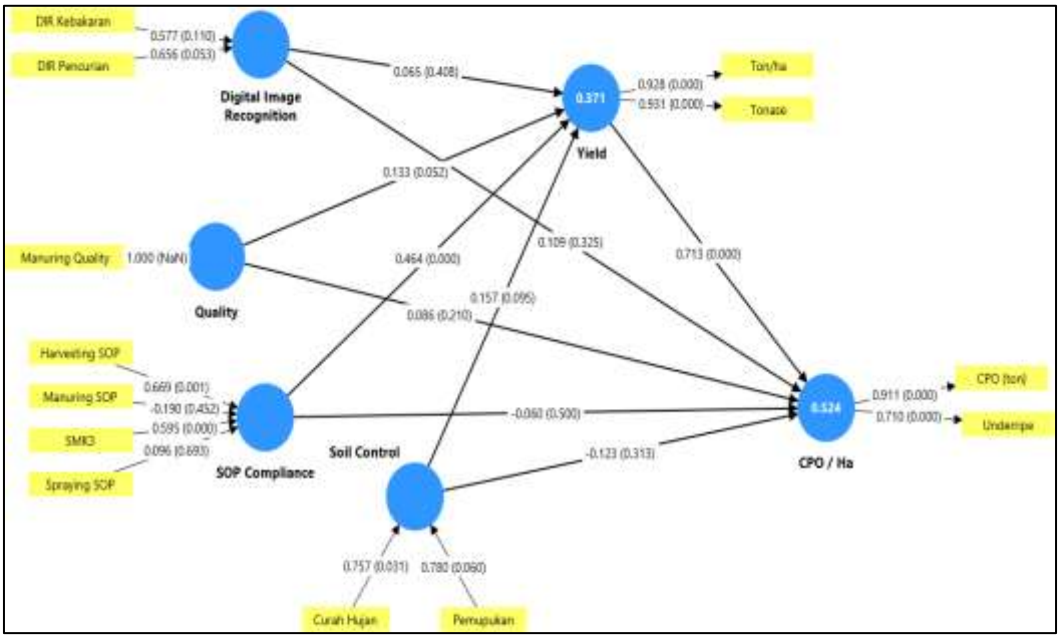

Figure 4 Bootstrapping Analysis Diagram

The hypothesis model in this study was developed to examine the structural relationship between the variables of factors that are assumed to affect palm oil production at PT XYZ. The modeling results are displayed in the form of a flowchart that illustrates the estimation coefficient (O), the level of statistical significance (P values) and the value of the determination coefficient as an indicator of the contribution of the variant explained by the dependent variable to the independent variable. The following are the results of the hypothesis model test in the research.

Research Model Test Results

Table 5 *Total Effect (Direct & Indirect)*

Relationship	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics	O/STDEV
Digital Image_Recognition -> CPO / Ha	0.155	0.164	0.096	1.620	0.105
Digital Image_Recognition -> Yield	0.065	0.081	0.078	0.827	0.408
Quality -> CPO / Ha	0.181	0.165	0.090	2.007	0.045
Quality -> Yield	0.133	0.130	0.069	1.943	0.052
Soil Control -> CPO / Ha	-0.011	0.010	0.149	0.073	0.942
Soil Control -> Yield	0.157	0.153	0.094	1.672	0.095
SOP Compliance -> CPO / Ha	0.270	0.300	0.094	2.890	0.004
SOP Compliance -> Yield	0.464	0.470	0.085	5.479	0.000
Yield -> CPO / Ha	0.713	0.704	0.066	10.873	0.000

Table 6 *Specific effect (indirect)*

Relationship	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics	O/STDEV
Digital Image_Recognition -> Yield -> CPO / Ha	0.046	0.056	0.055	0.843	0.399
Quality -> Yield -> CPO / Ha	0.095	0.092	0.050	1.903	0.057

SOP Compliance -> Yield -> CPO / Ha	0.330	0.331	0.067	4.909	0.000
Soil Control -> Yield -> CPO / Ha	0.112	0.108	0.068	1.649	0.099

Direct Influence

The test results showed that two pathways exerted a direct influence that proved positive and statistically significant:

1. The effect of latent variable SOP Compliance on *Yield.* The hypothesis states that SOP *Compliance* has an effect on Yield is accepted. It was found that the path coefficient was 0.464 with a T-statistical value of 5.479 and a P value of 0.000. A $P<0.05$ value indicates that SOP Compliance has been proven to significantly increase Yield.
2. The Effect of Yield on CPO/Ha. The hypothesis states that Yield has an effect on CPO/Ha is accepted and shows the strongest influence in this model. The path coefficient value was recorded at 0.713 with a very high T-Statistic value of 10.873 and a P value of 0.000. This confirms that yield is a very significant main predictor of CPO/Ha.
3. The effect of latent variable Quality on *Yield.* The hypothesis states that Quality affects the Yield received. It was found that the path coefficient was 0.133 with a T-statistical value of 1.943 and a P value of 0.052. The value is indeed $P > 0.05$ but it is still categorized as significant because the value of the path coefficient is quite high. This indicates that Quality is still proven to significantly increase yield.

In other direct influence hypotheses, this study did not show a statistically significant effect ($p>0.05$);

1. The effect of latent variable Mitigation/*digital image recognition* on *Yield.* The hypothesis states that mitigation/*digital image recognition* has an effect on yield is rejected. It was found that the path coefficient was 0.065 with a T-statistical value of 0.827 and a P value of 0.408. A $P>0.05$ value indicates that Mitigation/*digital image recognition* has not been shown to significantly increase Yield.
2. The effect of latent variable *Soil Control* on *Yield.* The hypothesis states that *Soil Control* has an effect on yield is rejected. It was found that the path coefficient was 0.157 with a T-statistical value of 1.672 and a P value of 0.095. A P>value of 0.05 indicates that Nutrients have not been shown to significantly increase Yield.

Indirect Influence

In addition to analyzing direct influences, this study tested the indirect cause hypothesis. Specifically, this study examines whether the Yield variable acts as a mediator in the relationship between the Independent variables (Mitigation, Quality, SOP Compliance, Nutrients) and the final dependent variable (CPO/Ha). The results of the indirect effect bootstrapping test are presented in table number 6 Specific Effect (Indirect). The hypothesis is accepted if the P values are less than the significance level of 0.005 ($P < 0.05$) and the Statistical T is greater than 1.96.

Based on the data in table 6, it was found that one of the four indirect pathways tested was proven to be statistically significant, namely SOP Compliance → Yield → CPO/Ha showed a positive and significant indirect influence. The value of the path coefficient (Original Sample) is 0.330 with a Statistical T value of 4.909 and a P value of 0.000 so that this hypothesis is accepted and confirms that the Yield variable effectively mediates the relationship between SOP Compliance and CPO/Ha which means that the SOP Compliance variable has a significant effect on CPO/Ha indirectly, namely by increasing Yield first.

Furthermore, three other hypotheses were rejected because they did not meet the criteria of statistical significance ($P > 0.05$), including:

1. The mitigation of → Yield → CPO/Ha was not significant, with a coefficient of 0.046, but the statistical T value of 0.843 was below 1.96 and the P=0.399 value was greater than 0.05.
2. Quality → Yield → CPO/Ha is insignificant and weak with a coefficient value of 0.095, statistical T of 1.903 and a value of P=0.057, greater than 0.05
3. The nutrient → Yield → CPO/Ha is insignificant and weak with a statistical coefficient value of 0.112 T (1.649) and a P=0.099 value, greater than 0.05

From these results, it indicates that in this research model, SOP Compliance and *Yield* are crucial factors statistically proven to contribute positively to the increase in CPO/Ha. Meanwhile, mitigation, *quality*, and nutrient factors did not show significant direct impacts.

In other words, the overall results of this mediation test reinforce the finding that the latent *SOP Compliance* variable is an important predictor, not only directly but also indirectly on CPO/Ha through increased *Yield.* Meanwhile, the latent variables Digital *image recognition*, *Quality* and *Soil Control* were not shown to have a significant indirect influence through yield in this model.

CONCLUSION

Based on the results of data analysis using SEM-PLS, this study produced several factors that affect Yield and CPO/ha in PT. XYZ, the applied model has met the required psychometric criteria, the convergent validity test of all valid indicators with a loading factor value of >0.6. The construct reliability test proved with Cronbach's Alpha (0.872) and Average Variance Extracted (AVE) values. The results of the analysis show that there are 6 (six) indicators that have a significant effect directly on yield and indirectly on CPO/Ha, namely: *theft mitigation (theft digital image recognition)* value coefficient = 0.656 p=0.053; manuring quality (fertilization quality) value coefficient value 1,000 p=0.000; harvesting SOP value coefficient value 0.669, p=0.001; compliance of SMK3 value coefficient value 0.595 p = 0.000 and rainfall value coefficient value 0.757 p = 0.031; while fertilization value High validity coefficient: 0.757, but p=0.060 (above the standard P>0.05) due to the significant impact of fertilizers needs a period of 3 years (starting from the formation period of the fruit will be) so that the 2-year sample data is still insufficient in significance. For the test of the direct influence of latent variables on dependent variables, only 2 (two) latent are significant, namely SOP compliance and Quality. Meanwhile, other indicators, such as: *fire mitigation (fire digital image recognition),* SOPs manuring, SOP spraying and soil control (C/N ratio, C-Organic, soil pH) do not have a significant direct influence on yield and CPO/ha, but still have an important role in the vegetative and generative growth process of oil palm plants. This research is useful for the Management of PT. XYZ and also oil palm farmers that to increase productivity/yield and CPO/ha, there are 6 important things that need to be considered, namely: Mitigation *(digital image recognition),* fertilization quality (manuring quality), compliance with harvesting SOPs, SMK3 compliance, availability of groundwater (rainfall) and fertilization. As for other indicators, it is still important in the process of vegetative and generative oil palm growth.

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