

# Using a types of chainsaw efficiently

*by* Andi Mujetahid

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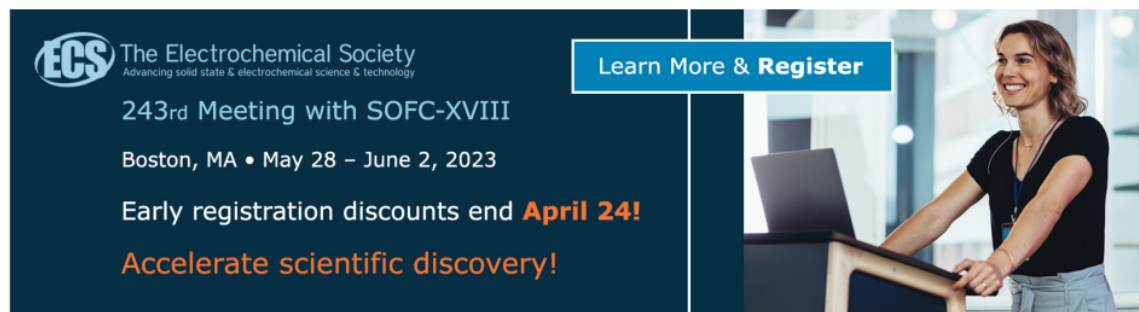
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## Using a types of chainsaw efficiently

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**Abstract.** This study aims to analyze the efficiency of types of chainsaws in logging activities and find out the needs of chainsaws in logging activities at PT. Inhutani 1 Gowa Regency. This research was carried out in December 2018 in industrial plantations in Parangloe District, Gowa Regency using quantitative analysis using tree volume calculation formula, log base area, volume sortimen log formula, logging productivity, estimation of chain saw needs, analysis of logging costs, and analyze the logging efficiency of the chainsaw type. Based on the results of the study, it is known that the production plan for each logging group is 256.69 m<sup>3</sup>/month/chainsaw while the average production of the three logging groups is 171,308 m<sup>3</sup>/month/chainsaw. The average logging productivity of these three logging groups is 0.607 m<sup>3</sup>/hour/unit. The estimation of the need for an efficient chain saw for logging group A is 1 chainsaw unit type MS-STIHL 070 and 1 unit MS-STIHL 381 while in the logging group B is 1 chainsaw unit type MS-STIHL 381 and for logging group C requires 1 unit chainsaw type Ms-STIHL 070 and 1 unit Ms-STIHL 381. The logging activity in this plantation has a chainsaw efficiency of 44.2% for type MS-STIHL 070 and for Ms-STIHL 381 has an efficiency of 45.7% meaning that the use of the number and type of chainsaws is less efficient because the number of chainsaws is used excessively so that the amount of timber production is more than the production plan which results in waste of costs on the chainsaw used.

### 1. Introduction

Logging activity is one of the most important activities in the collection of timber forest products. Errors in these activities can result in losses in the form of a decrease in the quality and volume of wood that reflects logging that has not been fully efficient and effective. Technically efficient logging does not cause wasteful costs due to the amount of equipment that exceeds the need, will not cause shortages or excess wood production and makes time efficient, because the time available can be followed by further work [1].

Cost limitations are an important factor to consider in planning efficient logging activities. One way to reduce costs incurred is to cut down the number of tools that suit your needs so that costs can be balanced and the inefficiency of costs in choosing tools can be avoided. Cost inefficiency caused by tool selection occurs when the needs and type of chain saws in their use are not adjusted to the number and diameter of trees to be felled so that logging is said to be inefficient.

Inefficient logging is prone to occur in industrial forest plantations. This is due to the fact that logging in industrial plantations generally does not take into account the suitability of the amount and type of equipment that should be available in the field to produce certain outputs. Efficient logging is important to study in Gowa Regency because it has a large potential for industrial plantations. Based on data from BPS, Gowa Regency Government (2017) notes that the potential of industrial plantations in Parangloe is 21,601.18 ha spread over 7 villages and 84.95% (18,350 ha) is found in Belapuranga



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Village, it can be calculated that the forest potential. Based on the background described above, research on the level of efficiency of various types of chain saws is required at IUPHHK-HTI PT [2]. Inhutani 1 Gowa Regency. This study aims to examine the efficiency of types of chain saws and determine the needs of chain saws needed in logging activities at PT. Inhutani 1 Gowa Regency. This research is expected to be used as a reference in selecting various types of chain saws inefficient logging planning.

## 2. Methods

The research was carried out in December 2018 at IUPHHK-HTI PT. Inhutani 1 precisely in Parangloe District, Gowa Regency. The tools used are phiband, roll meter, stopwatch, camera, writing stationery, calculator, and abney level. While the material used is a tree that is ready to harvest in the area of PT. Inhutani 1, logbook, and list of questions.

Data collection is done through measurement, observation, and recording in the field. Data collected includes log diameter and length, working time, type, amount and price of chain saws, fuel use, lubricants, maintenance, and repair costs and other costs incurred during logging. Other data collected in the form of secondary data obtained from relevant institutions or agencies, books, research reports and other sources related to this research.

### 2.1. Data analysis

The data collected is then analyzed quantitatively using formulas :

### 2.2. Volume calculation

The calculation method used to calculate the sorting volume in the form of logs (SNI 7535.3-2011 - Teak Wood Round Type Part 3 Measurement and Table of Contents) is as follows :

$$\begin{aligned} \text{LBp} &= (\pi D_p^2)/4 \\ \text{LBU} &= (\pi D_u^2)/4 \\ \text{Ik} &= ((\text{LBp} + \text{LBU})/2) \times p \end{aligned}$$

Description :

$$\begin{aligned} \text{Ik} &= \text{Volume of log (m}^3\text{)} \\ \text{LBp} &= \text{Base area of log (m}^2\text{)} \\ \text{LBU} &= \text{Tip area of log (m}^2\text{)} \\ p &= \text{Length (m)} \\ D_p &= \text{Average base diameter (cm).} \\ D_u &= \text{Average tip diameter (cm).} \end{aligned}$$

### 2.3. Felling Productivity

Logging productivity is calculated using the FAO formula (1992) in Mujetahid (2010) as follows:

$$P_t = \frac{V_t}{W_t}$$

Description :

$$\begin{aligned} P_t &= \text{Felling productivity (m}^3\text{/hour)} \\ V_t &= \text{Volume (m}^3\text{)} \\ W_t &= \text{Felling time (hour)} \end{aligned}$$

### 2.4. Estimated of Chainsaw Needs

Estimated chain saw requirements are used to determine the standard value of efficient chain saw chains for logging activities. Mathematically written as follows [1] :

$$JCR = \frac{IDR}{Pk \times WK}$$

$$Pk = Pt \times Wke$$

Description :

JCR = Number of chainsaw (unit)

IDR = Felling production plan (m<sup>3</sup>/month)

Pk = Productivity of chainsaw (m<sup>3</sup>/day)

WK = Felling time (day/month)

Pt = Felling productivity (m<sup>3</sup>/hour)

Wke = Effective working time (hour/day)

### 2.5. Logging cost analysis

Logging costs are calculated using the FAO formula (1992) in Mujetahid (2010) as follows [3]:

1) Maintenance (Plh)

$$Plh = \frac{\text{Total maintenance cost per year}}{\text{Equipment hours per year}}$$

2) Repair (Prb)

$$Prb = \frac{\text{Total repair cost per year}}{\text{Equipment hours per year}}$$

3) Fuel (Bbk)

$$Bbk = \frac{\text{Amount of fuel consumption} \times \text{Fuel price}}{\text{Felling time}}$$

4) Lubricant cost (Plm)

$$Plm = \frac{\text{Amount of lubricant consumption} \times \text{Lubricant price}}{\text{Felling time}}$$

5) Labor wages

$$Up = \frac{\text{Amount of wage}}{\text{Working hours}}$$

6) Total production cost

$$TC = Plh + Prb + Bbk + Plm + Up$$

### 2.6. Efficiency of Chainsaw

The efficiency of chain saws systematically can be written as follows:

$$\text{Efficiency of Chainsaw} = \frac{\text{Number of Chainsaw} - JCR}{\text{Number of Chainsaw}} \times 100$$

The value of the chain saw efficiency obtained above is then matched to the interval and the cutting efficiency criteria by rating as follows:

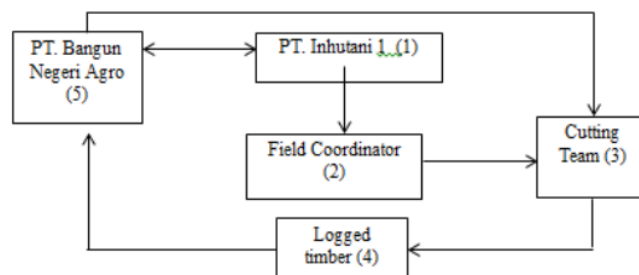
**Table 1.** Criteria for felling efficiency

Interval	Criteria
0 – 25 %	Efficient
26 – 50 %	Inefficient
51 – 75 %	Not efficient
>75 %	Very inefficient

### 3. Results

#### 3.1. Chart of Forest Harvester

The value of the chain saw efficiency obtained above is then matched to the interval and the cutting efficacious on harvesting plantations consist of PT. Inhutani 1 as the permit holder, field coordinator, harvesting labor, and its partners namely PT. Bangun Negeri Agro (BNA) which is a sawmill industry. Based on the harvesting actors' chart, each party has a relation to one another. The chart of the peIDRetrators of the harvesting of plantations is described in the following Figure 1 criteria by rating as follows:



**Figure 1.** Chart of PT. Inhutani 1 Gowa Regency

In logging activities in PT. Inhutani 1, Gowa Regency, the holder of a Timber Forest Product Utilization Permit (IUPHHK) assigns an assignment to the field coordinator to coordinate the loggers to carry out logging in planned plots. Regarding lumberjacks, PT. BNA's role is to prepare harvesting workers who will carry out logging activities. One felling team consists of 4 operators and 4 helpers in which the total number of loggers in PT. BNA numbered 24 people who were then divided into 3 groups of loggers. The operator in each felling team has the role of providing the equipment while all the maintenance and repair needs of the equipment and fuel that will be used in the felling activities are provided by the felling operator. The types of wood felled at the logging site include *Acacia mangium*, *Eucalyptus deglupta*, *Senna siamea*, and the dominant *fascataria Paraserianthes* found at that location. Loggers are given wages on a piece rate basis based on the volume of harvest produced, which is IDR. 40,000/m<sup>3</sup> per group of loggers by PT. BNA, all logged timber that has been felled is then transported by truck and brought to the partner company of PT. BNA after the administrative process is completed by the company. PT. BNA also plays a role in conducting a survey of potential forest plantations with permit holders who will be harvested and agreed that the harvested timber will be sold to industry. By the industry, the survey results of existing plantations are used as a basis for determining annual production plans. The industry's annual production plan is supplied by the permit holder. Fulfillment of the production plan is carried out for 24 days/month in one year.

#### 3.2. Production plan and realization

Based on the work system carried out, PT. BNA and permit holders play a role in conducting a site survey in each cutting plot to be used as a reference in making annual work plans for subsequent fulfillment of wood by the workers. This production plan and realization is used to find out how much the comparative value is and also as a reference to find out the estimated chain saw needs that should be used in the logging activity. Fulfillment of this wood is carried out for 24 days/month for 1 year. The production realization data from July-December 2018 are presented in Table 2 as follows:

**Table 2.** Production realization based on data from PT. Build Agro Country.

No	Month	Total (m <sup>3</sup> )
1.	July	3,126.12
2.	August	1,496.12
3.	September	2,024.45
4.	October	791.87
5.	November	2,520.97
6.	December	3,343.32
Total		13,343.32
Percentage		28.78 %

Based on production plans targeted in July 2018 - June 2019 by PT. BNA is known to be 46,205.03 m<sup>3</sup>/year. The table above shows that the largest amount of production realization occurred in December 2018 so that based on the plan and realization of production it is known that only around 28.78% of the volume of timber that can be fulfilled during the 6 months of logging. Based on the company data above, it is necessary to compare with the results of the research presented in Table 3 below:

**Table 3.** The productivity of logging in PT. Inhutani 1.

Cutting Team	Types of Chainsaw	Total (Unit)	Vt (m <sup>3</sup> )	Wt (Minute)	Productivity (m <sup>3</sup> /hour/chainsaw)
A	MS-STIHL 070	3	12.71	464.36	1.63
	MS-STIHL 381	1	3.12	169.11	1.10
B	MS-STIHL 381	4	15.25	607.93	1.51
C	MS-STIHL 070	2	6.74	399.71	1.02
	MS-STIHL 381	2	4.99	188.17	1.61
Average		2.4	8.56	365.85	1.37

Description : Vt (Volume); Wt (Time)

In Table 3 above shows that the productivity of logging in PT. Inhutani 1 Gowa Regency for logging team A with MS-STIHL 070 chain saw type has the productivity of 1.63 m<sup>3</sup>/hour/chainsaw while MS-STIHL 381 type has the productivity of 1.10 m<sup>3</sup>/hour/chainsaw. Logging Team B has 4 chainsaw units with MS-STIHL 381 type with a productivity of 1.51 m<sup>3</sup>/hour/chainsaw. Whereas C logging team with MS-STIHL 070 chain saw type has the productivity of 1.02 m<sup>3</sup>/hour/chainsaw and MS-STIHL 381 type has the productivity of 1.61 m<sup>3</sup>/hour/chainsaw. The average felling time owned by the three felling groups is 6 hours effective time, but working hours are generally 8 hours per day. This 2-hour difference is used by loggers for lunch and rest after cutting down a number of trees so that the average productivity of chain saws used for 3 groups of loggers is 8.22 m<sup>3</sup>/day.

### 3.3. Estimated chainsaw needs

Based on the estimated results of the chain saw needs, it can be seen that from the logging activities carried out by the three logging groups, the average production plan is known to be 256.69 m<sup>3</sup>/month. Group A obtained average work productivity (Pk) for MS 070 type chain saws that are 9.78 m<sup>3</sup>/day and for MS type chain chainsaw 381 average obtained work productivity which was 6.6 m<sup>3</sup>/day each type only requires 1 unit of MS 070 type chain saw and 1 unit of type MS 381. Group B receives average work productivity for MS 381 type chain saw which is 9.06 m<sup>3</sup>/day requires only 1 unit of chain type chainsaw. Group C obtained average work productivity of MS 070 and MS 381 chain saws, respectively 6.12 m<sup>3</sup>/day which only needed 1 unit type MS 070 and 9.66 m<sup>3</sup>/day which only needed 1 unit for type MS 381.

### 3.4. Logging cost analysis

Analysis of the total production costs incurred during logging activities so that the costs associated with waste are related to the amount and type of equipment used in the field. In calculating the total costs incurred related to the time of completion of logging activities include maintenance costs, repairs, fuel, lubricants, and labor costs so that the total cost of production is calculated in IDR / hour to facilitate calculating the total cost.

**3.4.1. Maintenance cost.** Maintenance costs are costs incurred aimed at maintaining and maintaining the function of the cutting tool to be used. Large maintenance costs are obtained by multiplying the amount of equipment used for maintenance (miser) with the price of the component and then dividing it by the life of the tool using the unit hour/year, the results obtained per hour maintenance costs (IDR /hour). Total maintenance costs for group A is IDR. 96.05/hour and group B has a total maintenance cost of IDR. 37.03/hour and finally group C with a total maintenance cost of IDR. 70.54/hour.

**3.4.2. Repair cost.** Repair costs are intended as an effort to recover damaged equipment so that it can be reused in the form of replacement parts. The spare parts that are repaired/replaced are chainsaw and chainsaw spark plugs. The cost of repairs is obtained by multiplying the amount of use of the repair needs by the price of the component then the results are divided by the number of tool life using hours/year, then the results of the hourly repair costs are obtained. Based on the calculation, it is known that the total repair cost for the logging group A is IDR. 763/hour and group B was 578.7/hour and finally, group C was 717.5/hour.

**3.4.3. Fuel cost.** Fuel costs are costs incurred by the faller operator in accordance with the use of fuel from the MS-STIHL 381 chainsaw and MS-STIHL MS070 chainsaw. The cost of fuel is directly proportional to the long chainsaw production, in other words, the longer the chainsaw is in production, the more fuel is used so that the costs incurred for fuel needs also increase. Fuel consumption is calculated based on IDR/hour. Based on the calculation data it is known that the current gasoline price is IDR. 7,650/liter then the price of 3 units of chainsaw fuel multiplied by the amount of gasoline consumption per day, for chainsaw MS-STIHL 070 required 5 liters/day with the number of tools that is 3 units so that the results are divided by the number of effective working hours of the tool then the results of fuel costs are obtained for 3 units of chainsaw namely IDR. 19,125/hour and fuel cost 1 unit of chainsaw type MS-STIHL 381 IDR. 3,825/hour so that the total fuel cost for logging group A is IDR. 22,950/hour. Loggers Group B has 4 units of MS-STIHL 381 chainsaw with a total fuel cost of 4 units, which is IDR. 15,300/hour. The C logging group has 2 units of MS-STIHL 070 chainsaw and 2 units of MS-STIHL 381 chainsaw so that the fuel cost of 2 units of MS-STIHL 070 chainsaw is IDR. 12,750/hour and fuel costs for 2 units of MS-STIHL 381 chainsaw amounting to IDR. 7,650/hour with a total overall fuel cost for the C logging group of IDR. 20,400/hour.

**3.4.4. Lubricant cost.** Lubrication costs are costs incurred for the needs of engine oil and fuel mixture according to the type and number of tools used by the loggers group. The effective working time of these three felling groups is 6 hours/day. The current engine oil price is IDR. 53,000/liter. The amount of use of engine oil for chainsaw MS-STIHL type 070 per day is 1.5 liters then multiplied by the number of chainsaw units of that type is 3 units so that it is known to be 4.5 liters/day needed for all three tools of the same type. The cost of the lubricant for the MS-STIHL 070 type is obtained from the oil price multiplied by the total oil needed then the results are divided by the effective working time of the tool so that a result of IDR. 39,750/hour. Type MS-STIHL 381 has a lubricating fee of IDR. 8,833/hour for 1 unit of the chainsaw. The total cost of lubricants for the two types of chainsaw is IDR. 48,583/hour for the logging group A. The logging group B has a total lubricant cost for 4 units of MS-STIHL 381 chainsaw which is IDR. 48,583/hour. The felling group C costs 2 units of lubricant for MS-STIHL type 070 namely IDR. 26,500/hour and 2 units for MS-STIHL 381 namely IDR. 17,666/hour so that the total cost of lubricants for both types is IDR. 44,166/hour.

3.4.5. *Labor wages.* Logging labor wages are calculated according to the number of harvested harvests. To get wages (IDR/hour), then divided by the number of hours worked (hours/day). In this study, labor is given wages based on how much the volume of log sortimen is cut. The felling laborer is given a wage of IDR. 40,000/m<sup>3</sup> for one logging group. Logging Group A produces 15,836 m<sup>3</sup>/day after calculating labor costs for 1 unit of the chainsaw, which is IDR. 13,182/hour where 1 unit of chainsaw is for 2 people so labor costs for 4 units of chainsaw are IDR. 52,784/hour. Logging Group B produces 15.256 m<sup>3</sup>/day after calculating labor costs for 1 unit of chainsaw of IDR. 25,426 / hour and labor costs for 4 units of chainsaw which is IDR. 50,852/hour while the C logging group produced 11,735 m<sup>3</sup>/day so as to obtain labor costs for 4 chainsaw units, namely IDR. 39,116/hour.

3.4.6. *Total production cost.* Production costs are the accumulation of all costs needed in the production process. Total production costs are all cost components incurred in carrying out logging activities. Total production costs are calculated based on the number and type of equipment used [4]. Table 4 presents the component cost per unit of each type of chainsaw used in logging activities in PT. Inhutani 1.

**Table 4.** Components of chainsaw costs per unit in logging activities at PT. Inhutani 1

Cost	Cutting Team				
	A1 (STIHL 070)	A2 (STIHL 381)	B1 (STIHL 381)	C1 (STIHL 070)	C2 (STIHL 381)
Maintanance	17,3	9,25	9,25	17,3	9,25
Repairing	162	115	115	162	115
Fuel	6.375	3.825	3.825	6.375	3.875
Lubricant	13.250	8.833	8.833	13.250	8.833
Labor wages	26.392	26.392	25.426	19.558	19.558
Total (IDR/hour)	46.196,3	39.174,25	38.208,25	39.362,3	32.390,25

Based on Table 4 above, it can be seen that in logging group A the amount of costs is different for each type of chainsaw used. In the MS 070 chainsaw type of the costs of maintenance, repairs, fuel, lubricants, and labor costs have costs per unit in a row that is IDR.17.3/hour, IDR.162/hour, IDR.6.375/hour, IDR.13.25/hour, IDR.26,392/hour with the total cost component of IDR. 46,196.33/hours for that type. Unlike the MS 381 type, the cost of component costs per unit in the sequence is IDR.9.25/hour, IDR.115/hour, IDR.3,825/hour, IDR.8,833/hour, IDR.26,392/hour with the total amount of IDR. 39,174.25/hour for this type. In logging group, B the type of equipment used in logging activities is MS 381 with the cost per maintenance, repair, fuel, lubricants, and labor wages respectively IDR.9.25/hour, IDR.115/hour, IDR.3,825/hour, IDR.8,833/hour and IDR.25,426/hour with the total cost of IDR.38,208.25/hour for this type. And in the C logging group is known to have the type of tool used MS 070 and MS 381 which have a total cost component per unit of chainsaw of IDR. 39,362.33/hour for MS type 070 and IDR. 32,390.25/hour for MS chainsaw type 381. The total cost per unit incurred by the logging group A is IDR. 85,370.55/hour, logging group B has a total unit cost of IDR. 38,208.25/hour because only using one type of chainsaw in logging activities while group C has a total unit cost of IDR. 71,752.55/hour. The actual cost component in each loggers group is presented in Table 5 below :

**Table 5.** The actual cost components of the chainsaw in logging activities at PT. Inhutani 1

Cost	Cutting Team				
	A1 (STIHL 070)	A2 (STIHL 381)	B1 (STIHL 381)	C1 (STIHL 070)	C2 (STIHL 381)
Maintanance	86,8	9,25	37,03	52,04	18,5
Repairing	648	115	578,7	486,1	231,4
Fuel	19.125	3.825	15.300	12.750	7.650
Lubricant	39.750	8.833	48.583	26.500	17.666

Labor wages	79.176	26.392	101.704	39.116	39.116
Total	138.785,8	39.174,25	166.202,73	78.904,14	64.681,9
Total Cost	IDR.487.748,82/hour				

Based on Table 5 above, it can be seen that the total production cost for logging group A that uses two types of the chainsaw, namely MS-STIHL 070 and MS-STIHL 381 which is 4 in both types, has a total production cost of IDR. 177,960.05/hour. In the feller group B which has 4 chainsaws with MS-STIHL 381 type has a total production cost of IDR.166.202.73/hour. Whereas in C logging group which has 2 types of the chainsaw with type MS-STIHL 070 as many as 2 units and type MS-STIHL 381 as much as 2 units have a total production cost of IDR. 143,586.04/hour for both types of chainsaw. Of the three types of chainsaw used by logging group A, which has the largest amount of production costs compared to groups B and C, this is caused by the labor wages of group A which is greater than IDR. 105,568/hour compared to the two logging groups.

*3.4.7. The efficiency of felling.* Chainsaw needs estimation based on production plans is used as a basis for knowing the value of ongoing logging efficiency. After knowing the estimated needs of the chainsaw based on the production plan then compared with the number of chainsaw available in the field it is known that to achieve a production plan of 256.69 m<sup>3</sup>/month in each logging group only requires 1 unit of chainsaw each for MS-STIHL 070 and MS-STIHL 381 types so From the calculation data shows that the average efficiency of chainsaw for the three logging groups based on the type of chainsaw used is 44.2% for the MS-STIHL 070 type while the MS-STIHL 381 type gets a percentage of 45.7% which means it is less efficient.

The impact of the inefficiency of logging is that the costs must be very large. In logging group A, there are 2 units of chainsaw excess with type MS-STIHL 070 resulting in a waste of IDR. 92,392.6/hour. Whereas group B has the advantage of chainsaw 3 units with type MS-STIHL 381 resulting in a waste of costs of IDR. 127,994.48/hour for this type. And for logging group C has an excess chainsaw with type MS-STIHL 070 and MS-STIHL 381 as much as 1 unit so that it causes waste of costs amounting to IDR. 39,362.33/hour for MS-STIHL type 070 and IDR. 32,390.25/hour for MS-STIHL 381 type with a total loss for the three logging groups amounting to IDR. 292,139.63/hour. An excess in the use of chainsaw can speed up work but results in a large production cost due to the costs used to cover the number of labor costs namely the chainsaw operator incurred from using the existing chainsaw. This situation can occur an imbalance of production costs incurred with the time and results produced. Other study about chainsaw using three types of chainsaw fuel [5,6].

#### 4. Conclusion

Logging efficiency at PT. Bangun Negeri Agro showed that the average efficiency of chainsaw for the three logging groups based on the type of chainsaw used was 44.2% for MS-STIHL 070 while MS-STIHL 381 obtained a percentage of 45.7% which means it was less efficient. The total losses of the three logging groups were due to the number of inappropriate tools, which was IDR. 292,139.63 / hour. The estimated chainsaw requirements for the three felling groups show that each felling group only needs 1 unit of chainsaw for MS-STIHL 070 and MS-STIHL 381 types.

#### References

- [1] Suhartana S and Yuniawati Y 2006 Efisiensi Penggunaan Chainsaw pada Kegiatan Penebangan: Studi Kasus di PT Surya Hutani Jaya, Kalimantan Timur *J. Penelit. Has. Hutan* **24** 63–76
- [2] kabupaten Gowa B P S 2017 Kabupaten Gowa dalam Angka 2016 *Badan Pus. Stat. Kabupaten Gowa tahun*
- [3] Mujetahid A 2009 Analisis biaya penebangan pada hutan jati rakyat di Kabupaten Bone *J. Pannial* **6** 108–15

- [4] Magagnotti N, Picchi G, Sciarra G and Spinelli R 2014 Exposure of mobile chipper operators to diesel exhaust *Ann. Occup. Hyg.* **58** 217–26
- [5] Neri F, Foderi C, Laschi A, Fabiano F, Cambi M, Sciarra G, Aprea M C, Cenni A and Marchi E 2016 Determining exhaust fumes exposure in chainsaw operations *Environ. Pollut.* **218** 1162–9
- [6] Esteban E T, Jordan E R and Urionabarrenetxea P A 2013 Safety and health in forest harvesting operations. Diagnosis and preventive actions. A review *For. Syst.* **22** 392–400

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