BUSINESS PROCESS DESIGN TO IMPROVE MEAN TIME TO RECOVERY RADIO IP SERVICES

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ABSTRACT: This study aims to analyze the processes on the IP Radio assurance business process that contribute to the value of MTTR Radio IP and evaluate business process that meet the MTTR target of IP Radio with simulation design. This study uses theoretical approach to Business Process Rengineering and Business Process Simulation. This research uses Arena simulators to carry out the design simulation of the IP Radio assurance business process. The results of this study indicate that the dominant processes on the IP Radio assurance business processes are touble-shooting, spare parts request, travel time directly to site, location permission, technical tlosed, and analysis. The assurance business process that can meet the MTTR Radio IP targets is the IP Radio assurance business process that eliminates spare part request process and simplifies the trouble-shooting process, spare part request, direct travel time to site, location permission, technical closed, and analysis.

1 INTRODUCTION

1.1 *Background*

IP radio assurance business processes regulate activities in handling IP radio interference and responsible units. IP radio business assurance processes have two vendors to run the business process, namely the fulfillment of spare parts vendors and technician service vendors. Mean time to recovery (MTTR) Radio IP's realization was around 18 hours while the target was 9 hours. MTTR Radio IP's targets have not been achieved due to the long and long coordination paths in fulfilling spare parts and others process.

1.2 *Problem formulation*

Based on previous research by Rinaldi (2015) about improving the efficiency of public administration in Italy through business process reengineering and business process simulation. Business process reengineering (BPR) is fundamental rethinking, radical redesign of a business process to achieve dramatic improvement in performance such as cost, quality, service and speed (Hammer & Champy, 1993). Business process simulation (BPS) is the process of creating and analyzing digital prototypes from physical models to predict their performance in the real world. Simulation modeling is used to help designers understand whether, under what conditions, and in what ways parts can fail and what burdens can be withheld (Abdellatif, 2017).

Rinaldi (2015) research results show that a combination of BPR and simulation can be used to assess the current efficiency of an organization, then redesign its internal processes to improve its performance. BPR as an effective managerial tool to deal with technological changes and marketing changes in the competitive market today, which minimizes the cost of activities throughout the entire process or organization by analyzing and redesigning workflows and processes within and outside the organization (Omidi, 2016). Therefore in this study used a business process reengineering approach and business process simulation as a medium in the design of business assurance processes to improve the Mean Time To Recovery (MTTR) service of IP Radio.

2 LITERATURE REVIEW

2.1 *Business process reengineering*

Business process reengineering (BPR) according to Hammer & Champy (1993), emphasizing the extreme nature of redesign and also identifying desired results. They promote it as "fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical performance measures, such as cost, quality, service, and speed. The main emphasis of this approach is the fact that an organization can realize dramatic improvements in performance through a radical redesign of its core business processes.

The main idea of the definition of Hammer & Champy (1993) is breakthrough. Breakthrough is defined as a higher level of organizational performance beyond its current performance in order to achieve its vision. The difference in current performance and breakthrough performance is defined as a performance gap. Performance gaps if not corrected will hamper the organization's ability to compete. When there is a performance gap between current performance and potential performance, reengineering efforts may be needed to correct the gap. Watts (2002) explains that performance analysis is another form of process analysis that can be used to define and measure activities. The components of performance analysis, which are cost, time, and quality, can help organizations set priorities for process analysis.

2.2 *Business process simulation*

Business process simulation (BPS) is a tool used to analyze and understand system behavior that helps in decision making. BPS can also help predict system performance under a number of scenarios determined by decision makers (Greasley, 2003). Business process simulation is one of the most widely used operational research applications. This enables understanding the basics of business systems, identifying opportunities for change, and evaluating the impact of proposed changes on key performance indicators (Doomun, 2008). With simulation tools, we can take pictures of dynamic models. Some simulation tools available are Metis, Arena, and SimProcess.

After the data is collected, the process simulator identifies which steps constitute the process bottleneck and other weaknesses in the process design. Based on simulation results, the initial process design can be improved iteratively. Simulations also reduce the possibility of applying process design solutions that perform dramatically different than expected. This is a strong ability. Process owners can use data from simulations to improve processes. An iterative approach to process design allows the best processes to be designed and used (Chang, 2002).

2.3 *Simulasi arena*

Simulation is the process of designing and creating computerized models of real or proposed systems for the purpose of carrying out numerical experiments to give us a better understanding of the behavior of that system for a certain set of conditions (Kelton, 2015).

Arena Software brings the power of modeling and simulation into business. Arena is designed to analyze the impact of changes involving significant and complex redesigns related to supply chains, manufacturing, processes, logistics, distribution and warehousing, and service systems. Arena provides maximum flexibility and broad application scope to model the level of detail and complexity that wants (Kelton, 2015).

According to Kelton (2015) facilities that Arena can provide include:

1. Model the process for defining, documenting, and communicating.
2. Simulation of future system performance to understand complex relationships and identify opportunities for improvement.
3. Visualization of operations with dynamic animated graphics.
4. Analyze how the system will work in an "as-is" configuration and under various "to-be" possibilities so that it can choose the best way to run a business.

2.4 *Framework*

In this study, the main theories used are BPR and BPS. BPS is a part or tool of BPR quantitatively. The main emphasis of the BPR approach is that an organization can realize dramatic improvements in performance through a radical redesign of its core business processes. In this research, the IP Radio assurance business process has a Mean Time To Recovery (MTTR) that has not reached the target of more than 9 hours. The achievement of MTTR Radio IP depends on the performance of the implementing vendor namely spare part vendor and the technician service vendor. The BPR and BPS theory approaches are used to improve MTTR Radio IP through simulation modeling, simulation scenarios and simulation scenario analysis. The analysis process is done by taking into account managerial and operational impacts and the results of literature studies related to BPS and BPS. The resulting IP Radio business assurance process that can meet MTTR targets is less than 9 hours as illustrated in Figure 1 below.

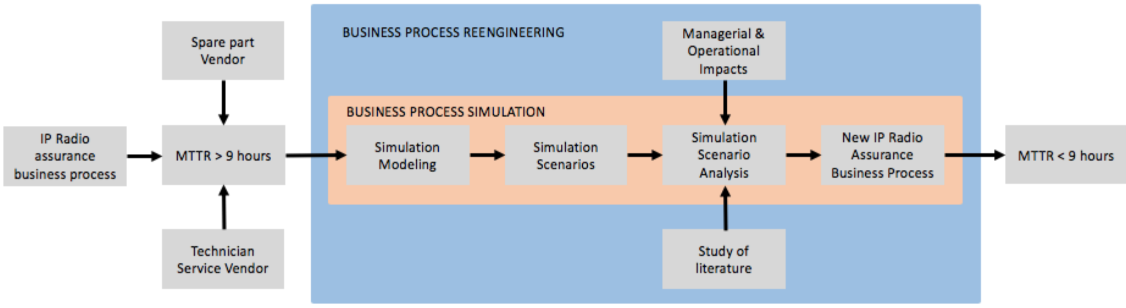

Figure 1. Framework

2.5 *Hypothesis*

The hypotheses in this study are:
H_0 : There is a difference between real system behavior and modeled system behavior.
H_1 : There is no difference between real system behavior and modeled system behavior.

3 METHODOLOGY

3.1 *Research Characteristics*

This study uses a mixed methods, namely the quantitative method to understand the processes in the IP Radio assurance business process that contribute to the value of the MTTR Radio IP. And qualitative methods for formulating and evaluating business process recommendations that can meet MTTR Radio IP targets with simulation design.

Quantitative methods play a role in obtaining measurable quantitative data that can be descriptive, comparative, and associative in nature. Whereas qualitative methods play a role in proving, deepening, expanding, weakening, and invalidating quantitative data obtained at an early stage.

3.2 *Variable Operations*

In this study a simulation design is carried out involving several variables that will be used to represent the behavior of the model in a real system as described in table 1

Table 1. Variable operations

No	Variable	Scale	Data type	Description
1	Date open	Ratio	Time	Open ticket time in helpdesk
2	Dispatch ticket	Ratio	Time	When tickets enter the technician service vendors Helpdesk
3	Analysis	Ratio	Time	The duration of time the analysis of the cause of the disturbance is logic or physical disturbance, it is necessary to change the spare parts or not
4	Sparepart request	Ratio	Time	The time duration for fulfilling spare part requests

5	Travel time dop spare part	Ratio	Time	The duration of the technician's trip to the DOP spare parts to pick up spare parts
6	Travel time DOP sparepart to the site	Ratio	Time	The duration of the technician's travel time from the DOP spare parts to the Site
7	Travel time witel	Ratio	Time	The duration of the technician's trip to Witel to pick up spare parts
8	Travel time witel to site	Ratio	Time	The duration of the technician's travel time from Witel to Site
9	Travel time directly to site	Ratio	Time	The duration of the technician's travel time directly to the Site
10	Location permissions	Ratio	Time	Entrances enter the site
11	Troubleshooting	Ratio	Time	Checking and replacement of spare parts
12	Link up	Ratio	Time	Disturbance has been fixed
13	Tech closed	Ratio	Time	Waiting for a stable IP Radio and confirm to the customer

3.3 *Measurements*

3.3.1 *Quantitative measurements*

According to Kelton (2015), verification and validation is the process of ensuring that the simulation model behaves as intended according to the modeling assumptions made. Model validation uses chi square two-sample to ensure that the real system output is the same as the simulation model output.

3.3.2 *Qualiitative measurements*

According to Sugiyono (2018), in qualitative research findings or data can be declared valid if there is no difference between what the researcher reports and what happens to the object under study. In this study the validity test was carried out in several ways namely triangulation of sources, triangulation of time, dan Discussion with friends.

3.4 *Data analysis*

3.4.1 *Quantitative Data Analysis*

Quantitative data analysis using statistical tests. Kolmogorov Smirnov statistical test is used to identify the probability distribution of each operational variable. Chi square two samples statistical test to test the hypothesis.

3.4.2 *Qualiitative Data Analysis*

According to Sugiyono (2018), data analysis in qualitative research is carried out at the time the data collection takes place and after the data collection is completed within a certain period. Data analysis includes data collection, data reduction, data presentation, and drawing conclusions

4 RESULTS AND DISCUSSION

4.1 *Quantitative research results*

4.1.1 *Characteristics of sample data*

The population in this study were 169 IP Radio interference tickets. By using the Slovin formula, a minimum number of samples is obtained 119 which are taken randomly using the random sampling method. The sample data is taken in the period of January - December 2018 to get the behavior of Radio IP's process assurance business in one year.

4.1.2 *Variable data distribution test*

The data distribution test is the identification of the probability distribution of each operational variable by using the Kolmogorov Smirnov statistical distribution test conducted by the Arena simulator. In this study the data from each variable is entered into the Arena Analyzer Input Analyzer, Kolmogorov Smirnov's D value is represented by the Corresponding p-value (p) in Arena. The limit value of $p = 0.05$, the probability distribution is more precise if the value of $p > 0.05$.

With a Hypothesis:

H_0 : Sample data for processing time duration cannot be approached by a particular distribution
H_1 : H_0 isn't right.
The criterion used is H0 is rejected if $p > \alpha = 0.05$. Variable data distribution test results are described in the following table 2

Table 2. Variable data distribution

No	Variable	Distribution
1	Date open	Weibull
2	Dispatch ticket	Exponential
3	Analysis	Weibull
4	Sparepart request	Gamma
5	Travel time DOP spare part	Exponential
6	Travel time dop sparepart to the site	Weibull
7	Travel time witel	Normal
8	Travel time witel to site	Weibull
9	Travel time directly to site	Beta
10	Location permissions	Weibull
11	Troubleshooting	Weibull
12	Link up	Gamma
13	Tech closed	Beta

4.1.3 *Modeling simulation models*

Model simulasi yang dibuat menduplikasi semua proses – proses yang ada di proses bisnis assurance Radio IP, proses – proses tersebut diterjemahkan ke dalam modul – modul yang ada di simulator Arena yaitu modul create, modul process, modul decide, modul dispose. By using these modules, the simulation model modeling in this study is shown in figure 2 below

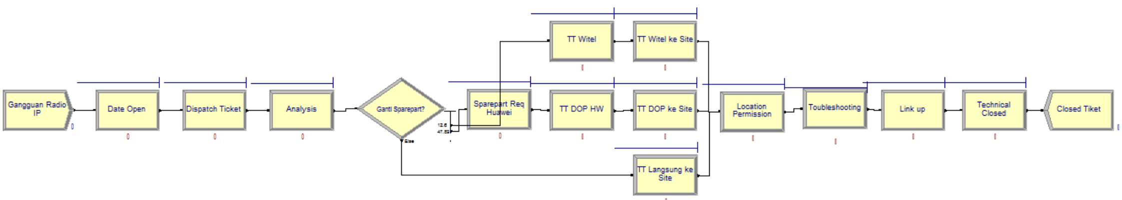

Figure 2. IP Radio Assurance Business Process Simulation Model.

4.1.4 Modeling simulation models

In this research the model verification test is done by ensuring all processes in the Assurance Radio IP business process (which is in a real system) have been modeled in the simulation model. And make sure the simulation model can run without any errors in each module used.

4.1.5 Model Validity Test / Hypothesis Testing

In this research the model validity test is done by comparing the behavior (output) of the Radio IP (real system) assurance business process with the system (output) behavior modeled using the Chi-Square Two Sample statistical test. Testing the validity of the model is also to test the hypothesis in this study.

Table 3. Variable data distribution

No	Proses	Total real system duration	Total duration of the simulation model	Total
1	Date open	18,48388889	18,5314	37,01528889

2	Dispatch ticket	38,2975	38,5691	76,8666
3	Analysis	200,2844444	177,81	378,0944444
4	Sparepart request	339,3652778	337,74	677,1052778
5	Travel time DOP spare part	66,10722222	65,9547	132,0619222
6	Travel time dop sparepart to the site	149,0338889	148,69	297,7238889
7	Travel time witel	4,366666667	4,0551	8,421766667
8	Travel time witel to site	33,68472222	35,5103	69,19502222
9	Travel time directly to site	338,0663889	341,48	679,5463889
10	Location permissions	245,8411111	304,31	550,1511111
11	Troubleshooting	477,8116667	389,12	866,9316667
12	Link up	20,73638889	20,5097	41,24608889
13	Tech closed	221,1741667	277,37	498,5441667
Total		2153,253333	2159,6503	4312,903633

The two data groups in table 3 are then calculated using the Chi Square Two Sample statistical formula as follows :

$$\chi^2 = \frac{\sum_{i=1}^{r}\sum_{j=1}^{k}(o_{ij}-e_{ij})^2}{e_{ij}} \quad (1)$$

With a Hypothesis:

H_0 : There is difference between the behavior (output) of the real system and the behavior of the system being modeled

H_1 : There is no difference between the behavior (output) of the real system and the behavior of the system being modeled

Reject H_0 if $X_{2\ count} > X2$ Chi Square table, with a value α: 5%

The calculation results above formula are:

$X_{2\ count}$: 25,4773

$X2_{\alpha/2}$: 23,337 (from the Chi Square table $\alpha/2$)

So the hypothesis is accepted

4.1.6 Pareto diagram

Pareto diagram is a tool to find the dominant cause or factor of a problem. Pareto diagram uses the principle of 80-20. It means that 80% of the accumulated percentage of factors is the dominant factor that must be prioritized while the rest is then.

Based on table 3 columns the total duration of the simulation model, the Pareto diagram is depicted in chart 1. Chart 1 shows that the dominant processes (accumulated percentage up to 80%) in the IP Radio assurance business process are toubleshooting, spare part requests, travel time directly to site, location permission, technical closed, and analysis. Then the processes that need to be improved to improve IP Radio MTTR.

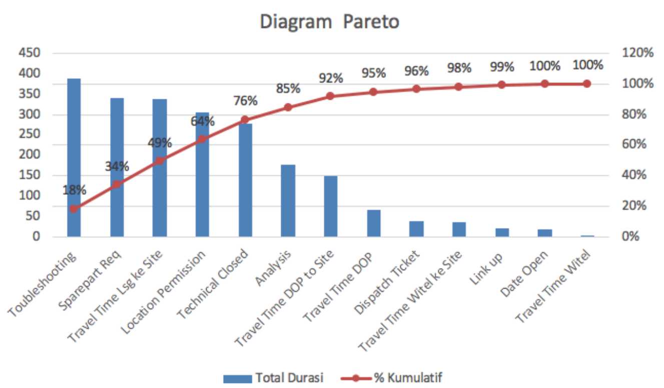

Chart 1. Pareto diagram

4.2 *Qualitative research results*

4.2.1 *Characteristic of interviewees*

The sample in qualitative research is purposive. Purposive is that the data source is chosen based on certain considerations or specific objectives (Sugiyono, 2018). Interviewees for this research are Manager of Fulfillment & Assurance and Manager of Performance Management, SLA Monitoring & KPI Report. The two speakers are the people who understand the end to end behavior of the IP Radio assurance business process and also who is directly involved in the IP Radio assurance business process.

4.2.2 *Interview result*

Interviews related to the dominant process to confirm the results of quantitative research include activities in the process, duration of process time, effectiveness of the performance of technicians, effectiveness of coordination, effectiveness of IT Tools, work rules / SOPs, standard processing time and improvement efforts. The results of the interviews reinforce the results of quantitative research

4.2.3 *Simulation scenario*

According to Adriansah (2010) to improve process performance, ESIA theory can be used namely eliminate, simplify, integrate, and automate business processes in organizations. In this study adopted the concepts of eliminate and simplify. Eliminate is eliminating processes that do not provide added value to customers. Simplify is to simplify unnecessary processes. simulation scenarios in the study according to table 4 below :

Table 4. Simulation skenarios

No	Concept	Process	Arena simulation scenario
1	Eliminate	Sparepart request	Remove the spare part request module
2	Simplify	Troubleshooting, sparepart request, travel time directly to the site, location permission, technical closed, dan analysis	Use a constant distribution with minimum values for modules of each dominant process
3	Eliminate & Simplify	Troubleshooting, sparepart request huawei, travel time directly to the site, location permission, technical closed, dan analysis	Remove the Spare Part Request module and use a constant distribution with a minimum value for the module of each dominant process

Simulation models for eliminate simulation scenarios are explained in figure 3

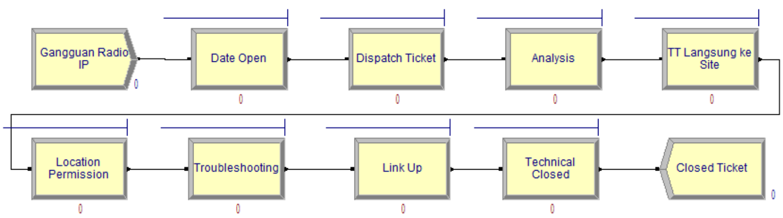

Figure 3. Eliminate simulation model

Simulation models for simplify and eliminate & simplify simulation scenarios are explained in figure 4

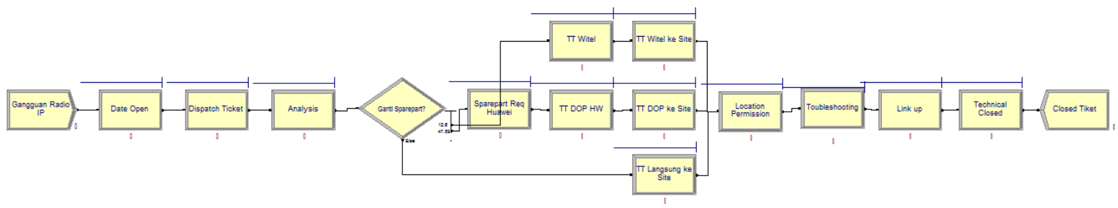

Figure 4. Simplify and eliminate & simplify simulation model

4.3 *Analysis scenario simulation result*

All simulation scenarios are run with 365 days length replication and number of replications are 100. The results of running the simulation scenario are explained in table 5

Table 5. Simulation skenarios result

No	Process	Total real system duration	Total duration eliminate simulation model	The total duration simplify simulation model	Total duration eliminate & simplify simulation model
1	Date open	18,48388889	18,3347	18,4582	18,6185
2	Dispatch ticket	38,2975	38,6928	39,1772	38,3551
3	Analysis	200,2844444	172,9	60,6232	60,6232
4	Sparepart request	339,3652778	0	67,0587	0
5	Travel time DOP spare part	66,10722222	0	66,1472	0
6	Travel time dop sparepart to the site	149,0338889	0	149,87	0
7	Travel time witel	4,366666667	0	4,0121	0
8	Travel time witel to site	33,68472222	0	36,0175	0
9	Travel time directly to site	338,0663889	872,55	59,2796	148,98
10	Location permissions	245,8411111	307,96	98,9551	98,9551
11	Troubleshooting	477,8116667	408,34	156,71	156,71
12	Link up	20,73638889	20,5028	20,803	20,5736
13	Tech closed	221,1741667	274,32	102,72	102,72
MTTR		18,09456583	17,282124	7,3935445	5,4246680
Delta to real			0,8124414	-10,701021	12,6699
Delta to real (%)			4%	59,14%	70%

According to Heizer (2017), competitive advantage in management operations is defined as a faster response to customers with lower costs and higher quality. In this research aspects of time, quality, and cost, become aspects used to analyze the output of the simulation scenario described in table 6 below

Table 6. Comparative analysis of simulation scenario results

Competitive advantage	Eliminate	Simplify	Eliminate & Simplify
Time	MTTR 17.28 hours, 4% decrease (MTTR target not reached)	MTTR 7.39 hours, 59.14% decrease (MTTR target reached)	MTTR 5.42 hours, 70% decrease (MTTR target reached)
Quality	MTTR performance 8.16% (quality and performance targets not achieved)	MTTR performance 120.24% (quality and performance targets are achieved	MTTR performance 142.57% (quality and performance targets achieved)
Cost	OPEX costs reduced (merging managed service contracts). Pay penalties to customers	OPEX costs reduced (reduction in transportation costs and technician accommodation). Do not pay penalties to customers	OPEX costs reduced (merging manage service contracts and reducing transportation and technician accommodation costs). Do not pay penalties to customers

Based on BPR approach that is fundamental rethinking, radical redesign of a business process to achieve dramatic improvement performance such as cost, quality, service and speed (Hammer & Champy, 1993). So that the assurance business process that can meet the MTTR Radio IP targets according to the results of the simulation scenario is the eliminate & simplify simulation scenario.

4.4 *Managerial Impact Analysis of Simulation Scenarios*

By combining spare parts supply contracts with technician services, it can reduce the cost of the original contract with two vendors to become just one vendor. In addition, the function of monitoring the vendor's performance is made easier, management focuses on just one vendor.

However, it is necessary to measure the capacity of the technician service vendor in handling the work of fulfilling IP Radio spare parts. If the vendor is able to handle the work, then the amendment to the cooperation agreement with the vendor of the technician service is related to the rights and obligations of Telkom and Mitratel and the making of new work rules in the assurance process of the IP Radio from the amendment. This amendment also needs to pay attention to the sustainability of spare parts availability in all operational areas. Sustainability of spare parts availability and performance of technicians to become vendor KPIs in the amendment.

Setting a standard time on the dominant processes means that the resources of the spare part vendor and the technician service vendor will work at the maximum level so that it will increase the productivity of the two vendor's resources. Increased vendor productivity will also have a positive impact on increasing corporate and regional productivity through the achievement of KPIs.

But to support the implementation of the standard time management needs to do several things, namely:

1. The review of work rules in the IP Radio assurance business process further simplifies the stages of work in unnecessary work rules.
2. Trial the implementation of simulation scenarios to analyze the suitability between the set time targets and operational conditions.
3. Upgrading the technician's technical ability to be able to analyze and improve IP Radio interference according to the specified target.
4. Assign a person in charge who is responsible for every process in the IP Radio assurance business process to speed up the coordination process for handling disturbances.
5. Conduct periodic evaluations between corporate-vendor-customers to analyze and resolve problems that arise in the IP Radio assurance business process.

5 CONCLUSIONS AND RECOMMENDATIONS

The dominant processes in the IP Radio assurance business process are based on the results of quantitative data processing namely toubleshooting, spare part requests, travel time directly to the site, location permission, technical closed, and analysis. The assurance business process that can meet the MTTR Radio IP targets according to the results of the simulation scenario is the eliminate & simplify simulation scenario.

This research can be continued by implementing the simulation scenario that gives positive results on time, quality, and cost in the IP Radio assurance business process. Then do a comparative analysis of the results of the implementation with the simulation results in terms of time, quality, cost and effectiveness of technician resources.

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