



**UNIVERSITI PUTRA MALAYSIA**

**FACTORS AFFECTING TECHNICAL EFFICIENCY OF TRAWL  
FISHERY IN PENANG, MALAYSIA**

**LIM GHEE THEAN**

**FP 2011 6**

**FACTORS AFFECTING TECHNICAL  
EFFICIENCY OF TRAWL FISHERY IN  
PENANG, MALAYSIA**

The logo of Universiti Putra Malaysia (UPM) is a shield-shaped emblem. It features a red and white design with a central figure that resembles a stylized bird or a person. The letters 'UPM' are prominently displayed in a red box at the top left of the shield. The entire logo is rendered in a light, semi-transparent grey color.

**LIM GHEE THEAN**

**MASTER OF SCIENCE  
UNIVERSITI PUTRA MALAYSIA  
2011**

**FACTORS AFFECTING TECHNICAL EFFICIENCY OF  
TRAWL FISHERY IN PENANG, MALAYSIA**

By  
**LIM GHEE THEAN**

**Thesis Submitted to the School of Graduate Studies, Universiti  
Putra Malaysia, in Fulfilment of the Requirements for the Degree  
of Master of Science**

**March 2011**

**Specially dedicated to my beloved**

**Grandma,**

*Tang Siew Gan (1926 – 2008)*

**Wife,**

*Lee Huay Lin*

**Parents,**

*Lim Ah Seng & Ng Gook Hiang*

**Brothers,**

*Lim Ghee Sern & Lim Ghee Geen*

**Uncles, Aunties, Cousins**

**And**

**Friends**

Abstract of thesis presented to the Senate of Universiti Putra Malaysia in  
fulfilment of the requirement for the degree of Master of Science

**FACTORS AFFECTING TECHNICAL EFFICIENCY OF TRAWL  
FISHERY IN PENANG, MALAYSIA**

By

**LIM GHEE THEAN**

**March 2011**

**Chairman : Ismail Abd Latif, PhD**

**Faculty : Agriculture**

The main objective of this study is to investigate the level of technical efficiency and factors affecting technical inefficiency for a sample of local trawl vessel operating in Penang, Malaysia. This study was conducted due to the declining trend of marine fish landing of Penang trawl fishery 1993 – 2009. The annual cumulative number of days of local trawl vessels in these seventeen years was also declining in tandem. Data of this study were collected through questionnaire survey that was conducted from November 2009 to January 2010. Sixty-nine fishermen were selected randomly for this study. Information on landing per trip, number of crew, fishing days per trip, diesel consume per trip, gross registered tonnage of vessel and horsepower of vessel were gathered and analyzed by using two approaches namely, stochastic frontier analysis (SFA) and data envelopment analysis (DEA). Furthermore, the determinants of technical inefficiency (family background, age, years of experience and education level of fishermen together with age of vessel and possession of echo sounder) were analyzed through SFA and tobit regression. The results from both approaches (DEA and SFA) indicated that technical

efficiencies among vessels varied between 12.3% and 100%. The mean technical efficiency for DEA approach was 56.6% while SFA approach recorded 71.7%. The inefficiency model from SFA indicated that experience of fishermen, age of vessels and possession of echo sounder contributed positive influences on technical efficiency. In addition, the inefficiency model from tobit regression showed that family background, education, experience of fishermen and possession of echo sounder contributed positive influences on technical efficiency. The inefficiency models from both SFA and tobit regression consistently indicated that possession of echo sounder was the only significant variable having positive influence on technical efficiency which meant a vessel with possession of echo sounder would be more efficient compared with those vessels without echo sounder. Hence, this study suggested that fishermen should be encouraged to acquire an echo sounder and improve the marine fish landings through offering loans, subsidies or other incentives provided by the government to lessen the high capital investment cost borne by the fishermen.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia  
sebagai memenuhi keperluan untuk ijazah Master Sains

**FAKTOR-FAKTOR YANG MEMPENGARUHI KECEKAPAN  
TEKNIKAL PERIKANAN PUKAT TUNDA DI PULAU PINANG,  
MALAYSIA**

Oleh

**LIM GHEE THEAN**

**Mac 2011**

**Pengerusi : Ismail Abd Latif, PhD**

**Fakulti : Pertanian**

Kajian ini dijalankan untuk menyelidik tahap kecekapan teknikal dan faktor kecekapan teknikal untuk sampel kapal pukat tunda di Pulau Pinang, Malaysia. Kajian ini dijalankan disebabkan jumlah pendaratan ikan di Pulau Pinang semakin menurun sejak tahun 1993 – 2009. Tambahan pula, kajian ini turut dijalankan memandangkan jumlah bilangan hari menangkap ikan tahunan didapati juga menurun. Data untuk kajian ini diperolehi dan dikumpul melalui kajian soal selidik yang telah dijalankan dari bulan November 2009 hingga bulan Januari 2010. Seramai enam puluh sembilan orang nelayan telah dipilih secara rawak untuk kajian ini. Segala maklumat tentang jumlah pendaratan ikan, jumlah hari menangkap ikan, kuantiti minyak diesel yang digunakan, pendaftaran muatan kasar kapal dan kuasa enjin kapal telah diperolehi dan dianalisis melalui dua kaedah, iaitu *Stochastic Frontier Analysis* (SFA) dan *Data Envelopment Analysis* (DEA). Selain itu, faktor kecekapan teknikal yang merangkumi latar belakang keluarga, umur, tahun pengalaman, tahap pendidikan, umur kapal dan kemudahan pemerun

gema turut dianalisis melalui SFA dan regresi *tobit*. Keputusan yang diperoleh melalui kedua-dua kaedah (DEA dan SFA) telah menunjukkan bahawa tahap kecekapan teknikal kapal pukat tunda adalah antara 12.3% dan 100%. Purata tahap kecekapan teknikal untuk sampel kapal dalam kaedah DEA ialah 56.6% manakala kaedah SFA merekodkan 71.7%. Model ketidakcekapan dari SFA menunjukkan bahawa pengalaman nelayan, umur kapal dan kemudahan pemerun gema memberi kesan positif kepada kecekapan teknikal. Di samping itu, model ketidakcekapan dari regresi *tobit* menunjukkan bahawa latar belakang, pendidikan, pengalaman nelayan dan kemudahan pemerun gema memberi kesan positif kepada kecekapan teknikal. Kedua-dua model ketidakcekapan daripada SFA dan regresi *tobit* memaparkan bahawa kemudahan pemerun gema merupakan satu-satunya pemboleh ubah yang memberi kesan positif yang ketara kepada kecekapan teknikal. Hal ini bermakna kapal yang dilengkapi dengan pemerun gema akan beroperasi dengan lebih cekap berbanding dengan kapal yang tidak dilengkapi dengan alat ini. Oleh itu, melalui kajian ini, dicadangkan bahawa para nelayan harus digalakkan menggunakan alat pemerun gema untuk meningkatkan jumlah pendaratan ikan marin melalui penawaran pinjaman, subsidi dan insentif lain yang diberi oleh kerajaan untuk mengurangkan kos pelaburan yang tinggi yang ditanggung oleh nelayan.



## ACKNOWLEDGEMENTS

I gratefully acknowledge the funding from the project of Fundamental Research Grant Scheme (project number: 05-11-08-631 FR).

I am grateful to my supervisor, Dr. Ismail Abd Latif, for the two years mentoring, guidance and kindness throughout the completion of this work. I am also grateful for the suggestions and comments from Prof. Dr. Md. Ariff Hussein.

I would like to thank the staffs in Department of Fisheries, Penang for their assistance. Special thanks to Pn. Zubaidah Ahmad (Assistant Officer SMPP, DoF) for her assistance and the permission to use the secondary data. I would like to thank all the fishermen surveyed during the interview for their cooperative, helpful and friendly.

Special appreciation to my dearest wife and my beloved parents for their invaluable encouragement and support. Finally, I would like to thank God for enabling me to go through my master study.

## APPROVAL

I certify that a Thesis Examination Committee has met on **15<sup>th</sup> March 2011** to conduct the final examination of Lim Ghee Thean on his thesis entitled “**Factors Affecting Technical Efficiency of Trawl Fishery in Penang, Malaysia**” in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the Master of Science.

Members of the Thesis Examination Committee were as follows:

**Abdullahi Farah Ahmed, PhD**

Faculty of Agriculture  
Universiti Putra Malaysia  
(Chairman)

**Amin Mahir Abdullah, PhD**

Faculty of Agriculture  
Universiti Putra Malaysia  
(Internal Examiner)

**Mohd. Mansor Ismail, PhD**

Associate Professor  
Faculty of Agriculture  
Universiti Putra Malaysia  
(Internal Examiner)

**Abdul Hamid Jaafar, PhD**

Associate Professor  
Faculty of Economics and Business  
Universiti Kebangsaan Malaysia  
(External Examiner)

---

**BUJANG KIM HUAT, PhD**

Professor and Deputy Dean  
School of Graduate Studies  
Universiti Putra Malaysia

Date:

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of **Master of Science**. The members of the Supervisory Committee were as follows:

**Ismail Abd Latif, PhD**

Senior Lecturer  
Faculty of Agriculture  
Universiti Putra Malaysia  
(Chairman)

**Md. Ariff Hussein, PhD**

Professor  
Faculty of Agriculture  
Universiti Putra Malaysia  
(Member)

---

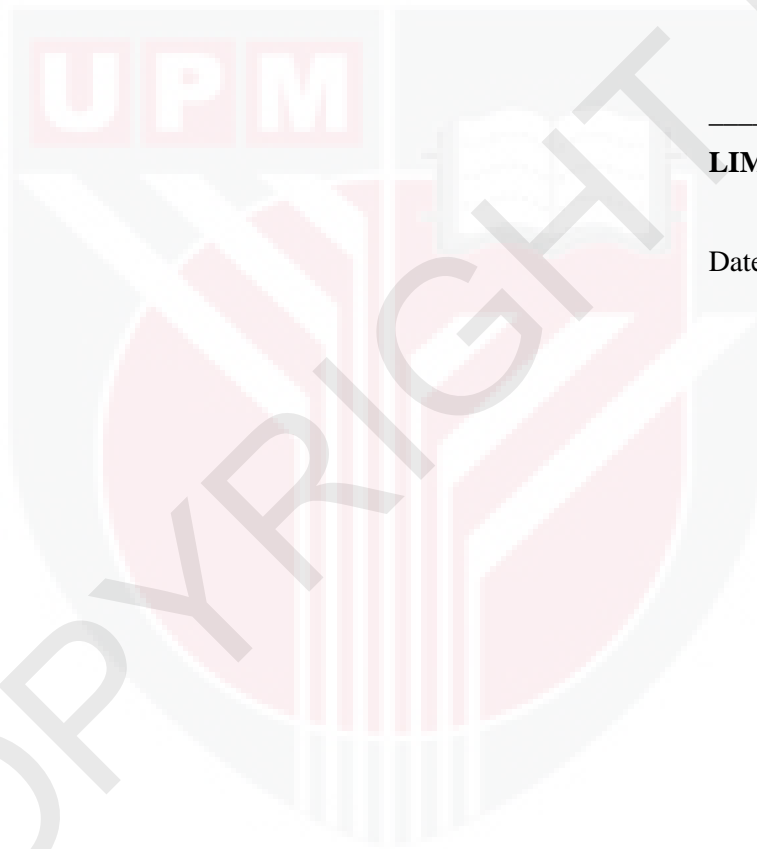
**HASANAH MOHD GHAZALI, PhD**

Professor and Dean  
School of Graduate Studies  
Universiti Putra Malaysia

Date:

## DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, and is not concurrently, submitted for any other degree at Universiti Putra Malaysia or at any other institution.



---

**LIM GHEE THEAN**

Date: 15 March 2011

## TABLE OF CONTENTS

	<b>Page</b>
<b>DEDICATION</b>	i
<b>ABSTRACT</b>	ii
<b>ABSTRAK</b>	iv
<b>ACKNOWLEDGEMENT</b>	vi
<b>APPROVAL</b>	vii
<b>DECLARATION</b>	ix
<b>LIST OF TABLES</b>	xii
<b>LIST OF FIGURES</b>	xiii
<b>CHAPTER</b>	
<b>1 INTRODUCTION</b>	<b>1</b>
1.1 Fisheries in Malaysia	1
1.2 Marine fisheries	5
1.2.1 Landings	5
1.3 Marine fisheries policies	6
1.3.1 National Agriculture Policy, 1992-2010	6
1.3.2 Third National Agriculture Policy, 1998-2010	7
1.3.3 Policy of management applied to marine Fisheries	8
1.4 Penang marine fisheries	10
1.4.1 Landings	11
1.4.2 Fishermen	14
1.4.3 Fishing vessels and fishing gears	16
1.5 Problem Statement	19
1.6 Objective of Study	21
1.7 Significant of Study	22
1.8 Organization of Thesis	22
<b>2 LITERATURE REVIEW</b>	<b>24</b>
2.1 Definitions and Concepts	24
2.2 Stochastic Frontier Analysis (SFA)	26
2.3 Data Envelopment Analysis (DEA)	28
2.4 SFA versus DEA	30
2.4.1 Advantages and disadvantages of SFA	30
2.4.2 Advantages and disadvantages of DEA	31
2.5 Tobit regression model	31
2.6 SFA related studies	33
2.7 DEA related studies	43
2.7.1 Studies of fisheries	44
2.7.2 Studies of non fisheries	45
2.8 DEA versus SFA related studies	47
2.9 Tobit regression related studies	50
<b>3 METHODOLOGY</b>	<b>52</b>
3.1 Theoretical framework	52

3.1.1	Stochastic frontier analysis	53
3.1.2	Data envelopment analysis	53
3.2	Conceptual framework	55
3.3	Instrument design	57
3.3.1	Source of data	57
3.3.2	Questionnaire design	58
3.4	Data collection	58
3.4.1	Sampling design	58
3.4.2	Sampling size	59
3.5	Data analysis	59
3.5.1	Description of variables	60
3.5.2	Descriptive analysis	61
3.5.3	Generalized likelihood ratio test	61
3.5.4	Modification of SFA model	62
3.5.5	Modification of DEA model	63
3.5.7	Modification of Tobit regression model	64
3.5.8	Elasticity and return to scale	65
4	<b>RESULTS AND DISCUSSION</b>	67
4.1	Descriptive Analysis	67
4.1.1	Characteristics of vessels	67
4.1.2	Fishing operation	70
4.1.3	Social demographic of fishermen	72
4.2	Hypothesis testing	74
4.3	Technical efficiency analysis	75
4.3.1	Stochastic frontier analysis	75
4.3.2	Data envelopment analysis	78
4.4	Input elasticity	80
4.5	Factors affecting technical efficiency	82
4.5.1	Technical inefficiency and family background	82
4.5.2	Technical inefficiency and education background	83
4.5.3	Technical inefficiency and experience	83
4.5.4	Technical inefficiency and age of fisherman	84
4.5.5	Technical inefficiency and age of vessel	84
4.5.6	Technical inefficiency and possession of echo sounder	85
5	<b>SUMMARY AND CONCLUSION</b>	86
5.1	Summary of results	86
5.2	Policy recommendations	88
5.3	Recommendations for the further research	89
5.4	Conclusion	90
	<b>REFERENCES</b>	92
	<b>APPENDICES</b>	96
	<b>BIODATA OF STUDENT</b>	137
	<b>LIST OF PUBLICATION</b>	138