STUDY OF FARM MACHINERY POWER AND TOTAL OPERATING COST IN PADDY FIELD SUNGAI BALANG, JOHOR

NUR NAJWA BINTI AB GHAFAR

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In the name of Allah the Most Gracious, the Most Merciful. Peace and blessing be upon the prophet Muhammad

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NUR NAJWA BINTI AB GHAFAR

DECLARATION

This Final Year Project is a partial fulfilment of the requirements for a degree of Bachelor of Science (Hons.) Plantation Technology and Management, Faculty of Plantation and Agrotechnology, Universiti Teknologi MARA.

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I hereby declare that I have checked this project and in my opinion, this project is adequate in terms of scope and quality for the award of the degree of Bachelor of Science (Hons.) Plantation Technology and Management, Faculty of Plantation and Agrotechnology, Universiti Teknologi MARA.

Signature: …….....

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LIST OF ABBREVIATIONS

UiTM	Universiti Teknologi MARA
Km	Kilometer
Hr	Hour
M	Meter
AAFC	Average Annual Fixed Cost
Hp	Horsepower
TFC	Theoretical Field Capacity
EFC	Effective Field Capacity
FE	Field Efficiency

ABSTRACT

STUDY OF FARM MACHINERY POWER AND TOTAL OPERATING COST IN PADDY FIELD SUNGAI BALANG, JOHOR

Rice (*Oryza sativa*) is one of our staple food in the worldwide and have a large number of consumers. Most of rice producer are using agricultural practices. Mechanization is combination application of mechanical that apply at farm and it need utilization, maintenance and repair the tools, equipment and also costing. Farm mechanization usage with suitable engine power and specialized equipment affected on cost of paddy rice production and mechanization cost. To determine the relationship between mechanization and management cost besides comparing actual Field Efficiency and theoretical Field Efficiency, secondary data was taken at paddy field in Sungai Balang, Johor. Two different types of machine data was taken that are tractor Kubota M9540 with 95 horsepower and combine harvester New Holland 1545 with 150 horsepower. Total area of study, total time taken, speed, width of mechanization implement, farm mechanization cost, and power usage was measure to calculate by using formula Theoretical Field Capacity (TFC), Effective Field Capacity (EFC), Field Efficiency (FE), fixed cost, and operation cost. Fixed cost calculation on tractor are half from total cost and the highest rate that are 47% because less budget to repair and maintenance are needed while fuel and lubricant cost of combine harvester is the most higher from total cost which are 41%. Higher fuel and lubricant cost in using combine harvester because more time losses during operating the harvester in field. High annual usage make combine harvester need more repair such as engine overhaul, routine and accidental breakage. Tractor's FE is higher than combine harvester's FE that are 83.52% and 56.81% because of higher EFC. Effect of high difference between actual FE and theoretical FE on combine harvester is higher operating cost and lower fixed cost while small differences between actual FE and theoretical FE on tractor make lower operating cost and higher fixed cost.

Keyword: mechanization, cost, rice, fixed cost, operation cost.

ABSTRAK

ABSTRAK

KAJIAN KUASA JENTERA LADANG DAN JUMLAH KOS OPERASI DI SAWAH PADI SUNGAI BALANG, JOHOR

Beras (Oryza sativa) adalah salah satu makanan ruji kami di seluruh dunia dan mempunyai sebilangan besar pengguna. Kebanyakan pengeluar beras menggunakan amalan pertanian. Mekanisasi adalah kombinasi aplikasi mekanikal yang digunakan di ladang dan ia memerlukan pemanfaatan, penyelenggaraan dan pembaikan peralatan, peralatan dan juga biaya. Penggunaan mekanisasi ladang dengan tenaga enjin yang sesuai dan peralatan khusus terkena biaya pengeluaran padi dan biaya mekanisasi. Untuk menentukan hubungan antara mekanisasi dan kos pengurusan selain membandingkan Kecekapan Bidang sebenar dan Kecekapan Bidang Teori, data sekunder diambil di medan padi di Sungai Balang, Johor. Dua jenis data mesin yang diambil ialah traktor Kubota M9540 dengan 95 kuasa kuda dan menggabungkan penuai New Holland 1545 dengan 150 kuasa kuda. Jumlah kawasan pengajian, jumlah masa diambil, kelajuan, lebar pelaksanaan mekanisasi, kos mekanisasi ladang, dan penggunaan kuasa adalah ukuran untuk dikira dengan menggunakan Formula Kapasiti Kapal Teoritis (TFC), Kapasiti Bidang Berkesan (EFC), Kecekapan Bidang (FE) kos tetap, dan kos operasi. Pengiraan kos tetap pada traktor adalah separuh daripada jumlah kos dan kadar tertinggi iaitu 47% kerana kurang anggaran untuk pembaikan dan penyelenggaraan diperlukan manakala harga bahan bakar dan pelumas menggabungkan mesin penuai adalah yang paling tinggi dari jumlah biaya yang 41%. Kos bahan bakar dan pelincir yang lebih tinggi dalam menggunakan penuai menggabungkan kerana lebih banyak kehilangan masa semasa mengendalikan penuai di lapangan. Penggunaan tahunan yang tinggi menjadikan pengeluar menggabungkan memerlukan lebih banyak pembaikan seperti penggantian enjin, kerosakan rutin dan tidak sengaja. FE traktor adalah lebih tinggi daripada mesin penuai 83.52% dan 56.81% kerana EFC yang lebih tinggi. Kesan perbezaan yang tinggi antara teori FE dan FE yang sebenar untuk menggabungkan penuai adalah kos operasi yang lebih tinggi dan kos tetap yang lebih rendah manakala perbezaan kecil antara teori FE dan FE yang sebenar pada traktor menjadikan kos operasi yang lebih rendah dan kos tetap yang lebih tinggi.

Kata kunci: mekanisasi, kos, beras, kos tetap, kos operasi.

CHAPTER 1

INTRODUCTION

1.1 Background of study.

Rice (*Oryza sativa*) is one of our staple food in the worldwide and have a large number of consumers. There are many rice producer such as Malaysia, Thailand, India, Pakistan and Iran which most of them using agricultural practices that are source of employment of rural production. Rice is cultivation was started at 15th century in South East Asia and spread to India, Thailand, China and Japan.

Rice are consumed by more than 2,500 million people and 90% produced and consumed from Asia. In Malaysia, there are about 700,000 acres area were planted by paddy cultivation. The worldwide increment in population and restriction in horticultural land request effectiveness and profitability in all phases of rice generation. Manual paddy transplanting require more forces around 200 to 250 man hectare for every hour, which is approximately 25 percent of the aggregate work necessity of rice generation (Mufti, 1995).

Malaysia's paddy yield have low productivity compared to another countries due to some factors such as inadequate labour force and technology use before. Total difference are 10% with others. More than half was planted in Peninsular and top five high state supply of paddy are Perlis, Kedah, Kelantan, Selangor and Perak.

Mechanization of agriculture is application of machine or mechanical implement use in the field during all activity from land preparing until harvest and post-harvest. The function is to increase productivity and reach sustainable agriculture as population in our country and world is increase. Technologies is needed and it is the most important thing that help to meet customer demand. Besides that, mechanization use directly with the farmers in management of land,

labour and capital. Management cost of mechanization in paddy field is counting based on their cost in operating, fixed, maintenance and fuel with lubricant cost.

As we know, machine give huge impact on output for any sector including agricultural sector. Mechanization must have capacity, degree and level to run the work in field. Capacity of every machine are different based on horsepower they use, age, and others.

1.2 Problem statement

Most of producer countries are using agricultural practices and it shows that mechanization operation used give an effect for time using, labour, effectiveness, yield and economically for the farmers. There are so many types of machinery use during the process from paddy field until post-harvest harvest process in mill. As an example, the machine use are paddy harvester, paddy transplanter, and another agriculture implement. There are some problem can be state due to low productivity of paddy yield

According to (Najim, 2007), cost of importing white rice mill into Malaysia is less than locally. This outcome is because less labour force is seen to achieve timeliness and profit to avoid more waste. Less labour does not mean we need more manual worker to handle the operating activity such as planting and harvesting but need more mechanization to solve the work. (Ferrero and Tinarelli, 2008) reported that in Italy they are managing 60 hectare with only using tractor and combine harvester. But in small and less develop country, they using high number of manual worker which have less return in money. In addition, area that was managed lesser that in Italy.

According to (Nagaraj, 2012), most of farmers have knowledge about mechanization operation use in the field but there was a research at Raichur district in India on 120 respondent from 6 different villages. Half of the respondent have full knowledge about

mechanization on the operation, frequency of use and specification of the implement such as plough, rotor, power tiller, combine harvester and thresher while half of them have medium knowledge and skill about mechanization. This is happened because less exposed and knowledge about mechanization at the beginning by government.

Another problem faced by farmer is they tend to make a choice either to own the machine, rent or lease it. Due to high costing to own the mechanization, they make result to rent it although the price and charges are higher. It gives a choice for them on how to manage the process either owned machine or hiring labour to handle the machine. Based on these research, 50% total cost production are machinery cost and another cost are labour, chemical, seed, fertilizer and others.

1.3 Significant of study

This research is based on past research done and it calculated secondary data that was collected regarding the relationship between mechanization cost and management in paddy yield. Mechanization cost are including all operating cost, labour cost and fixed cost. The result from this research give benefit for those who want to further research and study which can differentiate the management cost between own, rent and lease.

1.4 Objective

1. To determine the relationship between machinery and management cost.
2. To calculate fixed and variable cost for machine operation in paddy field.
3. To compare actual field efficiency and theoretical field efficiency.

1.5 Scope of study

This study concentrated on student and worker which are find an actual cost for preparing management of mechanization in paddy field because not all farmers own the mechanization but they tend to rent or lease it to run the project in the field. Farmer are not taking care about how many cost need to maintain the quality year-by-year. Besides that, the study are to find is it tally between cost of operation mechanization with theoretical field efficiency and find the reason why field efficiency are not related with the cost used. The study was conducted in paddy field Sungai Balang, Muar and used one type of instrument only by secondary data. The study also give reference for student who take subject related to management of mechanization. It will explore the actual condition on how to get the smooth work besides avoiding time losses.

CHAPTER 2
LITERATURE REVIEW

INTRODUCTION

This chapter provide an overview from previous research on farm machinery power and total operating cost in paddy field. It introduce the framework for the case study that comprises the main focus of the research described in this thesis.

2.1 Paddy Background

Paddy with scientific name of Oryza sativa L. It was came from family of *Poaceae* and refer to North American species in the genus Zizania. Three subspecies of rice such as Indica, Japonica and Javanica. Japonica is a sticky, short grain type of rice, mostly cultivated in dry fields. Indica is non-sticky and long-grained type of rice and is mostly grown in submerged fields. Both types have many different varieties. It is usually grown as an annual plant, but in the tropics it can be grown as a perennial. 90 per cent of rice producing is came from Asian region. Besides that, it is using a lot of water but if the area have high rainfall, it should be good for the crop (Piyush Pradhan, 2015). Based on the research, farmer have perform various direct energy task in field such as land preparation, irrigation, threshing, harvesting and transportation. (R K Naik, 2015).

2.2 Mechanization usage to help paddy cultivation.

Mechanization use for increasing production, processing and storage of food for human consumption by agricultural mechanization. It is require study, maintenance and repair of all tools before do the job, implements, equipment and structure that can high productivity (Kamruzzaman et al., July 2009). Agricultural mechanization are including

combine harvester, paddy transplant, tractor that are used to rotor plough eight inches deep, and others.

Based on previous research, cultivation cost of paddy are slightly higher because cost of labour. So, the farmer change their method to use farm mechanization slowly from the mostly activity such as land preparation, transplanting until harvesting. High population give an effect in increasing demand of food and cost of labour. Usage of farm operation by mechanization reduce time losses and more economically to farmers (Salini R Chandran, 2017). Farm operation need another cost that are maintenance and repair cost, fuel and lubricant cost and also fixed cost. Rice production are complicated and need long time to give more profit if the area of planting the plant is in small scale (Xu L., 2011). Usually farmer need more than 300 acres to own the mechanization for run the project.

Many operation and practices in paddy cultivation faced by farmers during owned their mechanization in farm. Because of problem that need to face, farmers choose to rent and lease the farm mechanization. Some of problems are machine operator does not have enough knowledge to handle the machine and need to maintain and repair the mechanization condition (Firouzi, 2015).

2.3 Knowledge and adoption of farm mechanization.

Some of the countries give negative feedback on using mechanization like India and they have their own reason why. Survey that have done by (Nagaraj, 2013), the farmers was forces to use mechanization in few years ago and the result is they get save from many losses such as in seedlings, fertilizing and crop intensity. Exposing more knowledge and adoption of farm mechanization is important to increase agriculture implement use.

Rice field operation system need high technologies in each field operation. There are a few processes using different mechanization from land preparation, planting until harvesting process. Land preparation including ploughing, first and second rotor, level the ground in dry and wet condition. These operation system are using tractor which have implement such as disc plough, mini plough, bucket and box driveller. For plant establishment, direct seeding method using mist blower at the field. Rice harvest accomplished by combine harvester. Strong evidence about product from paddy field are more when attract to agricultural input that are mechanization (Singh G.,2005).

In Thailand, crop production in 2005 is six times higher than 1960 because modern agriculture technology was introduced while total energy input increase 22 times as input production. Before increase mechanization usage, farmer increase land expansion and land productivity but it does not give a huge impact on yield. It was just increase total labour and input (Viboon Thepent, 2009). Relation between energy input and crop production also shows positive ending. They are create efficient field mechanization with more power and also PTO shalf. It is a task of operation which reducing in human drudgery, reduce time period and increase field efficiency in various operation. The task resulting in more land to cultivate, more quality of rice and better living condition was achieved besides better economic growth is markedly in the world (Odigboh 2000, Azogu 2009). Some developing countries start the farm operation that require high power to make it more efficiently but reduce labour to control. As an example are GPS and GIS that communicate with farm machineries and it only need a few workers that not more than 5 people to control the job. High power machinery activity means tillage, transport, water pumping, milling and threshing.

Machine capacity part also need to take seriously either it was increase or decrease because the result from field efficiency shows correlation and reason with the cost of operating.

Measuring machine capacity is percentage or rate of performance using in the field such as speed, time taken, total area covered and width. Sometimes, machine capacity have lack of efficiency due to width of mechanization and time taken to cover all the area. The longer the width of implement mechanization means higher efficiency of mechanization. Time taken can be longer because style of operator to turn back the machineries such as combine harvester. Soil condition in the field also one of the factor of lack efficiency especially clay loam soil.

2.4 Increase production by mechanization

Paddy yield increase after usage of mechanization in field through limited resources including seedling, fertilizing, weeding and others. Agricultural technology was started around 1960 due to increase population and land yield are limited (W.I.W. Ismail, 2016). High demand from all countries make farmers around the world including Malaysia tend to use paddy mechanization even the price is higher than use manual labour. The percent of yield can be reduce to 70 percent if time for harvesting is late in two months (W.I.W. Ismail, 2016). The condition and price can be fall during market the product so mechanization help to increase production.

2.5 Cost of mechanization.

Cost of farm mechanization are including the hire chargers, labour, repair, operating cost and fixed cost. Usually, fuel and lubricant cost will be the most expensive and highest cost than depreciation of farm machinery, taxes, shelter, insurance and interest (TSII). Total TSII are twelve percent from remaining value of farm machinery every year. Three types of fuel use by mechanization that are diesel, gasoline and lp-gas.

Operating cost in hired and owned machine do not differ greatly except in custom service. Labour cost includes actual wages paid by farmer casual labourers. Wage rate for harvesting activity difference between farm, season and village. So the rate is based on how many acres or areas covered per time. Major determinants of wage rate are size of paddy field area, yield, climatic condition, and distance from field to storage

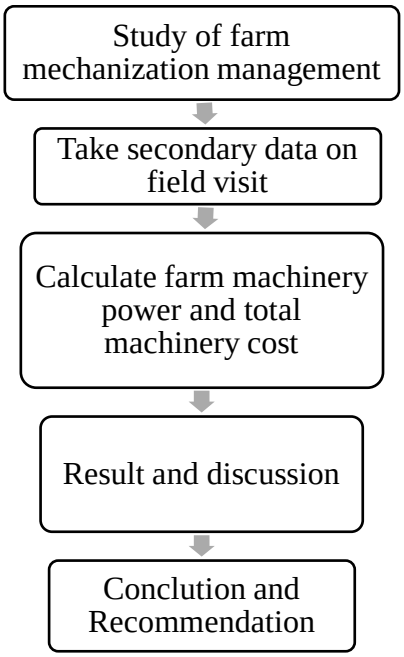
Machinery, tools and equipment, fuel and lubricant, depreciation also are important and major cost on business. Farmer need to maintain the quality of machinery with good managing by make sure how to acquire machinery and so on. Every year, better mechanization are develop based on technology, larger, capacity and power (Hormozi, 2012). Farmer and operator need to take time for ensure the machinery are gave profit for them in return and efficient during and after using the mechanization by make what needed of mechanization such as services. They are tend to have large cost in ownership and also operating the farm machinery.

Most of the problem faced by farmers are shortage of workers especially during peak hour such as transplanting the plant and harvesting. They need high cost of labour if using manually worker instead of using agricultural mechanization

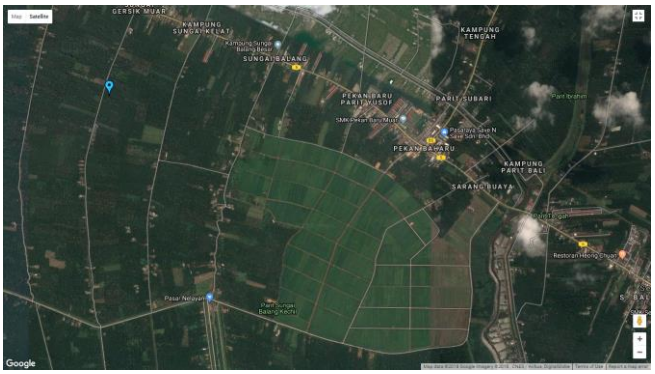
CHAPTER 3

RESEARCH METHODOLY

3.1 Flow chart



3.2 Location of study



(Figure 3.1 - Location of paddy field in Sungai Balang, Muar)

Figure 3.1 shows the location of research study to determine the total area covered per day in calculation efficiency of mechanization.

Secondary data was taken at paddy field in Sungai Balang, Muar, Johor. The farmers run the project under development and help from Pejabat Pertanian Sungai Sudah, Muar. Its geographical coordinate is 1° 54' 0" North, 102° 44' 0" East. Total area of these paddy field are 320 hectares, means 790.752 acres. One acre including 660 feet length x 66 feet wide. Type of soil is clay.

3.3 Measurement and calculation.

Total area of study, farm mechanization cost, time, speed, width of mechanization implement and power usage was measure to calculate using formula by theoretical field capacity, effective field capacity, field efficiency, fixed cost, operation cost for repair and maintenance, fuel and lubricant. Different actual and theoretical for field efficiency were calculated.

There are some mechanization used by the farmer to improve yield capacity and not use high labour force. Machine use are six tractor KUBOTA M9540, one excavator, and three harvester. Every tractor have different implement, function and size such as rotor with two different lengths that are 90 inch and 120 inch, plough 110 inch and 120 inch length, bucket and box driveller of 140 inch. Bucket use to levelling the ground during dry condition while box driveller use during the soil is wet after fill water into the field.

Tractor buying price is RM120000 and it have 95 horsepower. The speed is 3km/hr. Working hour for labour force is eight hours per day and they usually work in 47 days per season. There are two season per year, April until August and October until February. Labour done the job three acres in 45 minutes, 15 acres per day. Wages is RM75 per acre for the labour using 90 inch implement while RM65 per acre for the labour using 120 inch implement. The tractor use 80 litre fuel diesel per day and fuel cost per day is RM160.

Storage of this mechanization is at Melaka and cost of transportation and lorry loader is RM40.

Maintenance and repair cost is another important part in operating cost. It is important to avoid delay and decreasing paddy yield and quality in field. Total cost for engine overhaul is RM4800 including piston, piston ring, gasket and head engine. Total cost for implement overhaul is RM2000 including bearing on rotor, sub, and blade.

Another mechanization use and owned by the farmer is combine harvester, New Holland 1545. Buying price is RM160000 and the farmer have used the harvester for five years. The speed is 4km/hr, engine power is 422 horsepower. Total cost on fuel is RM250 per day because paddy harvester need 115 litre per day. Total lubricant cost is RM1495. Working day for harvesting process is eight hours per day and 44 day per season. Average yield per day is 1.5 tonne per acre. Wages on labour force is RM10,527.60 per season. Total repair and maintenance cost for combine harvester is higher than tractor which is RM13000.

3.3.1 Theoretical Field Capacity (TFC)

Theoretical field capacity is total time in field including all the work done such as turns, filling hopper and others. Measuring machine capacity is important to determine on how many time was spent at the field with or without losses time and product.

Theoretical field capacity: $\frac{\text{Speed (km/hr) x width (m)}}{10}$

3.3.2 Effective Field Capacity (EFC)

Effective field capacity show how much time spent working in hectare per hour. Effective field capacity is always less than theoretical field capacity because TFC give maximum

capacity to evaluate time for machine and operator. EFC is the measure of a machines capacity to carry out a vocation under genuine field conditions.

Field capacity: $\frac{\text{area}}{\text{time}}$

3.3.3 Field Efficiency (FE)

Based on survey and calculation, it will show actual and theoretical field efficiency. FE is define as percentage of time the machine operate at its full rate, speed and width at the field. There are some differences between two of them based on typical range by ASABE 85%.

Field efficiency: $\frac{\text{Field capacity (FC)}}{\text{Theoretical field capacity (TFC)}}$

3.3.4 Operation cost

Repair and maintenance cost.

Repair cost is estimate by Total Accumulated Repairs formula. It also can estimate by actual repair cost that was kept in field record.

Fuel and lubricant cost.

Fuel and lubricant cost also including in operation cost. Usually fuel and lubricant cost are higher than fixed cost due to price market of fuel use. Three factors that give impact when estimating fuel needs are horsepower-hours of energy, fuel types and fuel consumption. Different amount of fuel needed when farm machinery such as tractor use three different fuel that are diesel, gasoline and LP-gas. Fuel consumption use to estimate fuel requirement for specific level of power. Formula in fuel and lubricant cost are estimate

fuel consumption, fuel cost per hour times with fuel price and estimate fuel and lubricant cost.

3.3.5 Fixed cost.

Fixed cost are the most part incorporate the costs that are brought either the machine is really utilized as a part of generation. These cost are not fluctuate with the measure of machine utilize as it is slightly decrease as higher annual use. Fixed cost also call ownership cost and all the cost must be kept. Fixed cost are including depreciation, taxes, shelter, insurance and interest. Depreciation can be calculate by three methods, straight-line depreciation method, sum-of-the-digits depreciation method and declining-balance depreciation method. Based on these survey, declining balance method, Average Annual Fixed Cost (AAFC) from table 3 in John Deer book is refer.

Table A. Average annual fixed cost

Average Annual Fixed Cost as a percentage of original list price			
End of year	Tractors & combines	Forage harvester	All others
1	33.07%	35.75%	34.41%
2	22.52%	24.81%	23.68%
3	18.76%	20.70%	19.75%
4	16.71%	18.33%	17.55%
5	15.36%	16.69%	16.06%
6	14.36%	15.42%	14.93%
7	13.56%	14.39%	14.01%
8	12.90%	13.51%	13.24%
9	12.33%	12.75%	12.57%

AAFC x buying price of mechanization.

As an example, buying price for tractor Kubota is RM120000 and the Annual Average Fixed Cost is 15.38%. RM120000 x 0.1536 = RM18432

CHAPTER FOUR

RESULT AND DISCUSSION

4.1 Mechanization cost and efficiency for tractor Kubota M9540

Theoretical Field Capacity	0.9144 hectare per hour
Effective Field Capacity (EFC)	0.76 hectare per hour
Field Efficiency (FE)	83.54%
Difference actual FE and theoretical FE	1.48%
Fuel and Lubricant cost	RM13612.80
Repair and Maintenance cost	RM6800
Fixed cost	RM18432

Based on TFC formula, tractor's speed and width of implement is three kilometre per hour and 3.048 meter. Speed and width is multiplying before divided with ten. Total TFC is 0.9144 hectare per hour. Working hour is eight hours per day and total days in field is 48 days so time taken in operating activity by tractor is 384 days. Total area covered in 384 hours are 291.37 hectare. Total area divided time taken is 0.76 hectare per hour. FE is calculated by using formula FC divided with TFC and the difference between actual FE 85% and theoretical FE 83.52% is 1.48%. There are small differences from the actual capacity from theoretical capacity because higher EFC result. Supposedly EFC result is 0.60 hectare per hour was divided with TFC, FE result will be fewer than now that are 65.93%. Diesel fuel price during August 2017 is RM2.04 per litre and ten percent from estimate fuel cost is lubricant cost. Total fuel and lubricant cost is RM13612.80 per season. Fixed cost was calculated by take accumulated repair cost percentage of list price in table

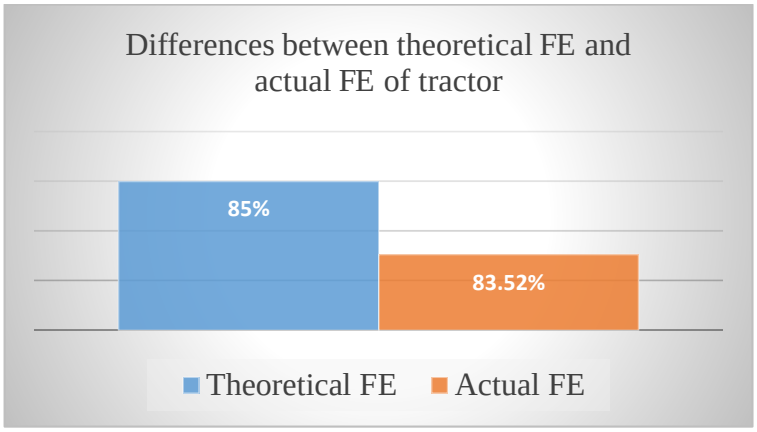
2, John Deer book multiply with list price of tractor, RM120000. (See the appendix for accumulated repair cost percentage).

4.2 Mechanization cost and efficiency of combine harvester New Holland 1545

Theoretical Field Capacity (TFC)	1.44 hectare per hour
Effective Field Capacity (EFC)	0.818 hectare per hour
Field Efficiency (FE)	56.81%
Difference actual FE and theoretical FE	28.19%
Fuel and Lubricant cost	RM19912.64
Repair and Maintenance cost	RM13000
Fixed cost	RM24576

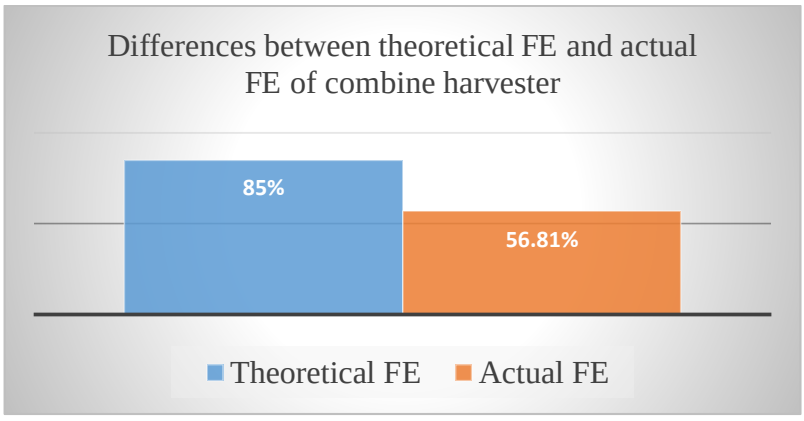
Based on TFC formula, combine harvester's speed and width of implement is four kilometre per hour and 3.6 meter. Speed and width is multiplying before divided with ten. Total TFC is 1.44 hectare per hour. Working hour is eight hours per day and total days in field is 44 days so time taken in operating activity by tractor is 352 days. Total area covered in 352 hours are 288 hectare. Total area divided time taken is 0.818 hectare per hour. FE is calculated by using formula FC divided with TFC and the difference between actual FE 85% and theoretical FE 83.52% is 28.19%. There are many differences from the actual capacity from theoretical capacity because lower EFC result. Mechanization need some recommend due to low EFC and FE to improve the field efficiency because the result will increase more capacity thus reduce input cost such as fuel cost and repair cost. Diesel fuel price is RM2.05 per litre and ten percent from estimate fuel cost is lubricant cost. Total fuel and lubricant cost is RM19912.64 per season. Fixed cost was calculated by take

accumulated repair cost percentage of list price in table 2, John Deer book multiply with list price of tractor, RM160000. (See the appendix for accumulated repair cost percentage).



(Figure 4.1 shows different between theoretical field efficiency and actual field efficiency of tractor)

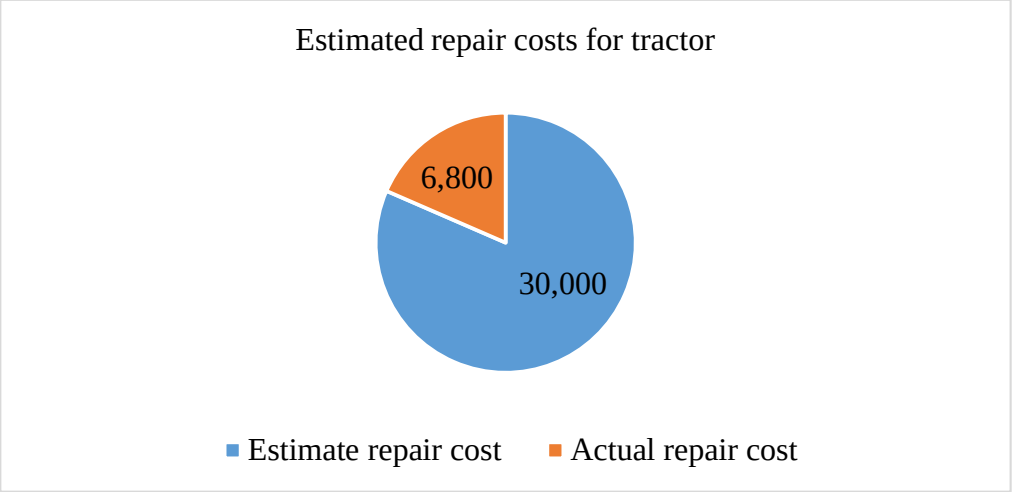
Figure 4.1 shows 1.48% differences between theoretical and actual field efficiency of tractor in field because breakdown of tractor. Soil condition is one of the factor why timelines is longer than usual. Rotor disc was broken during operating and need repaired. Repair and maintenance need to be done during the process of rotor in the field.



(Figure 4.2 – Differences between theoretical FE and actual FE of combine harvester)

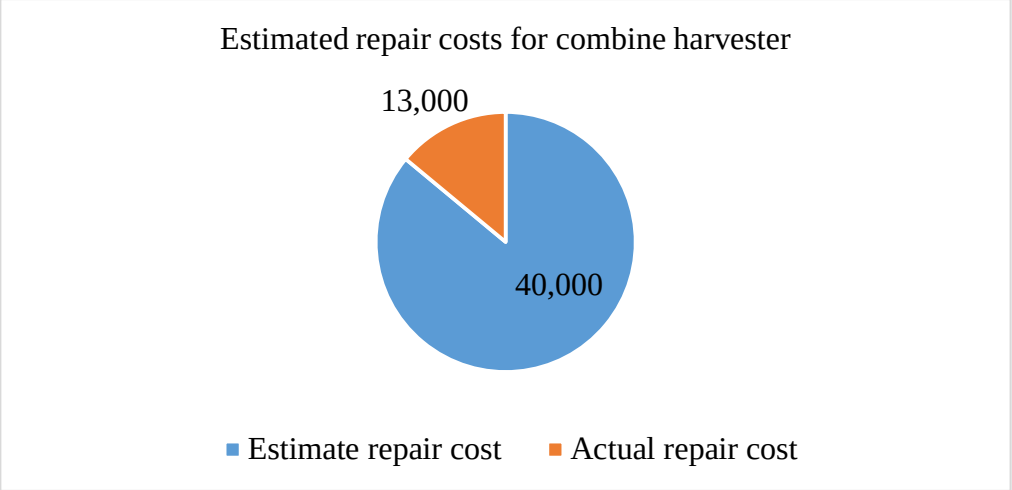
Figure 4.2 shows 28.19% differences between theoretical and actual field efficiency of harvester in field. Harvester need high maintenance and repair to improve field efficiency such as reducing breakdown, routine repair and overhaul. High annual usage and high maintenance can reduce fixed due to low quality and condition of machine.

Repair cost for tractor and combine harvester.



(Figure 4.3- Estimated repair cost for tractor)

Figure 4.3 shows estimate repair cost for tractor. RM30, 000 is the estimated while RM6,800 is actual cost of repair. Tractor list price is RM120000 was purchased five years ago. Based on annual usage of tractor and refer to table b accumulated repair cost, percentage cost is 25% from list price. The calculation is RM120000 multiply 0.25 equal to RM30000. So the estimate is slightly higher more than actual price. Low repair and maintenance cost and high fixed cost is good result.



(Figure 4.4- Estimated repair cost for combine harvester)

Figure 4.4 shows estimate repair cost for combine harvester. RM40, 000 is the estimated while RM13000 is actual cost of repair. Combine harvester list price is RM160000 was purchased five years ago. Based on annual usage of the machine and refer to table b accumulated repair cost, percentage cost is 25% from list price. The calculation is 0.25 multiply list price equal to RM40000. So the actual is almost half from estimate price. High repair and maintenance cost and lower fixed cost is the result if the farmer want to trade the machinery.

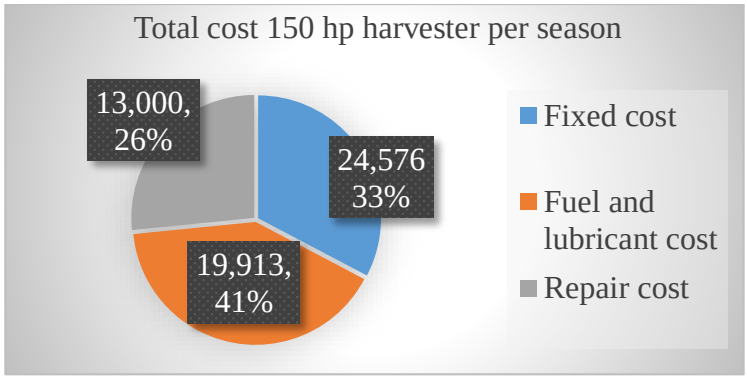
4.3 Total machinery cost

*Total cost = fixed cost + fuel and lubricant cost + repair cost

Total cost of tractor = RM18432 + RM13612.80 + RM6800 = RM38844.80

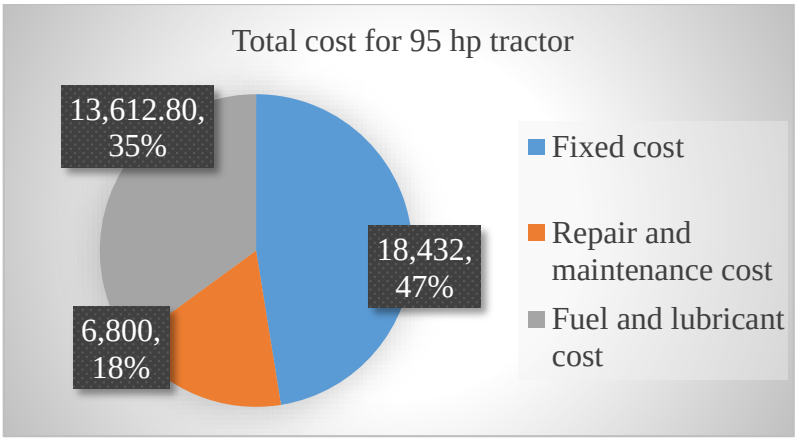
Total cost of harvester = RM24576 + RM19913 + RM13000 = RM57489

RM38844.80 + RM57489 = RM96333.80



(Figure 4.5- Total cost 150 hp combine harvester)

Figure 4.5 show total estimate cost for 150 hp harvester used by farmer. So the cost of fuel is RM51.43 per hour, ten percent from the cost of fuel is lubricant cost and the total is RM56.57. Total time per usage are 352 hour throughout the data and it is the highest cost among fixed and repair cost. Fuel and lubricant cost are costly because there was more time losses during operating tractor in field. Based on calculation of theoretical field efficiency of combine harvester with actual field efficiency, there are 28.19% differences between them. This is because repair and maintenance cost are high more than normal cost besides fuel and lubricant cost also too costly. For mechanization that are used almost five years, the major repair usually engine overhaul. So, the cost of repair need to reduce but in this cases, combine harvester need more maintenance and fuel lubricant cost. The effect of high difference actual FE and theoretical FE is higher cost in operating cost and lower fixed cost of combine harvester.



(Figure 4.6- Total cost for 95 hp tractor)

Figure 4.6 show total cost of 95 hp tractor which fixed cost are the highest cost among fuel and repair cost. Fixed cost are true ownership cost since it is give important role in all mechanization decision such as remaining value by year, how much the cost when the farmer want to trade it and also the cost from taxes, shelter, insurance and interest (TSII). It is the highest cost among fuel lubricant cost and maintenance cost. Every year, fixed cost will be decrease due to some reason such as age, breakage and condition. Fuel and lubricant cost of tractor and harvester are almost same. The total of fuel and lubricant cost are half of the mechanization cost since it is specifically corresponding to the measure of total usage. During month of April 2018, price for diesel is RM2.04 per litre when using tractor while RM2.05 during the month of using combine harvester. The cost for fuel usage per hour is RM32.23 per hour and ten percent from total fuel usage is lubricant cost. So the total is RM35.45 per hour times with 384 hour use throughout the data of tractor per season and it is the highest cost among fixed and repair cost. Fixed cost are the highest cost because less repair and maintenance cost are needed. Based on calculation of theoretical field efficiency and actual field efficiency the differences are only 1.48%. Small differences between theoretical FE and actual FE shows small cost needed for operating cost and give higher effect on fixed cost.

Based on this research, I have some recommendation to increase field efficiency of mechanization usage in paddy field. One of the recommendation are use paddy planter because the farmer only use mist blower for planting the seedlings. Paddy planter can help in increasing total number of yield because total area are using preferably. Besides that, farmer can save 40% from net cost of labour. To increment rural mechanization, the quality and amount it may to be assessed in detail for every area. More planning can best be performed with learning of existing conditions.

CHAPTER FIVE

CONLUSION AND RECOMMENDATION

Higher mechanization power means advance and increasingly of specialized machinery and equipment such as implement and tool used. Higher Field Efficiency can reduce total cost of mechanization especially operating cost such as fuel and lubricant cost. Fuel and lubricant cost is the highest cost in mechanization while higher time using in field capacity lead to low field efficiency. Higher TFC lead to high Field Efficiency so the production cost and yield will be higher. Owning farm machinery help farmer to manage the input cost compared to lease and rent mechanization. Based on my interview, if the farmer rent the mechanization such as combine harvester but the operator take time and late to harvest the paddy, the quality of paddy will be reduced. It is usually done and the farmer at Sungai Balang can avoid that from the losses. Farmers working their machines may be more careful in seeing that the work is done right than custom operators working on a piecework premise. On the other hand, owning machine may have superior machines and be more talented at adjusting and working the machines than the custom operators who uses his machine as it were a couple of days each year. They may have higher knowledge to repair or increase the power of mechanization such as increase the speed during work in the field. Great judgment is required when making taken a cost alterations based on performance quality. My recommendation is reduce time for covered the area so cost of operating can be reduce. Besides that, repair and maintenance can be done before using the mechanization at the field.

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APPENDICES

7.1 Measuring tractor capacity

Theoretical field capacity (TFC):

Speed : 1.86411 mph @ 3 km/hour

Width : 10 feet @ 3.048 m

$$\frac{\text{speed } \left(\frac{\text{km}}{\text{hr}}\right) \text{x width (m)}}{10}$$

$$\frac{3\frac{\text{km}}{\text{hr}} \text{x } 3.048 \text{ m}}{10} = 0.9144 \text{ ha/hr}$$

Effective Field capacity (EFC):

Total working hours: 8

Total hours in field : 384 hours

Total area covered: 291.37 hectare

$$\frac{\text{Area}}{\text{Time}}$$

$$\frac{291.37 \text{ hectare}}{384 \text{ hour}} = 0.76 \text{ ha/hr}$$

Field efficiency (FE):

EFC: 0.76 hectare per hour

TFC: 0.91 hectare per hour

Total hectares covered: 291.37 hectare

$$\frac{\text{EFC}}{\text{TFC}}$$

$$\frac{0.76\ \text{ha/hr}}{0.91\ \text{ha/hr}} = 0.8352$$

= 0.8352 × 100

= 83.52 %

Theoretical field efficiency: 85%

Actual field efficiency : 83.52%

Difference between theoretical field efficiency: 85% - 83.52% = 1.48%

7.2 Measuring combine harvester capacity

Theoretical field capacity (TFC):

Speed: 4 km/hr

Width: 3.6 m

$$\frac{\text{speed}\ \left(\frac{\text{km}}{\text{hr}}\right) \text{x width (m)}}{10}$$

$$\frac{4\frac{\text{km}}{\text{hr}} \text{x } 3.6\ \text{m}}{10} = 1.44\ \text{ha/hr}$$

Effective Field capacity (EFC):

Total working hours: 8

Total hours in field : 44 days

Total area covered: 288 hectare

$$\frac{\text{Area}}{\text{Time}}$$

$$\frac{288 \text{ hectare}}{352 \text{ hour}} = 0.818 \text{ ha/hr}$$

Field efficiency (FE):

$$\frac{\text{EFC}}{\text{TFC}}$$

$$\frac{0.818 \text{ ha/hr}}{1.44 \text{ ha/hr}} = 0.5681$$

Actual field efficiency : 56.81%

Theoretical field efficiency : 85%

Difference between theoretical field efficiency:

85% - 56.81% = 28.19%

7.3 Repair and maintenance cost on tractor

0.25 × RM120000 = RM30000

RM30000 – RM6800 = RM23200

RM23200 is less than estimate repair cost.

Cost per hour = RM6800 = RM17.71 per hour
384 hours

7.4 Repair and maintenance cost on combine harvester

0.25 × RM160000 = RM40000

RM40000 – RM13000 = RM27000

RM27000 is less than estimate repair cost

Cost per hour = RM13000 = RM36.93 per hour
352 hours

7.5 Fuel and lubricant cost on tractor

Estimate average fuel consumption

*95 horsepower × 0.75 = 70.84 kiloWatt

70.84 kiloWatt × 0.223 = 15.797 Litre per hour

Estimate fuel cost

15.797 litre per hour × RM2.04 per litre = RM32.23 per hour

Fuel and lubricant cost

RM32.23 per hour + (10% × RM32.23) = RM35.45 per hour

RM35.45 per hour x 384 hour per season = RM13, 612. 80

7.6 Fuel and lubricant cost of combine harvester

Estimate average fuel consumption

*150 horsepower × 0.75 = 112.5 kiloWatt

112.5 kiloWatt × 0.223 = 25.088 Litre per hour

Estimate fuel cost

25.088 litre per hour × RM2.05 per litre = RM51.43 per hour

Fuel and lubricant cost

RM51.43 per hour + (10% × RM51.43) = RM56.57 per hour

RM56.57 per hour × 352 hour per season = RM19, 912. 64

7.7 Fixed cost of tractor and combine harvester.

Table 1.0 - Average Annual Fixed Cost as a percentage of original list price**.**

Average Annual Fixed Cost as a percentage of original list price			
End of year	Tractors & combines	Forage harvester	All others
1	33.07%	35.75%	34.41%
2	22.52%	24.81%	23.68%
3	18.76%	20.70%	19.75%
4	16.71%	18.33%	17.55%
5	15.36%	16.69%	16.06%

Buying price of tractor: RM120000

Years owned: Five years

AAFC: 15.36%

RM120000 × 0.1536 = RM18432

Buying price of combine harvester: RM160000

Years owned: Five years

AAFC: 15.36%

RM160000 × 0.1536 = RM24576

Table A- Average annual fixed cost

Average Annual Fixed Cost as a percentage of original list price			
End of year	Tractors & combines	Forage harvester	All others
1	33.07%	35.75%	34.41%
2	22.52%	24.81%	23.68%
3	18.76%	20.70%	19.75%
4	16.71%	18.33%	17.55%
5	15.36%	16.69%	16.06%
6	14.36%	15.42%	14.93%
7	13.56%	14.39%	14.01%
8	12.90%	13.51%	13.24%
9	12.33%	12.75%	12.57%

Table B- Accumulated repair cost as percentage of list price

	¼ accumulated		½ accumulated		¾ accumulated		Full life accumulated			
Machine	Hours	Cost	Hours	Cost	Hours	Cost	Hours	Cost	RF1	RF2
All wheel tractor	3000	6.2%	6000	25.0%	9000	56.2%	12000	100%	0.006944	2.0
Crawlers	4000	5.0%	8000	20.0%	12000	45.0%	16000	80%	0.003125	2.0
Self-propelled combines	750	2.2%	1500	9.3%	2250	21.9%	3000	40%	0.039820	2.1

STUDY OF FARM MACHINERY POWER AND OPERATION COST IN PADDY FIELD SUNGAI BALANG, JOHOR

Nur Najwa binti Ab Ghafar[1], Samihah binti Mustaffha[2]*,
[1 2]*Faculty of Plantation and Agrotechnology, Universiti Teknologi MARA Jasin, 77300, Melaka, Malaysia, wanzuraida@melaka.uitm.edu.my*
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Abstract

Rice (*Oryza sativa*) is one of our staple food in the worldwide and have a large number of consumers. Most of rice producer are using agricultural practices. Mechanization is combination application of mechanical that apply at farm and it need utilization, maintenance and repair the tools, equipment and also costing. Farm mechanization usage with suitable engine power and specialized equipment affected on cost of paddy rice production and mechanization cost. To determine the relationship between mechanization and management cost besides comparing actual Field Efficiency and theoretical Field Efficiency, secondary data was taken at paddy field in Sungai Balang, Johor. Two different types of machine data was taken that are tractor Kubota M9540 with 95 horsepower and combine harvester New Holland 1545 with 150 horsepower. Total area of study, total time taken, speed, width of mechanization implement, farm mechanization cost, and power usage was measure to calculate by using formula Theoretical Field Capacity (TFC), Effective Field Capacity (EFC), Field Efficiency (FE), fixed cost, and operation cost. Fixed cost calculation on tractor are half from total cost and the highest rate that are 47% because less budget to repair and maintenance are needed while fuel and lubricant cost of combine harvester is the most higher from total cost which are 41%. Higher fuel and lubricant cost in using combine harvester because more time losses during operating the harvester in field. High annual usage make combine harvester need more repair such as engine overhaul, routine and accidental breakage. Tractor's FE is higher than combine harvester's FE that are 83.52% and 56.81% because of higher EFC. Effect of high difference between actual FE and theoretical FE on combine harvester is higher operating cost and lower fixed cost while small differences between actual FE and theoretical FE on tractor make lower operating cost and higher fixed cost

Keywords: mechanization, cost, rice, fixed cost, operation cost.

Introduction

Rice (Oryza sativa) is one of our staple food in the worldwide and have a large number of consumers. There are many rice producer such as Malaysia, Thailand, India, Pakistan and Iran which most of them using agricultural practices that are source of employment of rural production. Rice is cultivation was started at 15th century in South East Asia and spread to India, Thailand, China and Japan.

Rice are consumed by more than 2,500 million people and 90% produced and consumed from Asia. In Malaysia, there are about 700,000 acres area were planted by paddy cultivation. The

worldwide increment in population and restriction in horticultural land request effectiveness and profitability in all phases of rice generation. Manual paddy transplanting require more forces around 200 to 250 man hectare for every hour, which is approximately 25 percent of the aggregate work necessity of rice generation (Mufti, 1995).

Malaysia's paddy yield have low productivity compared to another countries due to some factors such as inadequate labour force and technology use before. Total difference are 10% with others. More than half was planted in Peninsular and top five high state supply of paddy are Perlis, Kedah, Kelantan, Selangor and Perak.

Mechanization of agriculture is application of machine or mechanical implement use in the field during all activity from land preparing until harvest and post-harvest. The function is to increase productivity and reach sustainable agriculture as population in our country and world is increase. Technologies is needed and it is the most important thing that help to meet customer demand. Besides that, mechanization use directly with the farmers in management of land, labour and capital. Management cost of mechanization in paddy field is counting based on their cost in operating, fixed, maintenance and fuel with lubricant cost. As we know, machine give huge impact on output for any sector including agricultural sector. Mechanization must have capacity, degree and level to run the work in field. Capacity of every machine are different based on horsepower they use, age, and others.

According to Najim (2007), cost of importing white rice mill into Malaysia is less than locally. This outcome is because less labour force is seen to achieve timeliness and profit to avoid more waste. Less labour does not mean we need more manual worker to handle the operating activity such as planting and harvesting but need more mechanization to solve the work. Ferrero and Tinarelli (2008) reported that in Italy they are managing 60 hectare with only using tractor and combine harvester. But in small and less develop country, they using high number of manual worker which have less return in money. In addition, area that was managed lesser that in Italy.

According to (Nagaraj,2012), most of farmers have knowledge about mechanization operation use in the field but there was a research at Raichur district in India on 120 respondent from 6 different villages. Half of the respondent have full knowledge about mechanization on the operation, frequency of use and specification of the implement such as plough, rotor, power tiller, combine harvester and thresher while half of them have medium knowledge and skill about mechanization. This is happened because less exposed and knowledge about mechanization at the beginning by government.

Another problem faced by farmer is they tend to make a choice either to own the machine, rent or lease it. Due to high costing to own the mechanization, they make result to rent it although the price and charges are higher. It gives a choice for them on how to manage the process either owned machine or hiring labour to handle the machine. Based on these research, 50% total cost production are machinery cost and another cost are labour, chemical, seed, fertilizer and others.

This research is based on past research done and it calculated secondary data that was collected regarding the relationship between mechanization cost and management in paddy yield. Mechanization cost are including all operating cost, labour cost and fixed cost. The result from this research give benefit for those who want to further research and study which can differentiate the management cost between own, rent and lease.

This study concentrated on student and worker which are find an actual cost for preparing management of mechanization in paddy field because not all farmers own the mechanization but they tend to rent or lease it to run the project in the field. Farmer are not taking care about how many cost need to maintain the quality year-by-year. Besides that, the study are to find is it tally between cost of operation mechanization with theoretical field efficiency and find the reason why field efficiency are not related with the cost used. The study was conducted in paddy field Sungai Balang, Muar and used one type of instrument only by secondary data. The study also give

reference for student who take subject related to management of mechanization. It will explore the actual condition on how to get the smooth work besides avoiding time losses.

Paddy yield increase after usage of mechanization in field through limited resources including seedling, fertilizing, weeding and others. Agricultural technology was started around 1960 due to increase population and land yield are limited (W.I.W. Ismail, 2016). High demand from all countries make farmers around the world including Malaysia tend to use paddy mechanization even the price is higher than use manual labour. The percent of yield can be reduce to 70 percent if time for harvesting is late in two months (W.I.W. Ismail, 2016). The condition and price can be fall during market the product so mechanization help to increase production.

Cost of farm mechanization are including the hire chargers, labour, repair, operating cost and fixed cost. Usually, fuel and lubricant cost will be the most expensive and highest cost than depreciation of farm machinery, taxes, shelter, insurance and interest (TSII). Total TSII are twelve percent from remaining value of farm machinery every year. Three types of fuel use by mechanization that are diesel, gasoline and lp-gas.

Operating cost in hired and owned machine do not differ greatly except in custom service. Labour cost includes actual wages paid by farmer casual labourers. Wage rate for harvesting activity difference between farm, season and village. So the rate is based on how many acres or areas covered per time. Major determinants of wage rate are size of paddy field area, yield, climatic condition, and distance from field to storage

Machinery, tools and equipment, fuel and lubricant, depreciation also are important and major cost on business. Farmer need to maintain the quality of machinery with good managing by make sure how to acquire machinery and so on. Every year, better mechanization are develop based on technology, larger, capacity and power (Hormozi, 2012). Farmer and operator need to take time for ensure the machinery are gave profit for them in return and efficient during and after using the mechanization by make what needed of mechanization such as services. They are tend to have large cost in ownership and also operating the farm machinery.

Most of the problem faced by farmers are shortage of workers especially during peak hour such as transplanting the plant and harvesting. They need high cost of labour if using manually worker instead of using agricultural mechanization

Material and method

Secondary data was taken at paddy field in Sungai Balang, Muar, Johor. The farmers run the project under development and help from Pejabat Pertanian Sungai Sudah, Muar. Total area of these paddy field are 320 hectares, means 790.752 acres. One acre including 660 feet length x 66 feet wide. Type of soil is clay.

Total area of study, farm mechanization cost, time, speed, width of mechanization implement and power usage was measure to calculate using formula by theoretical field capacity, effective field capacity, field efficiency, fixed cost, operation cost for repair and maintenance, fuel and lubricant. Different actual and theoretical for field efficiency were calculated.

There are some mechanization used by the farmer to improve yield capacity and not use high labour force. Machine use are six tractor KUBOTA M9540, one excavator, and three harvester. Every tractor have different implement, function and size such as rotor with two different lengths that are 90 inch and 120 inch, plough 110 inch and 120 inch length, bucket and box driveller of 140 inch. Bucket use to levelling the ground during dry condition while box driveller use during the soil is wet after fill water into the field.

Tractor buying price is RM120000 and it have 95 horsepower. The speed is 3km/hr. Working hour for labour force is eight hours per day and they usually work in 47 days per season. There are two season per year, April until August and October until February. Labour done the job three acres in 45 minutes, 15 acres per day. Wages is RM75 per acre for the labour using 90 inch implement while RM65 per acre for the labour using 120 inch implement. The tractor use 80 litre fuel diesel per day and fuel cost per day is RM160. Storage of this mechanization is at Melaka and cost of transportation and lorry loader is RM40.

Theoretical Field Capacity (TFC)

Theoretical field capacity is total time in field including all the work done such as turns, filling hopper and others. Measuring machine capacity is important to determine on how many time was spent at the field with or without losses time and product.

$$\frac{\text{speed } \left(\frac{\text{km}}{\text{hr}}\right) \text{x width (m)}}{10}$$

Effective Field Capacity (EFC)

Effective field capacity show how much time spent working in hectare per hour. Effective field capacity is always less than theoretical field capacity because TFC give maximum capacity to evaluate time for machine and operator. EFC is the measure of a machines capacity to carry out a vocation under genuine field conditions.

$$\frac{\text{Area}}{\text{Time}}$$

Field Efficiency (FE)

Based on survey and calculation, it will show actual and theoretical field efficiency. FE is define as percentage of time the machine operate at its full rate, speed and width at the field. There are some differences between two of them based on typical range by ASABE 85%.

$$\frac{\text{EFC}}{\text{TFC}}$$

Operation cost

Repair and maintenance cost.

Repair cost is estimate by Total Accumulated Repairs formula. It also can estimate by actual repair cost that was kept in field record.

Fuel and lubricant cost.

Fuel and lubricant cost also including in operation cost. Usually fuel and lubricant cost are higher than fixed cost due to price market of fuel use. Three factors that give impact when estimating fuel needs are horsepower-hours of energy, fuel types and fuel consumption. Different amount of fuel needed when farm machinery such as tractor use three different fuel that are diesel, gasoline and LP-gas. Fuel consumption use to estimate fuel requirement for specific level of power. Formula in fuel and lubricant cost are estimate fuel consumption, fuel cost per hour times with fuel price and estimate fuel and lubricant cost.

Fixed cost.

Fixed cost are the most part incorporate the costs that are brought either the machine is really utilized as a part of generation. These cost are not fluctuate with the measure of machine utilize as it is slightly decrease as higher annual use. Fixed cost also call ownership cost and all the cost must be kept. Fixed cost are including depreciation, taxes, shelter, insurance and interest. Depreciation can be calculate by three methods, straight-line depreciation method, sum-of-the-digits depreciation method and declining-balance depreciation method. Based on these survey, declining balance method and Average Annual Fixed Cost (AAFC) was used.

Result and discussion

Mechanization cost and efficiency for tractor Kubota M9540

Theoretical Field Capacity	0.9144 hectare per hour
Effective Field Capacity (EFC)	0.76 hectare per hour
Field Efficiency (FE)	83.54%
Difference actual FE and theoretical FE	1.48%
Fuel and Lubricant cost	RM13612.80
Repair and Maintenance cost	RM6800
Fixed cost	RM18432

Based on TFC formula, tractor's speed and width of implement is three kilometre per hour and 3.048 meter. Speed and width is multiplying before divided with ten. Total TFC is 0.9144 hectare per hour. Working hour is eight hours per day and total days in field is 48 days so time taken in operating activity by tractor is 384 days. Total area covered in 384 hours are 291.37 hectare. Total area divided time taken is 0.76 hectare per hour. FE is calculated by using formula FC divided with TFC and the difference between actual FE 85% and theoretical FE 83.52% is 1.48%. There are small differences from the actual capacity from theoretical capacity because higher EFC result. Supposedly EFC result is 0.60 hectare per hour was divided with TFC, FE result will be fewer than now that are 65.93%. Diesel fuel price during August 2017 is RM2.04 per litre and ten percent from estimate fuel cost is lubricant cost. Total fuel and lubricant cost is RM13612.80 per season. Fixed cost was calculated by take accumulated repair cost percentage of list price in table 2, John Deer book multiply with list price of tractor, RM120000. (See the appendix for accumulated repair cost percentage).

Mechanization cost and efficiency of combine harvester New Holland 1545

Theoretical Field Capacity (TFC)	1.44 hectare per hour
Effective Field Capacity (EFC)	0.818 hectare per hour
Field Efficiency (FE)	56.81%
Difference actual FE and theoretical FE	28.19%

Fuel and Lubricant cost	RM19912.64
Repair and Maintenance cost	RM13000
Fixed cost	RM24576

Based on TFC formula, combine harvester's speed and width of implement is four kilometre per hour and 3.6 meter. Speed and width is multiplying before divided with ten. Total TFC is 1.44 hectare per hour. Working hour is eight hours per day and total days in field is 44 days so time taken in operating activity by tractor is 352 days. Total area covered in 352 hours are 288 hectare. Total area divided time taken is 0.818 hectare per hour. FE is calculated by using formula FC divided with TFC and the difference between actual FE 85% and theoretical FE 83.52% is 28.19%. There are many differences from the actual capacity from theoretical capacity because lower EFC result. Mechanization need some recommend due to low EFC and FE to improve the field efficiency because the result will increase more capacity thus reduce input cost such as fuel cost and repair cost. Diesel fuel price is RM2.05 per litre and ten percent from estimate fuel cost is lubricant cost. Total fuel and lubricant cost is RM19912.64 per season. Fixed cost was calculated by take accumulated repair cost percentage of list price in table 2, John Deer book multiply with list price of tractor, RM160000. (See the appendix for accumulated repair cost percentage).

The cost of fuel is RM51.43 per hour, ten percent from the cost of fuel is lubricant cost and the total is RM56.57. Total time per usage are 352 hour throughout the data and it is the highest cost among fixed and repair cost. Fuel and lubricant cost are costly because there was more time losses during operating tractor in field. Based on calculation of theoretical field efficiency of combine harvester with actual field efficiency, there are 28.19% differences between them. This is because repair and maintenance cost are high more than normal cost besides fuel and lubricant cost also too costly. For mechanization that are used almost five years, the major repair usually engine overhaul. So, the cost of repair need to reduce but in this cases, combine harvester need more maintenance and fuel lubricant cost. The effect of high difference actual FE and theoretical FE is higher cost in operating cost and lower fixed cost of combine harvester.

Fixed cost are true ownership cost since it is give important role in all mechanization decision such as remaining value by year, how much the cost when the farmer want to trade it and also the cost from taxes, shelter, insurance and interest (TSII). It is the highest cost among fuel lubricant cost and maintenance cost. Every year, fixed cost will be decrease due to some reason such as age, breakage and condition. Fuel and lubricant cost of tractor and harvester are almost same. The total of fuel and lubricant cost are half of the mechanization cost since it is specifically corresponding to the measure of total usage. During month of April 2018, price for diesel is RM2.04 per litre when using tractor while RM2.05 during the month of using combine harvester. The cost for fuel usage per hour is RM32.23 per hour and ten percent from total fuel usage is lubricant cost. So the total is RM35.45 per hour times with 384 hour use throughout the data of tractor per season and it is the highest cost among fixed and repair cost. Fixed cost are the highest cost because less repair and maintenance cost are needed. Based on calculation of theoretical field efficiency and actual field efficiency the differences are only 1.48%. Small differences between theoretical FE and actual FE shows small cost needed for operating cost and give higher effect on fixed cost.

Based on this research, I have some recommendation to increase field efficiency of mechanization usage in paddy field. One of the recommendation are use paddy planter because the farmer only use mist blower for planting the seedlings. Paddy planter can help in increasing total number of yield because total area are using preferably. Besides that, farmer can save 40% from net cost of labour. To increment rural mechanization, the quality and amount it may to be assessed in detail for every area. More planning can best be performed with learning of existing conditions.

Conclusion and recommendation

Higher mechanization power means advance and increasingly of specialized machinery and equipment such as implement and tool used. Higher Field Efficiency can reduce total cost of mechanization especially operating cost such as fuel and lubricant cost. Fuel and lubricant cost is the highest cost in mechanization while higher time using in field capacity lead to low field efficiency. Higher TFC lead to high Field Efficiency so the production cost and yield will be higher. Owning farm machinery help farmer to manage the input cost compared to lease and rent mechanization. Based on my interview, if the farmer rent the mechanization such as combine harvester but the operator take time and late to harvest the paddy, the quality of paddy will be reduced. It is usually done and the farmer at Sungai Balang can avoid that from the losses. Farmers working their machines may be more careful in seeing that the work is done right than custom operators working on a piecework premise. On the other hand, owning machine may have superior machines and be more talented at adjusting and working the machines than the custom operators who uses his machine as it were a couple of days each year. They may have higher knowledge to repair or increase the power of mechanization such as increase the speed during work in the field. Great judgment is required when making taken a cost alterations based on performance quality. My recommendation is reduce time for covered the area so cost of operating can be reduce. Besides that, repair and maintenance can be done before using the mechanization at the field.

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CURRICULUM VITAE

1. PERSONAL INFORMATION

Full Name	:	Nur Najwa binti Ab Ghafar	
I/C Number	:	940710015056	
Race	:	Malay	
Date of Birth	:	10 July 1994	
Place of Birth	:	Hospital Segamat	
Number of Siblings	:	4	
Permanent Home Address	:	MBP 637 B Sungai Pulai, Seri Menanti, 884160 Muar, Johor.	
Telephone (Home)	:	06-9881079	(Office) :-
Mobile Phone No.	:	016-9650838	E-mail : najwaghafar94@gmail.com
Marital Status	:	Single	
Gender	:	Female	

2. EDUCATIONAL BACKGROUND

School/College/University	Certificate/Diploma/Degree	Year
Universiti Teknologi MAR Melaka, Kampus Jasin	B. Sc. (Hons.) Plantation Technology & Management	2018
Universiti Teknologi MAR Melaka, Kampus Jasin	Dip. in Planting Industry Management	2015
S.M.K. Seri Kenangan, Segamat, Johor.	Sijil Pelajaran Malaysia (SPM)	2011
S.M.K. Seri Kenangan, Segamat, Johor.	Penilaian Menengah Rendah (PMR)	2009
S.K. LKTP Felda Chemplak, Labis, Johor.	Ujian Penilaian Sekolah Rendah (UPSR)	2006

3. WORKING EXPERIENCE (IF ANY)

Medical assistant at Klinik Parit Jawa, Muar, Johor.

Medical assistant at Poliklinik Amin, Muar, Johor.

Intership practical at MARDI Pontian, Johor.

Internship practical at MPIB Pontian, Johor

Corn cob project at UiTM Jasin.

Signature: _____ **Date: _____**