

# Portfolio Simulation in GSM Cellular Telecommunication Industry for Company's Decision and Policies Making

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**Abstract**—The rising growth of the GSM cellular phone industry has tightening competition level between providers in making strategies enhancing the market shares in Indonesia. Tsel, as one of those companies, has to determine the proper strategy to sustain as well as improve the market share without reducing its operational income level. Portfolio simulation model is designed with a dynamic system approach. The result of this research is a recommendation to the company by optimizing its technological policies, services, and promotions. The tariff policies and the signal quality should not be the main focus because this company has had a large number of customers and a good infrastructural condition.

**Keywords**—Telecommunication industry, simulation, dynamic system, portfolio, quality services

## I. INTRODUCTION

TELECOMMUNICATION industry is the most developing sector in the business industry. By year of 2008, Indonesia has reached to 142.01 million cellular phone customers with growing percentage of 57.1%. Telkomsel, is the biggest market shares of GSM cellular telecommunication provider in Indonesia. The market share by the end year 2002 has decreased to 45.98% by the end of 2008. The telecommunication regulation which published in 1999 has serious threat to Telkomsel which reminds every competitor had to set up an attractive portfolios.

System is defined as a bunch of component that operating altogether in order to reach a certain objective [3]; a group of entities that acting and interacting altogether to reach a logical final objective [4].

Model is a representation of important parts in a system that reflects the knowledge in the system; defined as mathematical or physical system that fulfills a certain conditions which the behavior itself is used to understand a physical, social, or biological system, analogically. Using model can abstract few real systems to gain prediction and formulate system's controlling strategy [5].

Simulation is a model handling to reflect the real system's behavior. This activity comprises various activities; flow diagram and computer logic, computer coding, and the use of those coding to have the desired output. The modeling and the

simulation are two processes that related so strong to each other. Dynamic system is a method to enhance the learning and understanding in a complex system, a method to form a management flight simulator, a computer simulation model, to help us in understanding the dynamic complexities and the sources of the policies resistances in order to design a more effective policy. The dynamic or the system behavior is defined by its structures and its interaction between the components [6].

Basically, there are four basic concepts in dynamic systems that support the structures and the complex system behaviors; closed scoop area, feedback loop as the basic component of a system, *level* and *rate*, and the desired condition, the real condition, and the gap [7].

The main objective for a company to make a policy is to win the competition. Portfolio is used to show a package of products, projects, service, or brand offered, to be sold by a company. Those complex and difficult situation is hard to be analyzed directly. Therefore a model designing is necessary to map each factor and to see the impact directly and indirectly to the market share owning. From the model itself, we can get an understanding of how the impact of a change of a policy variable implemented in the company to the system characteristics itself [1].

The portfolio simulation model can be used quantitatively and effectively in allocating the investment and the other programs in the company, which is in this case, a telecommunication service provider. The portfolio simulation model is formulated by developing the dynamic system approach [2]. The analytical result and the simulation of this portfolio will provide the best policies that suited the company, or in this case, Telkomsel, to defend and enhance the market share considering the operation income gained.

The aim of this research is to provide the policies recommendation that suited the condition of GSM cellular telecommunication industry to enhance the market share aligned with the operational income. The data used in this research is gathered from the quarterly reports of the GSM cellular telecommunication provider which are showed from the official sites of each company from year 2003 to year 2008. The competition focused in this research is the competition in GSM industry.

## II. RESEARCH METHOD

The first stage of this research is problem development. In this stage, the situation, the condition, and the problem is defined. The scoop area or the problem boundaries of this research is identified. model is made, or what is usually

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known as causal loop diagram. The steps in designing the model for the GSM cellular telecommunication industries are as follow: a.Data gathering from the journals, quarterly reports of each company, and a questionnaire to acknowledge the rating that affecting the customers in choosing the operator. b.Main or key variables identification c.Drawing the behavior map for the main variables. d.Making the causal loop diagram to illustrate the relations between the variables. Figure 1 shows the causal loop of this research. e.Studying the dynamic behavior found in a certain range of time with the causal loop diagram that has been created earlier. The external factors can be seen from the Tsel company, which are its customers, the customers of the competitors, the performance of the competitors, and their portfolios. The external factor that directly affecting the internal factor of the company, is the subsystem of the cellular phone customers. While the other external factors will affect the internal factor through subsystem customer's consideration in choosing the operator. The internal factor will affect each other in determining the portfolio, and the success parameter of the system here is the value of subsystem company's performance.

The next stage is the dynamic model designing. The causal loop model that has been designed is converted into an input for the dynamic model design. The dynamic model design is started with the system diagram being designed, then each variables is defined, until a dynamic model is reached, verified, and validated, and finally a sensitivity test is done. The software used for this model is PowerSim. The next stage is the scenario model designing. In this stage, few policies and

strategies are applied and tested. The policy is related to the change of internal variable such as renting, quality, price or the other. The strategy is a combination of a set of policies and controllable variables changes, which are the internal changes. When a strategy is tested in some external condition, then we can call it as scenario modeling. The steps are as follow:

1. Determining the scoop areas generally, the time frame, and the boundaries in external environment for the scenario. Preparing few conditions that might happen in the future of the scenarios.
2. Identifying the key variables of the changes, the uncertainties, and the factors that can give significant effects on the decision, policies, and the evaluated or applied strategies. Determining the time range for the external parameter and the graphs.
3. Building extreme scenarios that placing the whole positive results in the best-case scenario and the whole negative results in the worst-case scenario. Checking the extreme scenarios for the internal consistencies. Modifying those scenarios as the learning scenarios.
4. Simulating those scenarios in the model. Redesigning the scenarios if those scenarios are not satisfying enough or have not comprising the total probable conditions that might happen in the future.
5. Performance evaluation of the policies and the strategies with the model for each scenario.

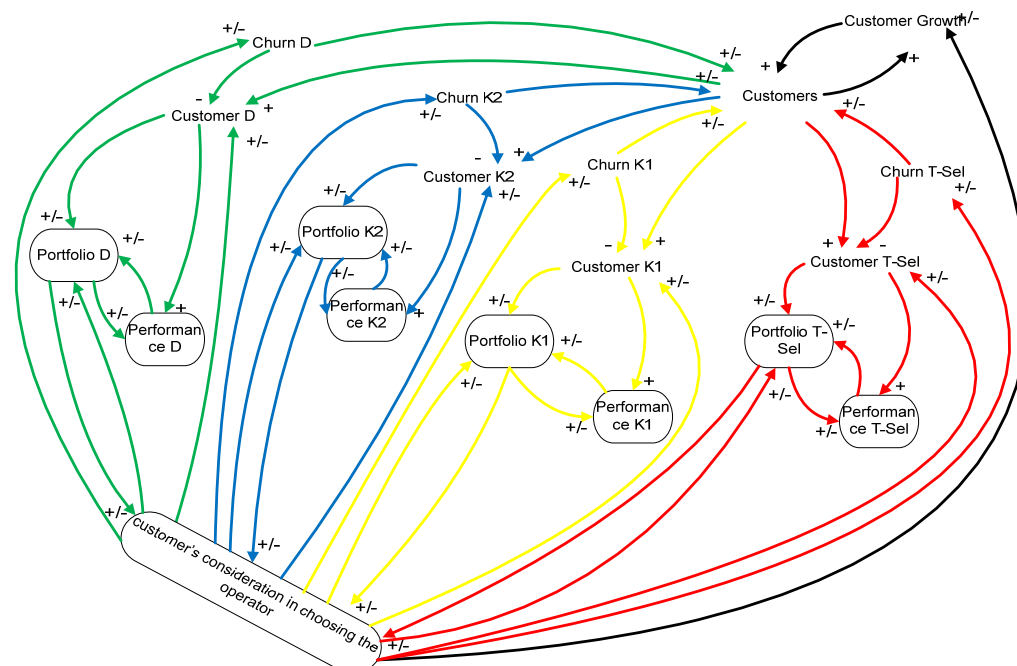


Fig. 1 Causal Loop Diagram Model of the Research

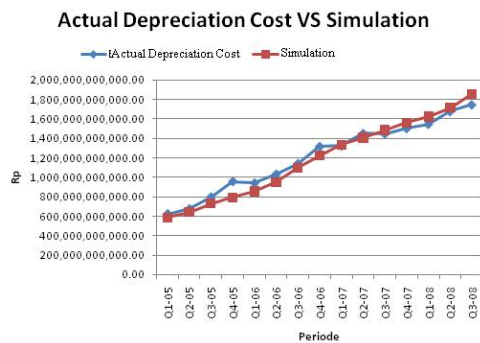


Fig. 2 The Actual Depreciation Cost Versus The Simulated Ones

The performance result from the simulation in period March 2005 to September 2008 has a moving characteristic that is similar with the real ones. From those result, it can be concluded that the model is verified. Or with another word, the counting process for each performance parameter in a model can be proven well.

#### A. Model Validation

Validation is done through few tests such as boundaries sufficiency, structure valuation, dimension consistency, extreme condition, integration error, behavior reproduction, and sensitivity analysis. The result of the validation showing that each model has already enough describing the competency level in GSM cellular telecommunication industry in Indonesia.

#### B. Area Scenario

The time range used to testify the scenario is starting from the beginning of 2009 to the end of the 2011. The time range has been chosen for 3 years because the telecommunication industry is still developing, so the changes in this industry are quite high. The beginning condition of the system is almost following the condition of GSM cellular telecommunication industry. There are 3 large companies that total owning 90% market share of the GSM cellular telecommunication industry in Indonesia.

TABLE I  
THE BEGINNING CONDITION

	T-Sel	Komp1	Komp2	Dummy
Post-paid Customer (subscriber)	3,628,012			
Pre-paid Customer (subscriber)	138,381,988			
Total Customer (subscriber)	142,010,000			
Customer's Company (subscriber)	Post-paid	2,011,240	919,213	417,000
	Pre-paid	63,288,760	35,591,033	25,599,000
	Total	65,300,000	36,510,246	26,016,000
Market Share		45.98%	25.71%	18.32%
BTS (bts)		26,872	14,162	16,729
Employee		4,080	2,281	2,097
Tariff (Rp/min)	Post-paid	884.00	850.00	900.00
	Pre-paid	1,150.00	1,100.00	1,050.00

The whole conditions that exist in this scenario also showed up in Table II.

TABLE II  
THE INDUSTRIAL CONDITION IN THE SCENARIO

Kondisi	Jenis Utama	Keterangan
1	Tariff	competitors focus on tariff with additional value based on their characteristics
2	Quality and Service	happens when the government make the tariff regulation in the midle of July 2009

To show every possibility that might happen, this research is designed with any possible scenario in every strategies applied by Telkomsel. There are 5 types of strategies combined here which are the tariff strategy, quality strategy, technological strategy, service strategy, and promotion strategy. From those 5 combined strategies, such results were obtained:

- 32 scenarios designed in condition 1 which are 32 probabilities from the combination of 5 policies.
- 16 scenarios designed in condition 2 which are 16 probabilities from the combination of 4 policies.

#### C. Simulation Result

The simulation of combining the condition 1 with 32 scenarios of decision making and the condition 2 with 16 scenarios of decision making will result in the best combination as seen from Table 3 and 4.

TABLE III  
THE RESULT OF THE BEST SCENARIO FOR CONDITION 1

Scenario	Strategy					The Increase of Market Share	EBIT Cumulative (Triliun Rupiah)	Average ARPU (Rupiah)
	Tariff	Signal Quality	Technoogy	Service	Promotion			
1-11	Average	Average	High	High	High	3.36%	52.37	79,634.43
1-32	Average	Average	High	Average	High	3.34%	52.37	79,634.30
1-14	Average	High	High	High	High	4.24%	52.04	79,765.74

TABLE IV  
THE RESULT OF THE BEST SCENARIO FOR CONDITION 2

Scenario	Strategy				The Increase of Market Share	EBIT Cumulative (Triliun Rupiah)	Average ARPU (Rupiah)
	Signal Quality	Technology	Service	Promotion			
2-16	Average	High	High	High	6.18%	69.62	89,404.73
2-12	Average	High	Average	High	6.17%	69.61	89,404.31
2-3	High	High	High	High	7.02%	69.34	89,415.89

For condition 1, the most optimal decision is obtained through scenario 1-11. From that scenario, it can be seen that with the optimization of service, technology, and promotion, may increase the income and the market share. The low tariff has less impact with the market share because it has already been followed with the optimization of technology, service, and promotion. While for the condition 2, the optimization of technology, service, and promotion with a medium level of quality improvement will increase the income and the market share. The analysis in condition 1 will be the same in condition 2 because they both resulting in the same optimal decision.

#### D. Policies Analysis

From all the scenarios that had been implemented, the most affecting policies that give significant impact to the increase of market share, income, or EBIT, is the optimization of technology, service, and promotion. The improvement of the signal quality is not the main focus because Tsel has already had a good signal infrastructure from the beginning, so that the other types of optimization are no longer necessary. The signal quality should also be focused but not too much because the basis is already good enough.

The signal quality policy has a large impact on the operating cost because infrastructures are giving large contributions to the operating cost.

To apply the post-paid tariff with comparison 1.3 between the T-Sel's tariff with the minimum post-paid tariff of the competitor and the implementation of the pre-paid tariff is 1.63 between T-Sel's tariff and those of the competitors. To have more focus on technology, the proper T-Sel policy is to optimize the technology every semiannually. That policy could be done by doing innovation in technology. Tsel is expected to be able to release good technology innovations that could trigger the use of telecommunication service provider.

To sustain the technology improvements and the tariff determination so it is still above the competitor's tariff, it should also be followed by the optimization of service and promotion so that an optimal output can be obtained.

### III. CONCLUSION

Based on the model scenario analysis of the dynamic model portfolio simulation in GSM cellular telecommunication industry in Indonesia with the focus on Tsel as the research object, and using PowerSim Studio 2005, as one of the tool that can be applied in the dynamic system method and simulation, such conclusions could be obtained:

- Tsel has its own strength in number of customers and signal quality or coverage until the end of year 2008.
- The improvement and effort to defend the *market share* is not only seen from the tariff policies applied, but also be seen from the optimization in service, technology, and promotion.
- The simulation model portfolio in GSM cellular telecommunication industry designed here can be a consideration in taking the best or optimal decisions and internal policies.

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### REFERENCES

- [1] O. Santos, S. P. (2002). Adding value to performance measurement by using system dynamics and multicriteria analysis.
- [2] Merten, P. P., et al. (2006). System Dynamics Review (Volume 3). John Wiley & Sons, Ltd.
- [3] Forrester, J. W. (1992). System dynamics, System thinking and Soft OR. International Journal of System Dynamics.
- [4] Kelton, W.D., & Law, A.M. (2000). Simulation modelling and analysis. McGraw-Hill. 2000. Singapore.
- [5] Rubinstein, R.Y., & Kroese, D.P., (2007). Simulation and The Monte Carlo Method (2nd ed). John Wiley & Sons, New Jersey.
- [6] Sterman, J.D. (2000). Business dynamic: system thinking and modeling for complex world. The McGraw Hill Companies, Inc, USA.
- [7] Barnes, J. (n.d.). System Dynamics and Its Use in Organization. Learning Organization Journal, no. 0342.511, p. 3