Performance Measurement Model of Environmentally Friendly Service Quality to Customer Using System Dynamics Approach

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Abstract

Periodic evaluation of service quality by the company is a routine activity that aims to improve company performance. Every decision taken by the company's leadership will affect the company's performance and organizational performance in general. For this reason, it is necessary to build a system dynamics model that is able to describe the current conditions that apply in the company and is able to do simulations to see conditions in the future. This study proves that the model built with a standard model for changing targets can simulate environmentally friendly service quality targets to customers with an overview of current achievements and forecasts of future achievements. Future achievements are influenced by the control value of achieving Service Level Agreement, Reopened and Response Time, where the greater the control value, the greater the correction level value so that the gap will be smaller. The correction rates determined in this study were 10%, 20% and 30% of the gap size.

Keywords
Company performance, service quality, environmentally friendly, and system dynamics.

1. Introduction
The increasingly fierce competition makes every company compete in building a strategy so that the company can survive and compete competitively. Every company has an impulse that the goods or services produced are of high quality and highly competitive in the hope of being accepted locally and internationally. To improve environmentally friendly services to customers, a company implemented a customer relationship management system (CRMS) with the system name "support site". Every issue that comes from a customer is recorded in the system, then every month the management evaluates the information (Fransisca, 2007).. The evaluation carried out by management on all data originating from customers is of course used for decision making. In simulating the company's performance which includes the company's business activities, it is a complex system. One approach that can be used to model the dynamics of complex systems is System Dynamics (Cakrawala, 2006).

System Dynamics is one approach that is widely used by companies in America and Europe, both large, small and medium scale companies that are proven to be able to help in company activities. Each company has its own method of how to improve company performance (Green et al. 2007).

In this study the author will build a model with System Dynamic, to answer the questions as follow:
1. What is the company's performance model that can be used to make strategic decisions?
2. What factors affect the company's performance?

2. Literature Review
In the systems thinking paradigm, the physical structure and decision-making structure must be believed to be built by interdependent elements and form a closed loop or feedback loop. The relationship of the interdependent elements is a feedback causal relationship and not a unidirectional causal relationship (Viggo, 2004).

This feedback loop is the main building block of the model. And this concept has been embedded in some of the foundations of social science and systems theory. Furthermore, the elements in the feedback loop can form material or information and can act as stocks or flows. In this flow there can be bias, distortion, lag, amplification, or attenuation. The relationship that occurs between the elements can be linear or non-linear. Based on a causal philosophy, the goal of the System Dynamics methodology is to gain a deep understanding of how a system works (Andreea, 2017).

Problems in a system are not seen as caused by external influences, but are considered to be caused by the internal structure of the system. In general, there are six steps in analyzing a problem with a System Dynamics perspective, namely problem identification and definition, system conceptualization, analysis formulation, analysis simulation and validation, policy analysis and improvement, and analysis implementation. An understanding of the system gives birth to the identification and definition of the problems that occur in the system. The conceptualization of the system is then carried out on the basis of the defined problems, this will lead to a deeper understanding of the system which in turn may lead to a redefinition of the problem until the conceptualization of the system is declared acceptable (Sardjono et al. 2020).

The System Dynamics approach holds a high philosophy about the importance of a researcher creating something new, because in the System Dynamics process there is always a new stock flow diagram. This means that every research made within the System Dynamics framework will create a new one. Behavioral model validation will be very helpful in assessing the suitability of the analysis, the consistency of the analysis, and the utility and effectiveness (Assegaff et al. 2017)

The validation results will then lead to the improvement process and formulate the analysis. As a result, policy analysis is carried out on the analysis that leads to further improvements being implemented and feedback, obtained from the real system, which in the end will also lead to additional understanding of the system. The software that will be used in this research is Powersim software version 2007. This software is widely used because it is comprehensive and able to represent the research method with this System Dynamics approach (Shujahat, 2016).

Furthermore, in chart form, the steps above can be presented as Figure 1.

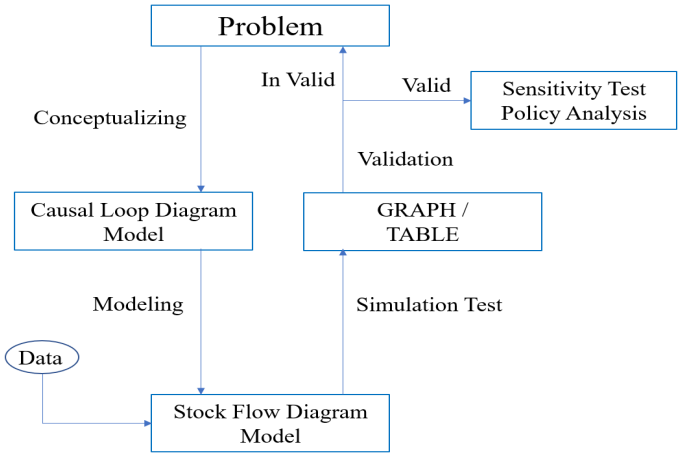

Figure 1. Cycle Model of System Dynamics

3. Methodology

The system dynamic method basically uses causal relationships in building a complex system model, as shown in the stages of building a causal loop diagram. Furthermore, the use of system dynamics methodologies is increasingly emphasized for the purpose of increasing our understanding of how system behavior emerges from its structure (Sardjono et al. 2021). Problems that can be accurately modeled using the system dynamics methodology are those that: has a dynamic nature (changes over time); and the phenomenon structure contains at least one feedback structure (Sardjono et al. 2019). The following are the principles for creating dynamic models with the characteristics as described above are as follows:

1. Tthe desired condition and the actual condition must be distinguished in the model;
2. The existence of stock and flow structures in real life must be represented in the model;
3. Conceptually different streams, in the model must be distinguished;
4. Only information that is actually available to the actors in the system that must be used in its decision modeling;
5. The structure of decision-making rules in the model must be based on (fit) with managerial practices; and
6. The model must be robust in extreme conditions.

Regarding the robustness of a model, according to Sterman, certain tests need to be carried out so that in turn it will increase user confidence in the model's ability to express the system it represents. This belief formed the basis for the validity of the model. Once the validity of the model has been achieved, the simulation can then be used to design effective policies. Figure 2.

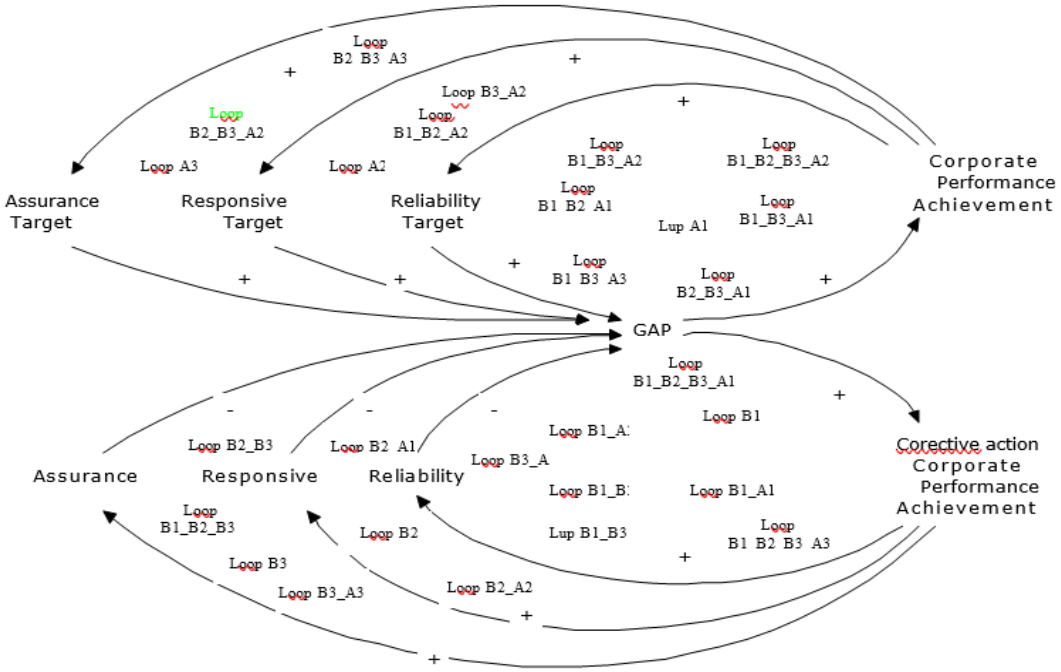

Figure 2. Causal loop Diagram (CLD) Corporate Performance

The loops listed in the relationships between one variable and another, where determining each series, it must be based on a causal relationship. between variables. Where the arrowhead reveals cause and the arrowhead reveals effect, either the cause or effect element must refer to the actual situation or the real world. Figure 3

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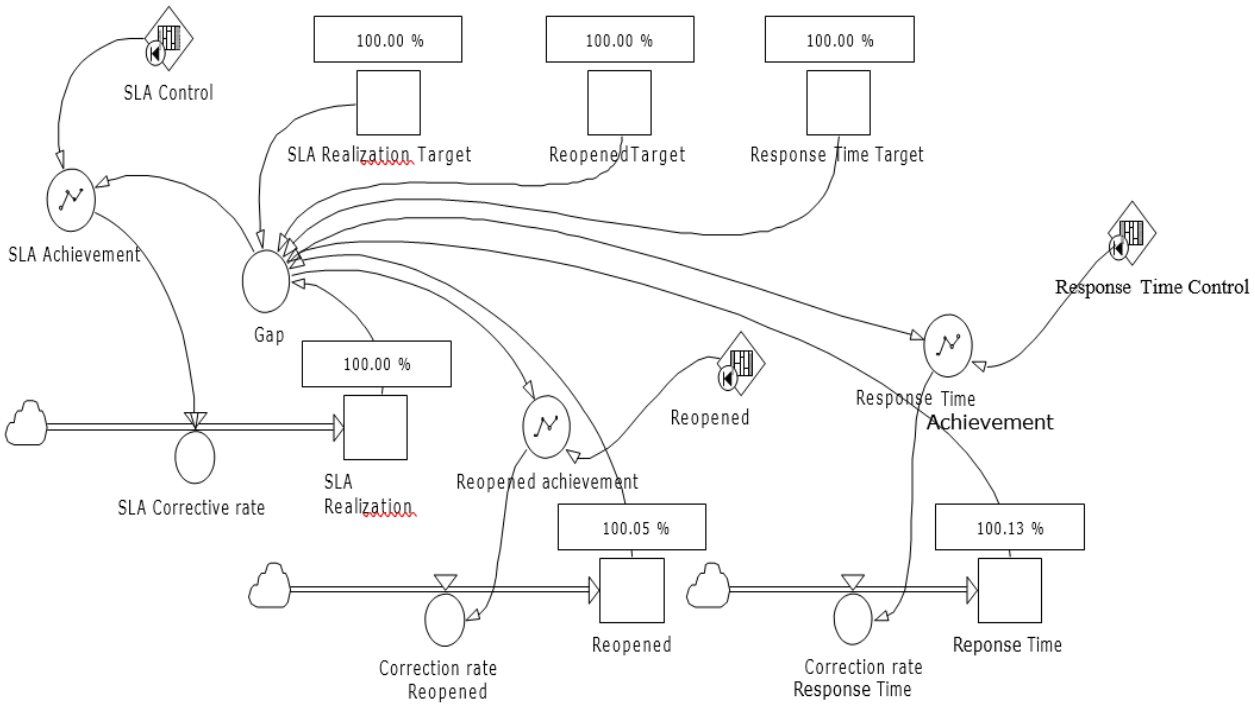

Figure 3. Stock Flow Diagram (SFD) Performance of Corporate

The description of the structure of the stock flow diagram of the behavior of the model used above is fully explained in the Table 1.

Table 1. Variables and Functions in Modeling

Variable	Function	Remark
Response Time Control	*Constanta*	Quantities that affect achievement of *Response Time*
Response Time Achievement	*Auxiliary*	Quantities that affect the rate of attainment correction of *Response Time*
Response Time	*Stock*	Response Time achievement rate per month
Response Time target	*Stock*	The target that the company has set for Response Time
Response Time Correction Rate	*Flow*	The magnitude of the correction rate for the achievement of
Reopened control	*Constanta*	Quantities that affect the achievement of Reopened
Reopened Achievement	*Auxiliary*	Quantities that affect the rate of correction of the achievement of Reopened
Reopened	*Stock*	Reopened achievement rate per month
Reopened Target	*Stock*	The target that the company has set for Reopened
Reopened Correction Rate	*Flow*	The magnitude of the correction rate at Reopened
Service Level Aggrement (SLA) Control	*Constanta*	Quantities that affect the achievement of SLA
SLA Achievement	*Auxiliary*	Quantities that affect the rate of correction of SLA achievement
SLA Realization	*Stock*	SLA achievement rate per month
SLA Realization Target	*Stock*	The target that the company has set for the SLA
SLA Correction Rate	*Flow*	The magnitude of the correction rate for achieving SLA
GAP (difference range)	*Auxiliary*	Difference between target and achievement

4. Results and Discussion

Company Performance Achievements

The achievement of the company's performance is the success achieved within of time. This achievement will be used as a reference for the company in making decisions, the data on the achievement of the company's performance is also the data that is used as the basis for assessing the company's performance. In this study, the data used is 2019 data from January to December.

2019 SLA Achievements

The average value of SLA fulfillment promised to customers in 2019 from January to December in percentage is as follows, Table 2.

Table 2. Achievement of SLA in 2019

Month	Percentage
January	86.06
February	80.81
March	85.78
April	85.18
May	87.22
June	82.89
July	86,11
August	88.13
September	91.32
October	86.06
November	89.01
December	92.01

In graphical form, the achievement of SLA in 2019 is presented in Table 2. It can be seen that there was a sharp increase until December 2019, Figure 4.

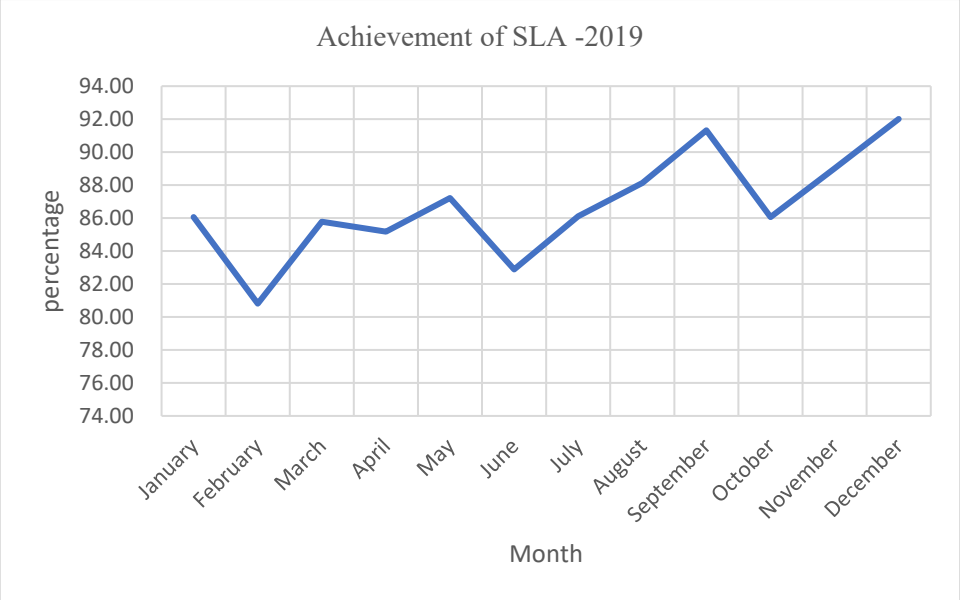

Figure 4. achievement of SLA in 2011

Response Time Achievement 2019

Response Time of less than 8 hours and less than 4 hours achieved in 2019 from January to December can be seen in Table 3. below:

Table 3. Achievement of *Response Time* in 2019

Month	**Response < 4 hour**	**Response < 8 hour**
January	9.04	35.46
February	4.28	12.94
March	1.00	14.51
April	6.64	16.73
May	1.49	7.54
June	2.83	11.62
July	0.61	2.97
August	1.94	13.88
September	7.46	15.89
October	3.75	12.36
November	11.44	17.85
December	0.53	3.62

In graphical form, the achievement of SLA in 2019 is presented in Table 3. It can be seen that there was a sharp increase until December 2019, Figure 5.

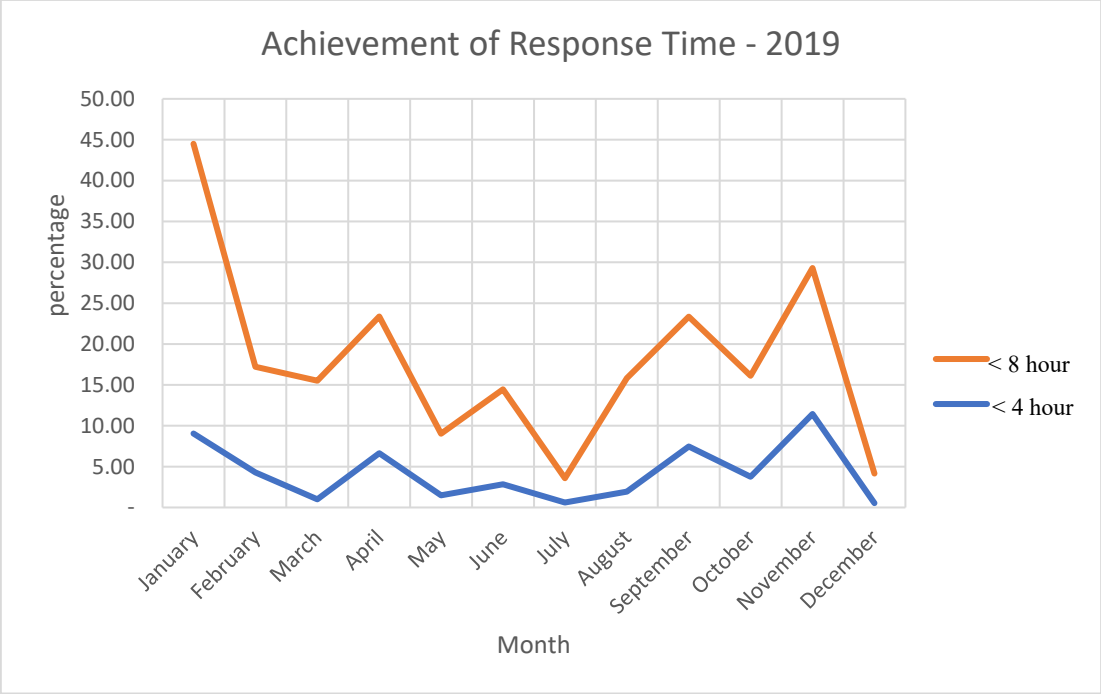

Figure 5. Response Time Achievement in 2019

Company Performance Model

Simulating feedback between variables, an Stock Flow Diagram (SFD) should be built. The existing data is inputted into the SFD to produce output. All data entered into the SFD is a percentage, some variables whose values are still not percentages must be converted into percentages. This is done so that the relationship between one variable and another is more consistent. The ways to convert from actual data into percentages are: Percentage to n = 100 – (original data to n – target value), So that all data that has been processed in the form of percentages which are the results of achievements during 2019 from January to December are as follows Table 4.

Table 4. Summary of SLA Achievements, Response Time and Reopened in 2019

Month	Response Time	Reopened	SLA
January	83.75	100.00	86.06
February	97.39	88.57	80.80
March	96.75	100.00	85.78
April	94.32	100.00	85.18
May	100.00	100.00	87.22
June	98.19	100.00	82.89
July	100.00	100.00	86.41
August	97.06	100.00	87.13

September	94.33	100.00	91.32
October	97.82	100.00	86.06
November	91.36	100.00	89.00
December	100.00	100.00	92.10

In the system dynamics simulation that the results achieved within a certain time are the results obtained from the value that of the gap, accumulation of Response Time, Reopened and SLA, constants of Response Time, Reopened and SLA as well as target achievement of Response Time, Reopened and SLA. The following are the values of the gaps and constants so that these values can produce achievements in 2019 from January to December, Figure 6 and Table 5.

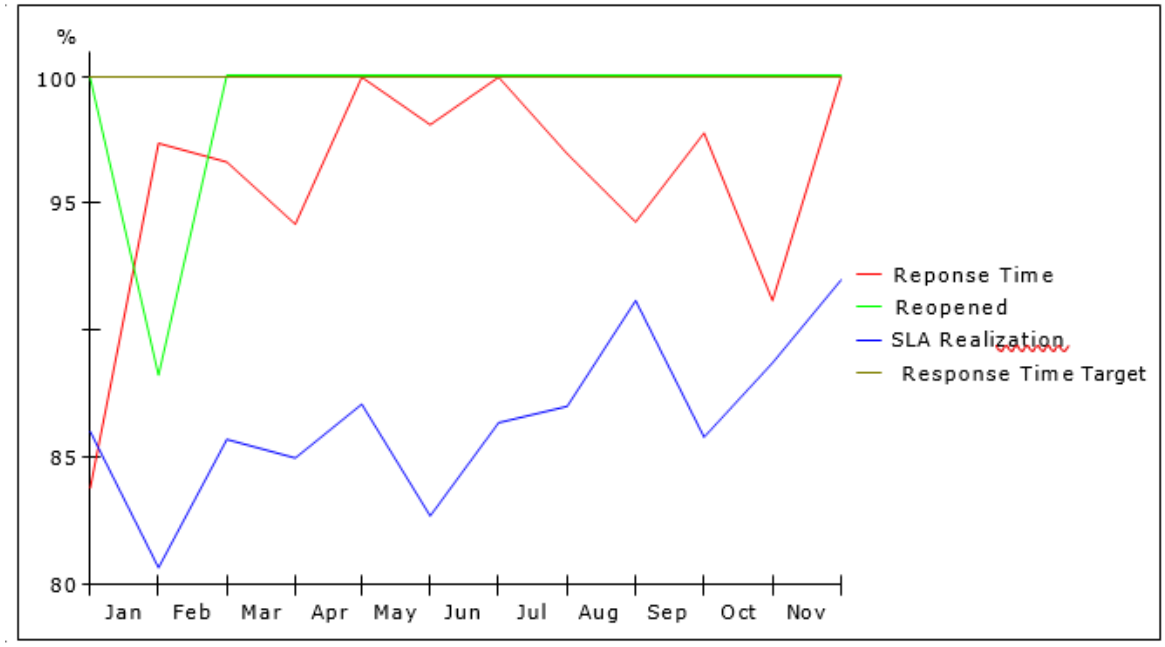

Figure 6. Response Time, Reopened and SLA Achievements in 2019

Table 5. SLA Control Value, Response Time, Reopened and Gap in 2019

Time	SLA Control (1/mo)	Reopened	Response Time	Gap (First) (%)
January	- 0.18	- 0.39	0.45	30.19
February	0.15	0.35	- 0.02	33.81
March	- 0.04	0.00	- 0.14	17.64
April	0.10	0.00	0.28	20.82
May	- 0.34	0.00	- 015	12.93
June	0.19	0.00	0.10	19.24
July	0.05	0.00	0.22	13.67
August	0.26	0.00	- 0.17	15.98
September	- 0.37	0.00	0.24	14.55
October	0.18	0.00	- 0.40	16.44
November	0.16	0.00	0.44	20.05
December				08.04

If each constant is determined a value that will affect achievement and in the future is a correction value to the

rate of service quality achievement, the company will see future results when the target achievement of each variable will be achieved. By setting the simulation up to January 2022 and entering the SLA constant at 10% per month, the graphical results of the simulation are as follows. Sensitivity test is a model response test to a simulation. The response is indicated by a change in behavior and or model performance. From the simulation that has been built with the standard target model that changes, it shows that the system performance in a certain time shows changes. The existence of these changes can be shown in the simulation below: Figure 7.

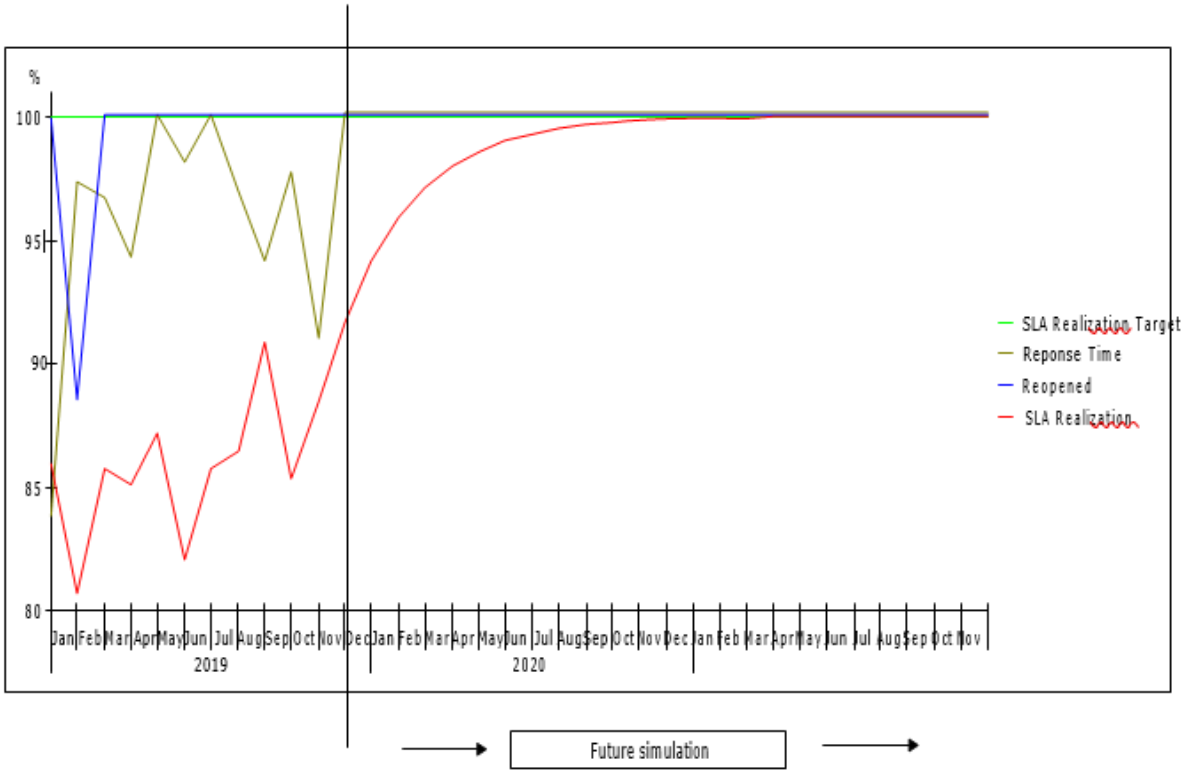

Figure 7. Simulation until 2022 with 10% SLA effect of the gap

5. Conclusion

From the results of this study, it proves that the model can describe the extent to which the target achievement is achieved within a certain period of time, while the conclusions from the results and discussion of this research are as follows:

1. Simulations carried out with several scenarios are expected to assist in decision making, by setting the correction rate of 10% of the GAP, the target achieved in 2025, when the correction rate is increased to 20%, the target will be achieved in 2022, and when the correction rate is increased to 20%, the target will be achieved in 2022. the correction rate is increased again by 10% to 30% the target is achieved in 2021.
2. Factors that affect the company's performance is the service quality factor that is not achieved in accordance with the target. The factors for not achieving service quality are due to not achieving SLA, Response Time and Reopened. The achievement of the minimum Response Time in 2019 was 83.75%, while the maximum achievement of Response Time and Reopened was 100%, there was no significant GAP for the achievement of Response Time and Reopened, but there was still a downward trend from the target that should have been achieved. The main cause of these factors is the absence of controls that are able to control the achievement of targets as expected by the company.

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