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TECHNICAL EFFICIENCY ON THE OPERATOR INDUSTRY OF TELECOMMUNICATION IN INDONESIA

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ABSTRACT

Introduction. The important role of telecommunication industry in providing the information and communication system service quickly in Indonesia needs the characteristics analysis of efficiency and concentration market in the telecommunication industry as a material policy implication. The company which has optimal efficiency level depicts the good company; hence, the importance of industry can be efficient in opposing the competitive market.

Aims. To analyze the relationship between technical efficiency and market concentration in the telecommunication company in Indonesia by testing the Quiet-Life hypothesis and Efficient-Structure hypothesis.

Method. There are three stages of measurement namely technically efficiency measurement used Data Envelopment Analysis method, market share measurement used ratio Concentration, and testing the relationship between Technically Efficiency and Market Share by using Granger Causality Test.

Result. The result and Granger Causality test between Technically Efficiency and Market Share is the market concentration has one way relationship since 2006-2016.

Conclusion. Telecommunication industry is a Quit-Life hypothesis. Efficiency characteristics analysis and industrial market can be used by the Government as a material policy implication to assess the business competition and the development of telecommunication industry in Indonesia.

INTRODUCTION

Telecommunication industry becomes the most dynamic industry in this globalization era. The economy activity which is getting faster and be globally makes the need of communication and information is the primary thing. Fast mobility as well as the highly communication need makes telephone is being popular to be chosen as the communication tool alternative that is easier to carry. Hand phone can be used to Short Message Service (SMS), Multimedia Messaging Service (MMS), and internet as another advantage of it (1). Since 2013, the use of telephone and SMS decreased. However, on the other side, the use of internet increased. Internet is not only can be accessed by wire telephone or wireless telephone, but also use hand phone. That is why many people choosing hand phone than wire telephone.

Traffic voice minute per month per subscriber continues to decline, where in 2013 as many as 116 million to 108 million in 2014. In 2015, it continued to decline to 102 million. SMS traffic per month per subscriber has decreased from 200 million in 2013 to 160 million in 2014. Then it continued to decline to 138 million in 2015 (2). The large number of cell phone users has an impact on the level of tale density in Indonesia. Tale density is the density of telephone usage of 100 inhabitants. Communication interaction will create a multiplier effect on the efficient and effective level of communication which will drive the rate of business growth and economic growth of a country (3). Currently, there are five cellular network operators in Indonesia, four of which are Global System for Mobile cellular network operators and one of them is Code Division Multiple Access cellular network operators (4). The remaining operator companies include PT. XL Axiata Tbk, PT. Indosat Ooredoo Tbk, PT. Telekomunikasi Indonesia Tbk, PT. Hutchison 3 Indonesia, and PT. Smartfren Telecom Tbk.

Many cellular operators cannot survive in the cellular telecommunications industry market because of the competitive market. Many telecommunications companies choose to merge with other cellular operators to stay in the market. Merger and takeover of operators has been a strategy in the world of telecommunications operators for years (5). The number of cellular operators became small in 2015, with the only eight cellular operators and there was only one CDMA operator and four GSM operators in 2016 (6). The development of the cellular telecommunications industry is very rapidly. Telecommunications technology trends are increasingly heading towards wireless technology. The increase of cellular telephone users' number and the internet access users' number in Indonesia is inseparable from the contribution of the cellular telecommunications industry in Indonesia. This directly triggered the development of 1G, 2G, 3G and 4G technology. Some operators have even started using generation 4.5G, even 5G in providing internet networks in 2016 (7).

Before the stipulation of deregulation about the liberalization of the telecommunications industry in Indonesia, the market structure of the cellular telecommunications industry was a natural monopoly but now competition in the market is increasingly competitive with new players entering the market. A competitive market makes every company strive to maintain its sustainability,

one of which is becoming more efficient. Companies with optimal levels of efficiency reflect good companies; therefore, the importance of an industry can be efficient in competitive market competition. Reputable company will gain more earning quality than non-reputable company (14). So, it is essential to maintain level of efficiency to become reputable company.

The level of technical efficiency and market concentration are interconnected and affect each other. This study analyzed the Indonesian cellular telecommunications industry whether the industry has indicated the Efficient-Structure hypothesis (8) or indicated the Quiet-Life hypothesis (9) in a condition where the number of market participants is not large. Variables used in the calculation of technical efficiency include: fixed-line services revenue and non-fixed-line services revenue as an output variable. However, the variable fixed assets, the amount of labor, and capital expenditure as input variables. It also analyzed whether market concentration in the cellular telecommunications industry influences the level of technical efficiency or just the opposite that the level of technical efficiency affects market concentration in the cellular telecommunications industry in Indonesia.

According to the introduction before, this study aimed to know how the technical efficiency, industry market concentration, and relationship between technical efficiency and market concentration of cellular telecommunication market in Indonesia. Hypothesis of this study are; the first is there is one way relationship from technical efficiency to market concentration in the cellular telecommunication market in Indonesia includes Quiet-Life Hypothesis. This implication is a consideration for the stakeholders to assess the competition and the development of cellular telecommunication industry in Indonesia.

METHOD
This study used a quantitative approach by using Data Envelopment Analysis (DEA) method which used two main variables in the calculation of technical efficiency such as input variable and output variable. Output variable in this study used two variables such as fixed-line services income and non-fixed-line services income. However, variable input that was used is three variables namely total fixed assets, total labor, and capital expenditure (10). All data needed was processed in software DEAP 2.1., then.

Market share measurement uses the Concentration Ratio (CR4) method to analyze the level of concentration in the cellular telecommunications industry market in Indonesia. The calculation formula of CR4 as follows:

$$CR4 = \frac{MS1 + MS2 + MS3 + MS4}{MSi} \; x100\%$$

Means:
MS1   : Market share of the first highest industry
MS2   : Market share of the second highest industry
MS3   : Market share of the third highest industry
MS4   : Market share of the fourth highest industry
Msi   : The number of all market share

There are four companies that are measured using CR4 such as PT. XL Axiata Tbk, PT. Indosat Ooredoo Tbk, PT. Telekomunikasi Seluler Indonesia Tbk, and PT. Smartfren Telecom Tbk that can exist until 2016. The Granger causality test will be used to examine the direct relationship between market concentration and technical efficiency in the cellular telecommunications industry. The type of data used in this study was secondary data from four cellular telecommunications companies in Indonesia. The data source used in this study was obtained from the Central Statistics Agency, an annual report from four cellular telecommunications operator companies namely PT. XL Axiata Tbk, PT. Indosat Ooredoo Tbk, PT. Telekomunikasi Indonesia Tbk, and PT. Smartfren Telecom Tbk.

This study used three stages of measurement to get the aims of study. The first stage measures the technical efficiency in each company of telecommunication industry in Indonesia. The second stage calculates the market concentration in the cellular telecommunication industry, and the third stage look at both relationships to determine whether the cellular telecommunication industry in Indonesia includes Efficient-Structure hypothesis or Quiet-Life hypothesis.

RESULT

Technical Efficiency Level

The result of input and output variables combination was got from average technical efficiency scores where the result of data analyzed used DEAP 2.1. program.

Table 1 Technical Efficiency Numbers of Cellular Telecommunication Industry in Indonesia 2006-2016

YEAR	*Average Technical Efficiency Scores* (TE)
2006	0,935
2007	0,907
2008	0,888
2009	0,888
2010	0,979
2011	1
2012	0,947
2013	1
2014	1
2015	1
2016	1

The results of the efficiency level measurement of cellular telecommunications industry, Indonesia in 2006 have an inefficient state, where the level of input used by one company, XL Axiata, was still not optimal. The industry was still in an inefficient state with a figure of 0.907 in 2007. The efficiency scores in the cellular telecommunications industry were the same, amounting to 0.888 which was the lowest average technical efficiency in 2008 and 2009. In 2010

the efficiency score was 0.979. 2012 was the last year for the cellular telecommunications industry to be inefficient. In 2011, 2013, 2014, 2015 and 2016, the condition of the four companies became efficient, which had an impact on efficiency in the cellular telecommunications industry which gave rise to a score of 1 as shown in **Table 2.**

Table 2 Technical Efficiency Numbers of Cellular Telecommunication Industry in Indonesia 2006-2016

YEAR	TECHNICAL EFFICIENCY NUMBERS			
	PT.XL AXIATA	PT. INDOSAT OOREDOO	PT. TELKOMSEL INDONESIA	PT. SMARTFREN TELECOM
2006	0,740	1	1	1
2007	0,628	1	1	1
2008	0,552	1	1	1
2009	0,552	1	1	1
2010	0,914	1	1	1
2011	1	1	1	1
2012	0,787	1	1	1
2013	1	1	1	1
2014	1	1	1	1
2015	1	1	1	1
2016	1	1	1	1

Among the four companies, only PT. XL Axiata acted inefficiently in 2006-2010 and in 2012, whereas, in 2011, 2013, 2014, 2015 and 2016 PT. XL Axiata was in an efficient condition. The inefficiency year period experienced by PT. XL Axiata was caused by expenses incurred by XL companies which were far more than the income. In 2006, 2007, 2008, 2009, 2010 and 2012 XL Company developed telecommunications infrastructure by adding fixed assets but paid by adding debt, so the impact on total revenue was not proportional to the costs incurred. In the efficient period of 2011, 2013, 2014, 2015, 2016 XL companies began a strategy of lowering prices by lowering SMS and telephone tariffs to reach the target in increasing the number of customers where the decision began in 2010. However, XL's decision to reduce prices Its service services were responded to by its competitors, Indosat and Telkomsel, where there was a tariff war between operators which causes the revenue of each company to decrease. The company did not care about the quality of the service but it was concentrated on controlling the market. Due to the increasingly unfair competition, the government, through the Ministry of Communication and Information Technology, warned all operators to carry out reasonable promotions and not to harm consumers and companies. In 2014 the XL Company decided to take efficiency steps by acquiring Axis Telecom.

Market Concentration Level

Market share in the cellular telecommunication industry in Indonesia was calculated based on the number of users in each cellular telecommunication

industry from 2006 till 2016. Result of CR4 can be categorized as some criteria namely low concentration for less than 50% and high concentration for more than 75%.

Table 3. Market Concentration Numbers of Cellular Telecommunication Industry in Indonesia 2006-2016 based on CR4

YEAR	MARKET CONCENTRATION (CR4)	YEAR	MARKET CONCENTRATION (CR4)
2006	0,974	2011	0,848
2007	0,959	2012	0,8534
2008	0,921	2013	0,8391
2009	0,909	2014	0,8449
2010	0,864	2015	0,811
		2016	0,838

The result of market concentration measurement by using CR4 showed that cellular telecommunication industry in Indonesia has an average market concentration of more than 75%. The result of CR4 showed the market industry from cellular telecommunication industry in Indonesia as same as the characteristics of oligopoly market such as 1) there are only a few companies on the market, 2) goods are homogeneous, and 3) difficult entry barriers.

Analysis of Relationship between Technical Efficiency and Market Concentration

In this study, Technically Efficiency and Market Share variables were stationary at the first difference level which includes testing the trend and intercept with Lag 2 and $\alpha = 10\%$, the results are shown in Table 4. The results show that the probability of TE variable is 0.0840 and the probability of the MS variable is 0.0143. After the data stationary test was done by using the Augmented Dickey Fuller test (ADF test); then, the two variables that have been stationary can be used in further testing.

Table 4. The ADF Variable Result of Technically Efficiency and Market Share

TE Variable	t-statistic	Probability
ADF Test Statistic	-3.903198	0.0840
Test Critical Values : 1% level	-6.292057	
5% *level*	-4.450425	
10% *level*	-3.701534	
MS Variable	**t-statistic**	**Probability**
ADF Test Statistic	-5.204415	0.0143
Test Critical Values : 1% level	-5.521860	
5% *level*	-4.107833	
10% *level*	-3.515047	

After the variables have been stationary, the next step is determining the optimal lag length which will be used in the Granger causality test and the VAR test. Then, in the final stage Granger causality test is performed, the results of which will explain the relationship between TE and MS proving that the cellular telecommunications industry in Indonesia is included in the quiet-life hypothesis or the efficient-structure hypothesis. Based on the results of the Granger causality test, it can be used in assessing the results of the hypothesis as follows:

1. Zero Hypotheses (H0): Market Share did not affect Technically Efficiency
2. Alternative Hypothesis (H1): Market Share affects Technically Efficiency
If the probability value in the granger causality test was less than $\alpha = 10\%$ or 0.1 then H0 can be rejected. The result showed a probability of 0.0561, H0 is rejected.

1. Hypothesis No (H0): Technically Efficiency does not affect Market Share
2. Alternative Hypothesis: Technically Efficiency affects Market Share

The results in the granger causality test showed a probability number of 0.3411, meaning that H0 cannot be rejected. Thus, Technically Efficiency did not affect Market Share during the study period, namely 2006 to 2016. This showed that the cellular telecommunications industry was included in the quiet-life hypothesis where there was a relationship between market concentration and technical efficiency of the cellular telecommunications industry in Indonesia.

DISCUSSION
The efficiency value that is produced by the cellular telecommunications industry every year is influenced by the use of fixed assets, determining the number of workers, and the amount of costs incurred for capital, capital expenditure. The value of technical efficiency is influenced by internal and external factors. Internal factors in the cellular telecommunications industry require the latest technology that is developing all the time. Technology development is not cheap and not all companies would like to expand the network. The second internal factor is market power tend to apply high prices. The external factors that influence the value of efficiency are the state of the market, the economy, politics, and government policy. Relatively, in 2006 and 2007 the cellular telecommunications industry was in an inefficient state. In addition to determining the workforce input and capital expenditure input, the other cause is the practice of the interconnection SMS cartel that was successfully dismantled by the Business Competition Supervisory Commission. In 2007, companies that undertook cartel namely Excelcomindo (XL Axiata), Telkom Indonesia, Telkomsel Indonesia, Bakrie Telecom, and Mobile-8 Telecom (Smartfren) were penalized by a Business Competition Supervisory Commission of around 4 to 25 billion rupiah per company. This has an impact on costs borne by cellular telecommunications companies in Indonesia.

In 2008 and 2009, the lowest efficiency decrease in the cellular telecommunications industry was only 88%. In 2008 and 2009 after the cartel case, competition in the cellular telecommunications industry became very

tight. This has an impact on the level of tale density that continues to rise continuously at 13.13% and 14.82%, whereas tale density in 2007 was only 8.57%. Due to intense competition, many cellular operator companies are competing to improve their services by developing technology. This causes a decrease in efficiency, where the costs incurred, capital expenditure, becomes too excessive. The efficiency rates in the cellular telecommunications industry were close to being efficient at 97% and 94% in 2006 and 2007. Efficiency that increased from the previous year, namely in 2009 was the impact of after expanding in technology development, in 2010 and 2012 the cellular telecommunications industry began to apply efficiently.

The telecommunications industry was in an efficient condition with an efficiency score of 1 in 2011, 2013, 2014, 2015 and 2016. This is in addition to the impact of the behavior of companies in the market for the better, on the other hand the government began to supervise and implement determining SMS, telephone and internet tariffs to avoid cartel practices and tariff wars between cellular operators.

The cellular telecommunications industry market in Indonesia is highly concentrated in several companies. In the period of the research years, 2006 to 2016 showed that the market was concentrated by the three largest companies namely PT. Telekomunikasi Seluler Indonesia, PT. Indosat Ooredoo, and PT. XL Axiata. The three companies controlled an average market share of 86% of the total market share of the cellular telecommunications industry in Indonesia. Based on the calculation of the market concentration with CR4, the cellular telecommunications industry is included in the high concentration category with a CR4 figure 75%, which is precisely the average CR4 yield of 96%.

The Structure-Conduct-Performance paradigm put forward by Joe S. Bain states that there are several companies in the market and the types of products sold are the same, but have differences in terms of packaging and presentation. This paradigm posits a specific causal relationship between market structure, behavior and performance (12). Based on this paradigm, the cellular telecommunications industry in Indonesia is oligopoly. The tariff pattern in the telecommunications industry in Indonesia is almost the same in every company. The small number of telecommunications industry companies causes high market concentration. This is used by companies to set prices above the equilibrium price which is actually detrimental to consumers. The existence of cross ownership makes it easier for telecommunications operators to follow prices set by the more dominant operators.

The consideration of the expensive investment cost for technology development causes the telecommunications infrastructure develop less than the potential and needs of the community. This causes the government through the Ministry of Communication and Information has to limit the number of companies of cellular telecommunications industry in order to improve the quality of services for cellular operator customers by instructing all companies in the cellular telecommunications industry to merge. This has a direct impact on the number of companies that merged or went out in the market until only five telecommunications companies in 2016 remained. The tendency of decreasing

cellular tariffs as a result of tariff war between operators indicates that competition between cellular operators is getting tougher. The concentration of the telecommunications industry market is still high because the liberalization carried out since 2002 was apparently unable to change the market structure drastically. Another impact of the liberalization of the telecommunications industry is that more and more telecommunications operators are offered with better quality at more affordable prices. The high market concentration makes it easy for companies to use their market power to produce higher profits. Companies which create good profits will express great prospect and expected to provide maximum return to them (15).

The statement is in accordance with the results of this study which states that the cellular telecommunications industry is included in the Quiet-Life hypothesis, which is a situation where market concentration affects technical efficiency. The cellular telecommunications industry tends to behave in terms of efficiency by relying on market forces. This is because Indonesia has a high concentration of industrial markets and has a negative impact on technical efficiency (13).

CONCLUSION

VAR analysis and granger causality test examined that market concentration of cellular telecommunication industry in Indonesia influenced the technical efficiency during 10 years (from 2006 to 2016). This showed that cellular telecommunication industry in Indonesia included in quiet-life hypothesis, where the company with market share tend to use its power to be inefficient.

REFERENCES

Gómez-Barroso JL, Feijóo C, Quiles-Casas M, Bohlin E. The evolution of the telecommunications policy agenda: Forty years of articles in Telecommunications Policy. Telecomm Policy. 2017;41(10):853–77.

Agustin WR, Haryadi S. Sustainability of Indonesian telecommunication operators in the era of net neutrality. In: 2017 3rd International Conference on Wireless and Telematics (ICWT). IEEE; 2017. p. 200–5.

Gillespie AE, Goddard JB. Advanced telecommunications and regional economic development. In: Managing the city. Routledge; 2017. p. 84–109.

Sumirat IR, Mohaidin Z. The Role of User Experience Towards Customer Loyalty in Indonesian Cellular Operator with the Mediating Role of User Satisfaction and Customer-Based Brand Equity. Adv Sci Lett. 2017;23(1):177–80.

Lebraud J-C, Karlströmer P. The Future of M&A in telecom. Telecom, Media & High Tech Extranet [Internet]. 2011; Available from: https://www.mckinsey.com/~/media/mckinsey/dotcom/client_service/Telecoms/PDFs/M_A.ashx

Maharani DA, Wulandari HW. Merger, Consolidation and Takeover in the Telecommunications Industry in Indonesia. J Post and Inform Research. 2017;5(1):19–36.

Sastrawidjaja L, Suryanegara M. Regulation Challenges of 5G Spectrum Deployment at 3.5 GHz: The Framework for Indonesia. In: 2018 Electrical Power, Electronics, Communications, Controls and

Informatics Seminar (EECCIS). IEEE; 2019. p. 213–7.

Berger AN. The profit-structure relationship in banking--tests of market-power and efficient-structure hypotheses. J Money, Credit Bank. 1995;27(2):404–31.

Berger AN, Hannan TH. The efficiency cost of market power in the banking industry: A test of the "quiet life" and related hypotheses. Rev Econ Stat. 1998;80(3):454–65.

Hu J-L, Chu W-K. Efficiency and productivity of major Asia-Pacific telecom firms. Chang Gung J Humanit Soc Sci. 2008;1(2):223–45.

Diskaya F, Emir S, Orhan N. Measuring the technical efficiency of telecommunication sector within global crisis: comparison of G8 countries and Turkey. Procedia-Social Behav Sci. 2011;24:206–18.

Anh TT, Binh DTT, Duong NV. The structure-conduct-performance paradigm revisited: an empirical analysis for Vietnamese firms. In: Proceedings of the VEAM: Vietnam Economists Annual Meeting, Ho Chi Minh City, Vietnam. 2014.

Setiawan M, Emvalomatis G, Oude Lansink A. Price rigidity and industrial concentration: evidence from the Indonesian food and beverages industry. Asian Econ J. 2015;29(1):61–72.

Iman Harymawan, Dewi Nurillah. Do Reputable Copanies Produce a High Quality of Statements? Asian Journal of Accounting Research. 2017. 2(2).1-7

Nurani Fatma, Widi Hidayat. Earnings, Persistence, Earnings Power, and Equity Valuation in Consumer Good Firms. Asian Journal of Accounting Research. 2019. 5(1). 3-13