OPERATIONAL EFFICIENCY OF TIMBER SKIDDING IN SAPULUT, SABAH

WAN MOHAMAD HAFEEZ BIN W AHMAD

FH 2019 31

OPERATIONAL EFFICIENCY OF TIMBER SKIDDING IN SAPULUT, SABAH

By

WAN MOHAMAD HAFEEZ BIN W AHMAD

A Project Report Submitted in Partial Fulfillment of the Requirements
For the Degree of Bachelor of Forestry Science in the
Faculty of Forestry
Universiti Putra Malaysia

2019

SPECIAL DEDICATION

In the name of ALLAH S.W.T, who had given strength to complete this thesis.

Thanks to my beloved parents:

W Ahmad Bin Wan Harun and Rohayah Binti Yusoff

My siblings:

Wan Nurul Hanan Binti W Ahmad and Wan Izzati Bin W Ahmad

My supervisor:

Associate Professor Dr. Seca Gandaseca

Thanks for your support, encouragement and advice

All my precious friends:

Thanks for your present in my life.

Thanks to all of you for your love, support and pray. May ALLAH S.W.T bless them all.

“Life is not a problem to be solved but a reality to be experienced”

ABCTRACT

Timber skidding is one of the important components in forest harvesting. The process of harvesting a forest includes all operations from cutting down trees and delivering the log to a mill, rail depot, or ship dock. Efficiency is the ability to avoid wasting materials, energy, efforts, money, and time in doing something or in producing a desired result. In forest harvesting, each of the operations conducted in the natural forest is being evaluated through details planning. For skidding operation, widely use bulldozer as a medium in transporting log to temporary log landing require attention from many sides. This is because it may affect the productivity and time consumed to do the work. The objectives of this study were i) measure the distance, time, productivity of skidding operation by crawler tractor and ii) to examine the relationship between time, distance and productivity of skidding operation by crawler tractor. Results showing relationship between volume of logs with trip cycle on average about 2.037m³ volume of log or one big log can be skidded on each trip. For relationship of distance and trip cycle, the results show the shortest distance is at 310 meters which due to efficiency productivity, and longest distance which is at 420 meters. On average, about 360 meters trail length of distance travelled by crawler tractor on each trip. Next, for speed and trip cycle graph shape distribution showing unevenness on the relationship between speed and number of trips. This could be due to describe problems as above or non-productive delay occurrence such as drinking, smoking or resting. Besides, distribution of work element on time consumption show skidding seems to consume more time compared to another process since crawler tractor workers manually doing the work. Crawler tractor took the total time to complete 5 trips per day was between 4.021 hours to 4.300 hours within distance at 310 meters to 420 meters including delay. The results of this study provide current information that could be used by the management agency in Sapulut Forest Reserve especially Forestry Department Sabah to make an improvement toward skidding operation in this type of forest.

ABSTRAK

Gelinciran balak adalah salah satu komponen penting dalam penuaian hutan. Proses penuaian hutan termasuk semua operasi dari memotong pokok dan menyampaikan log ke kilang, depot rel, atau kapal kapal. Kecekapan adalah keupayaan untuk mengelakkan pembaziran bahan, tenaga, usaha, wang, dan masa dalam melakukan sesuatu atau menghasilkan hasil yang diinginkan. Dalam penuaian hutan, setiap operasi yang dijalankan di hutan semula jadi sedang dinilai melalui perancangan terperinci. Untuk melancarkan operasi, menggunakan buldoser secara meluas sebagai medium dalam mengangkut log ke pendaratan log sementara memerlukan perhatian dari banyak pihak. Ini kerana ia boleh menjejaskan produktiviti dan masa yang digunakan untuk melakukan kerja. Objektif kajian ini adalah i) mengukur jarak, masa, produktiviti operasi skidding oleh traktor crawler dan ii) untuk menganalisis hubungan antara masa, jarak dan produktiviti operasi skidding oleh traktor crawler. Ini termasuk data mengenai produktiviti pengekstrakan log (diameter, panjang, bilangan log, dan masa yang digunakan). Hampir kira-kira 30 hingga 40 perjalanan masa kitaran pemanduan akan direkodkan menggunakan meja belajar masa. Jarak yang berbeza untuk setiap kitaran akan direkodkan dalam unit meter. Ketinggian di cerun yang berbeza dan ketinggian jejak skid akan diambil juga. Keputusan menunjukkan hubungan antara kelantangan log dengan kitaran perjalanan secara purata kira-kira 2.037m³ jumlah log atau satu log besar boleh tergendala pada setiap perjalanan. Untuk hubungan jarak dan kitaran perjalanan, hasil menunjukkan jarak terpendek adalah 310 meter yang disebabkan oleh produktiviti kecekapan, dan jarak terpanjang yang berada pada 420 meter. Rata-rata, kira-kira 360 meter jarak jejak yang dilalui oleh traktor crawler pada setiap perjalanan. Seterusnya, untuk pengagihan bentuk grafik kitaran kelajuan dan perjalanan menunjukkan ketidaksamaan pada hubungan antara kelajuan dan bilangan perjalanan. Ini mungkin kerana menggambarkan masalah seperti kejadian kelewatan atau tidak produktif seperti minum, merokok atau berehat. Selain itu, pengedaran elemen kerja pada masa penggunaan menunjukkan skidding seolah-olah mengambil masa yang lebih banyak berbanding proses lain sejak pekerja traktor perantara secara manual melakukan kerja. Traktor crawler mengambil masa untuk melengkapkan 5 perjalanan setiap hari antara 4.021 jam hingga 4.300 jam dalam jarak 310 meter hingga 420 meter termasuk kelewatan. Hasil kajian ini memberikan maklumat terkini yang dapat digunakan oleh agencie pengurusan di Hutan Simpan Sapulut terutama Jabatan Perhutanan Sabah untuk melakukan perbaikan terhadap operasi hutan yang tergendala dalam jenis hutan ini.

ACKNOWLEDGEMENTS

First and foremost, I would like to acknowledgement and extend my deepest gratitude to my supervisor, Associate Professor Dr. Seca Gandaseca for the guidance and encouragement. Acknowledge is also made to Dean Faculty of Forestry, Universiti Putra Malaysia. I would also like to thanks to Sabah Forestry Department for their supported and gain their helps during the study at Sapulut Forest Reserve, Sabah.

Last but not least, special thanks to Mr. Mustaffa bin Mohamad Pazi, my project members, especially to Mohammad Azhar Aziz and Nor Safiq Jamal during data collection through the course of this study. Finally, I would like to thanks to many of my friends who support and encourage me throughout this study especially Muhammad Adzim Mohd Ariff, Hamdan Budi, Pazlan Ngaliman, Razlan Haniff, Che Wan Mohd Hafiz and all colleagues in Faculty of Forestry which are not mentioned but helped me in ensuring the completion of this study.

APPROVAL SHEET

I certify that this research project report entitled “Operational Efficiency of Timber Skidding In Sapulut Forest Reserve, Sabah” by Wan Mohamad Hafeez bin W. Ahmad has been examined and approved as a partial fulfillment of the requirements for the Degree of Bachelor of Forestry Science in the Faculty of Forestry, Universiti Putra Malaysia.

_____

Assoc. Prof. Dr. Seca Gandaseca
Faculty of Forestry
Universiti Putra Malaysia
(Supervisor)

_____

Prof. Dr. Mohamed Zakaria Bin Hussin
(Dean)
Faculty of Forestry
Universiti Putra Malaysia

Date: JANUARY 2019

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

INTRODUCTION

1.1 General Background

Skidding is one of the important components in forest harvesting. The process of harvesting a forest includes all operations from cutting down trees and delivering the log to a mill, rail depot, or ship dock. It follows a step by step which is devising a harvesting plan, construction of logging road, logging, felling, skidding, yarding, processing and sorting, and log transport. Jour & Majnounian explained that a ground skidding system is the process of moving trees or logs from the cutting site to a landing or roadside where they will be processed into logs or consolidated into larger loads for transport to the processing facility or other final destination (as cited in Najafi, 2011, p. 21). As time has passed, the way logs are moved from the woods to the deck is being improved through technology.

Efficiency is the ability to avoid wasting materials, energy, efforts, money, and time in doing something or in producing a desired result. In a more general sense, it is the ability to do things well, successfully, and without waste. In more mathematical or scientific terms, it is a measure of the extent to which input is well used for an intended task or function (output). Efficiency is very often confused with effectiveness. In general, efficiency is a measurable concept, quantitatively determined by the ratio of useful output to total input.

Effectiveness is the simpler concept of being able to achieve a desired result, which can be expressed quantitatively but doesn't usually require more complicated mathematics than addition. Skidding operation in Malaysia mainly uses a machine for log extraction such as crawler tractor also known as skidders. Skidders represent ones of the most frequently used forest ground-based logging means, probably due to their increased mobility and productivity, reason for which several efficiency studies have been done so far around the world for this kind of forest equipment (Behjou et al. 2008, Naghdi & Mohammadi 2009, Behjou 2010, Spinelli & Magagnotti 2012, Ghaffarian et al. 2013). This process always takes place in tropical hilly forest or mixed-hill dipterocarp forest because it's suitable for ground base extraction system. In the southern part of Malaysia, mainly in the state of Johor, skidding operation is performed using heavy tracked skidding machine, which is a bulldozer. They are equipped with integral arch and winch functioning in hooking and pulling the logged timber.

1.2 Problem Statement

In forest harvesting, each of the operations conducted in the natural forest is being evaluated through details planning. For skidding operation, widely use bulldozer as a medium in transporting log to temporary log landing require attention from many sides. This is because it may affect the productivity and time consumed to do the work. All of this element may give major impact towards surrounding environment. Although Reduced Impact Logging practice is being implemented in Malaysia, but that only to a certain state with proper forest management practices such as Sabah. There are still many logging site operations that use conventional way.

Skid trails are constructed by bulldozer to access every individual tree to be felled. The logs are then winched and dragged out along the skid trials. When this happens, an impact towards the environment are less to be considered if there is no details study related towards machine performance are being made. Soil disturbance, loss of vegetation, and in the worst case, soil erosion may result due to improper skidding operation. Even though there is research conducted about operational efficiency on skidding machine which is crawler tractor. It's still not enough to be a source of reference in the future. Moreover, specific research of efficiency of crawler tractor in Hill Mixed Dipterocarp Forest isn't yet conducted.

Conway (1982) noted the importance of delays in all phases of production. For the delay, there will be mechanical, operational and personal delays involved. Early definitions focused on two types of delays which is productive and non-productive (McGraw and Hallett 1970). But many recently published productivity studied seem to prefer using mechanical, operational, and personal delays categorization (Visser and Stampfer 2003). Each definition set seems to have strengths and weaknesses.

This study is conducted with the aim to determine the time, productivity and efficiency of skidding machine which is crawler tractor in Hill Dipterocarp Forest. The study site takes place in Sapulut, Sabah wherein upland-mixed Dipterocarp forest is located since there is still a lack of study regarding the determination of the efficiency of the crawler tractor. At the end of this research, it is hoped that an improvement toward skidding operation can be made in this type of forest. The work assessment will be made towards its log volume, altitude, time, operator, road access (skid trials), and delay. For this study, the productive and non-productive delay will be analyzed.

1.3 Objectives

The objectives of this study were to:

1. To measure the distance, time, productivity of skidding operation by crawler tractor.
2. To examine the relationship between time, distance and productivity of skidding operation by crawler tractor.

REFERENCES

Bradshaw, J., & Murphy, S. (2005). Review of factors affecting disturbance, compaction and trafficability of soils west Western Australia. *Department of Conservation and Land Management SFM Technical Report* with particular reference to timber harvesting in the forests of south-, *2*, 160.

Ellis, J. (1996). Prospective memory or the realization of delayed intentions: A conceptual framework for research. *Prospective memory: Theory and applications*, 1-22.

Gholami, M. J., & Majnounian, B. (2008). Productivity and cost of wheeled skidder in Hyrcanian Forest. *International Journal of Natural & Engineering Sciences*, *2*(3): 30-34.

Gilanipoor, N., Najafi, A., & Heshmat Alvaezin S.M. (2012). Productivity and cost of farm tractor skidding. *Journal of Forest Science*, *58,*(1): 21–26.

Kluender, R., Lortz, D., McCoy, W., Stokes, B., & Klepac, J. (1997). Productivity of rubber-tired skidders in southern pine forests. Forest Products Journal, 47(11/12): 53-55.

Nurminen, T., Korpunen, H., & Uusitalo, J. (2006). Time consumption analysis of the mechanized cut-to-length harvesting system. Silva Fennica, 40(2): 35-38.

Norizah, K., Mohd Hasmadi, I., Kamaruzaman, J., & Alias MS. (2012). Operational Efficiency of Rimbaka Timber Harvester In Hilly Tropical Forest. *Journal of Tropical Forest Science, 24*(3), 368–378.

Rozainah M. Z. & Mohamad M. R. (2006). Mangrove forest species composition and density. *Institute of Biological Sciences, University Malaya. Ecoprint (13)*, 23–28.

Spinelli, R., & Visser, R. (2008). Analyzing and estimating delays in harvester operations. *International Journal of Forest Engineering*, *19*(1), 36-41.

Tapiwa, M., Kumbirayi, M., & Tauyanashe, C. (2013). The use of Work Study Techniques in Optimizing Manufacturing Plant Maintenance Processes: an Investigation into a Fertilizer Manufacturing Company in Zimbabwe. *International Journal of Science and Research, 2*(2), 98-103.