

# A Simulation Model To Analyze The Growth Of Cellular Market

Erma Suryani<sup>1</sup>; Dinar Restyandani<sup>1</sup>; Lily Puspa Dewi<sup>1,2</sup>; Rully Agus Hendrawan<sup>1</sup>

<sup>1</sup>Information System, Information Technology Faculty, Institut Teknologi Sepuluh Nopember (ITS), Jl. Raya ITS, Surabaya  
erma.suryani@gmail.com; eraha\_id@yahoo.com

<sup>2</sup>Department of Informatics, Petra Christian University, Jl. Siwalankerto 121-131, Surabaya 60236  
lilypd00@yahoo.com

## ABSTRACT

*Today, cellular industries are experiencing customer growth in recent years, so that the company continues to seek in increasing the number of customers to win the competition in mobile industry. For developing countries such as Indonesia, mobile services become a very significant part of the overall technology infrastructure. Increasing the number of mobile operators in Indonesia indicates the competition between operators become more stringent.*

*The phenomenon of competition seen in the Indonesian mobile market is a price war between mobile operators. Communities will move to competitors when they feel there are a cost and a more favorable tariff schemes. Mechanisms of competition in this market involve complex feedback effects between individual service providers and with their operating environment. In this research, we utilized system dynamics simulation model as a method to forecast the future growth of mobile customers. Based on the valid model, then we developed some scenarios to increase the number of customers as the inputs for decision maker in making effective decisions.*

**Keywords:** Customer growth, Model, Forecast, System dynamics, Scenario analysis

## 1. Introduction

In line with the development of the mobile telecommunication, the competition in mobile industry is becoming increasingly fierce. It is therefore in April 2008, the government imposed a tariff reduction which increased the prepaid cards usage to 90% of total mobile phone users. The prepaid card has a large market share due to its flexibility, high mobility, affordable price, promotion, and discounts.

As the world market leader in telecommunications, particularly prepaid cards, PT.Telekomunikasi Cellular (Telkomsel) still maintain its market share as the first mobile operator. According to data gathered from the *Direktorat Jenderal POS dan Informasi*, the growth of customer in Telkomsel prepaid card continues to increase, due to the development of the market share for mobile phones, the Telkomsel's strategy, network development, and the easiness become the prepaid customer and end the subscription process.

To increase the number of customers, companies need to build a system that can maintain sales and customer loyalty. Therefore in this study, we used system dynamics to simulate the system behavior of customers growth in the present and in the future so that the company can increase its market share. When the growth of cellular market is difficult to forecast, system dynamics is the most effective approach because of several reasons [5]:

- 1) Forecasts coming from calibrated system dynamics models are likely to be better and more informative than those from other approaches. The models are calibrated to historical data, and used to produce a forecast of the future growth. With the detailed and calibrated models, we will be able to accurately predict the growth of cellular market based on scenario analysis. It provides a clear information on the future growth of cellular market by considering the quality of service and fare. Having a detailed, calibrated model that produces accurate forecasts results in better decisions and significant savings to the firm.
- 2) System dynamics models can provide more reliable forecasts of short- to mid-term trends than statistical models, and therefore lead to better decisions.
- 3) System dynamics models provide a means to determine key sensitivities, and therefore more robust sensitivities and scenarios.

This paper may provide insights to researcher(s) or academician in developing system dynamics model to analyze the growth of cellular market in the future. The results of this research will assist the decision maker (business practitioners) in deciding policies to increase the market share.

## **2. Literature Review**

### **2.1. Cellular Communication**

Cellular communication system is one type of mobile communications, which is a communication between two terminals with one or both mobile terminals. The system can offers a high quality and not inferior when compared to fixed telephone (Public Switched Telephone Network or PSTN) better known as a home phone. To increase the capacity, the coverage area bounded by the area division into cells, thus it would allow the radio channel can be re-used by the base station at a remote distance. When cellular users move from one cell to another, the call will be kept uninterrupted by using one technique switching, namely handoff.

### **2.2 Market Share**

Market share is the ratio of the company's sales to total sales (total) within an industry [4]. Market share levels are expressed in percentage points. Market share is an indicator of the company in terms of:

- 1) The company's ability to dominate the market. The company's goal is to maintain or improve the level of market share
- 2) Company's position in the market competition. Based on the market share level, the position of each company can do the ranking in competitive markets. Company's positions can be distinguished sequentially as: Market Leader, Challenger, Follower, and Market Nicher.

### **2.3 Promotion**

Promotion is the advancement of a product, idea, or point of view through publicity and/or advertising [6]. There are three basic types of promotional strategies: 1) a push strategy, 2) a pull strategy, 3) a combination of the two. In general, a push strategy is sales oriented, a pull strategy is marketing-oriented and a push-pull strategy is a combination of the two [7]. In this case, PT. Telkomsel uses a pull strategy to attract customers through a vigorous campaign in the market. Promotional activities conducted primarily through advertising, both in print and electronic media [1].

### **2.4 Customer Growth**

Customer is an individual or company that buys goods or services produced in the economy. Meanwhile, customer growth is an increase in the number of an individual or a company that used to buy goods or services. We may forecast the growth, based on search engine marketing, affiliate marketing, site traffic, conversion rates and repeat purchase rates. The growth can be achieved through several strategy such as 1) increase the price of the product or service, 2) sell other products to existing customers 3) sell new products to existing customers, 4) sell existing products to new customers, 5) Sell new products to new customers [8].

## **3. Base Model Development**

Model development was conducted to determine patterns of behavior and relationships between variables in a system. In developing system dynamics model, causal loop diagram is used to model the causal relationship among significant variables to customer growth that can be seen in Figure 1. This diagram shows that the customer growth depend on quality of service, network quality, number of distributors, number of promotions, market share, and the number of existing customers.

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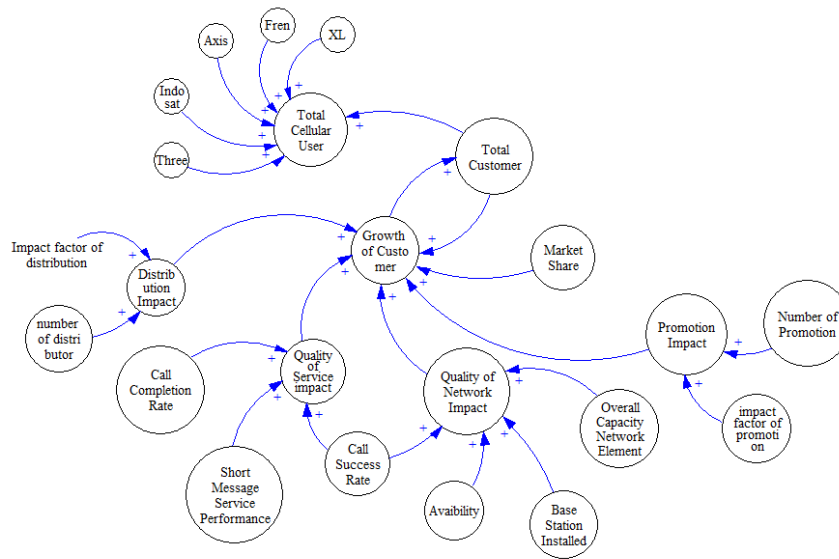


Figure 1 Causal Loop Diagram

Furthermore, the causal loop diagram is converted to a stock and flow diagram which reflect the structure of the model and is ready to be simulated. Stock and Flow diagram can be seen in Figure 2

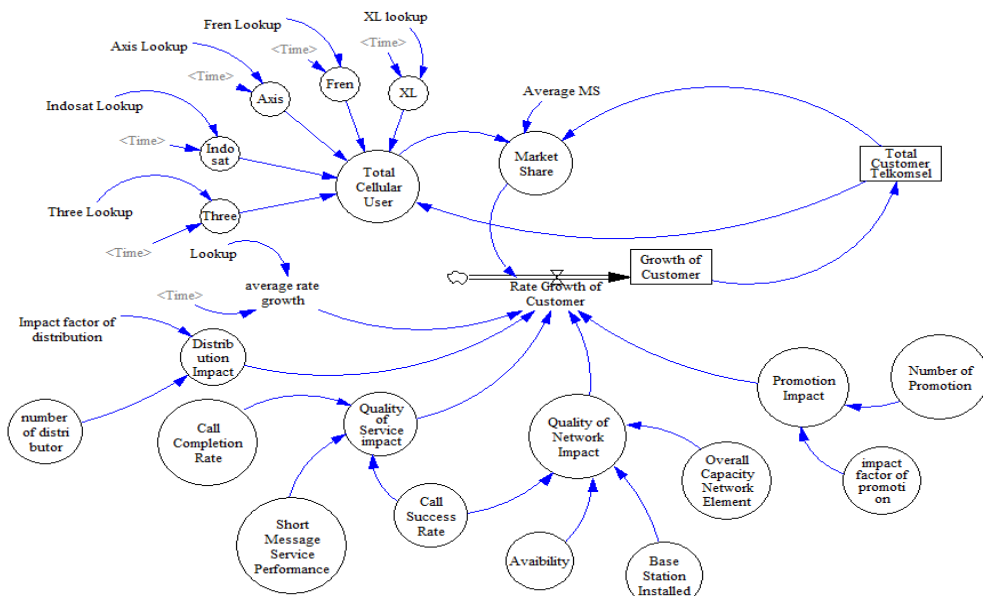


Figure 2 Stock and Flow Diagram

#### 4. Model Validation

Model validation is conducted to check the model accuracy. According to Barlas [3] there are two ways of testing: Means Comparison and Variations Comparison Amplitude. Here are the equations and results of the validation of the total customer.

Means Comparison

$$E1 = \frac{|\bar{S} - \bar{A}|}{\bar{A}}$$

Where :  $\bar{S}$  = the average rate of the simulation results  
 $\bar{A}$  = the average rate of the data

$$= \frac{|49.867.814 - 49.873.636|}{49.061.636}$$

$$= 0.00012$$

$$E1 = 0.012 \%$$

A model will be valid if the error rate is smaller than 5%.

Amplitude Variations Comparison

$$E2 = \frac{|Ss - Sa|}{Sa}$$

Where :  $S_s$  = Standard Deviation of the Simulation Results  
 $S_a$  = Standard Deviation of the Data

$$= \frac{|54.474.537 - 53.655.112|}{54.474.537}$$

$$= 0.015272$$

$$E2 = 1.52 \%$$

A model will be valid if the error variance is smaller than  $\leq 30\%$ .

#### 5. Scenario Development

In this research, the structural scenarios are done with altering the quality of service and fare. Furthermore, both of these scenarios can be explained as follows:

##### 5.1. Structural Scenario with Variable in Service Quality

Quality of service is the most influential variable. Thus, in this scenario, the service quality variables are used to modify the model structure. According to Arifin [1], in a journal titled "Performance Analysis of Network Operator 3G (WCDMA-UMTS) Using Drivetest Method" mentions that there are some parameters that are used as a general references to measure the network performance such as Call Setup Success Rate (CSSR), call Setup Time (CST), call Completion Success Rate (CCSR), Mean Opinion Score (MOS), and Reception Level (RxL).

##### 5.2. Structural Scenario with Variable in Tariff

Scenario structure is also done by adding variables to Effect Tariff to Improve Customer. Tariff is a service value that is determined by the amount of money (in this case the reduction of credit) on the consideration that the value will provide services to users. Based on the survey results, the Telkomsel cheap rates gives effect 40.9% to 76.7% of the Sim Card purchasing decisions.

The results of these two scenarios affect customer growth and total overall customer as shown in Figure 3 and Figure 4. The structural scenario with improved service and reduced tariff show that subscriber growth will increase by an average growth of 4% per year and total customer in 2020 will reach 7,699,740,000 customers.

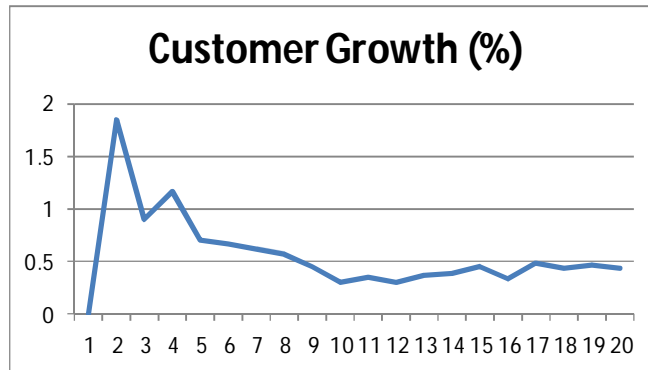


Figure 3. Customer Growth.

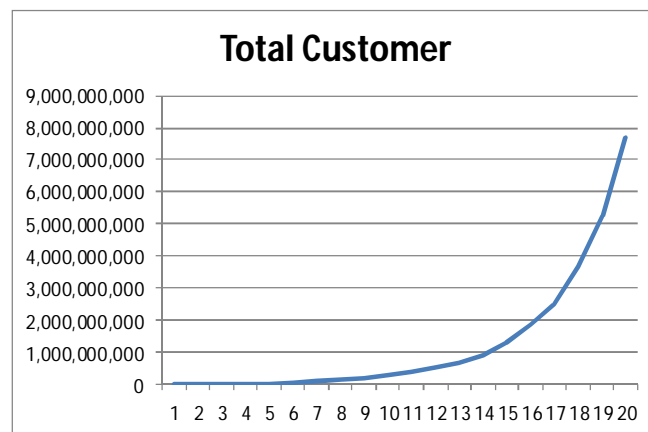


Figure 4. Total Customer.

## 6. Conclusion

Based on the base and scenario models, we can conclude that

a. The significant factors for the prepaid card customers growth of PT. Cellular telecommunications is as follows:

- Competitors prepaid card sales (iM3, XL, Three, Axis, dan Fren).
- Telkomsel prepaid card sales.
- The effect of Telkomsel tariff.
- The number of Telkomsel distributor.
- The number of Telkomsel promotion.
- Network quality.
- Service quality determined by:
  - Call Setup Success Rate is the rate of success call.
  - Call Setup Time is the time required to make call to the destination number.
  - Call Completion Success Rate is percentage rate of successful call from connection until one of the parties terminates.
  - Mean Opinion Score which describes the level of voice clarity.
  - Reception Level (RxL) adalah is a signal power level received in 2G mobile, while in the 3G mobile network uses the term Received Signal Code Power (RSCP).
  - Ec/No is data or voice quality in 3G/UMTS network.

b. This system dynamic model can help the companies to analyze the factors that affect customer growth based on several contributing factors and also to predict future customer growth.

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- c. The structural scenario with improved service and reduced tariff show that subscriber growth will increase by an average growth of 4% per year and total customer in 2020 will reach 7,699,740,000 customer.

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