Journal of System Management
(JSM)
Online ISSN: 2538-1571
Print ISSN: 2322-2301
6(2), Summer 2020, pp. 103-133
Research Paper

Service Process Modeling through Simulation and Scenario Development for Insurance Analysis

Reza Shakerin [1] **Abbas Toloie Eshlaghy** [2]

Abstract

Insurance companies are among the service organizations, which maintain close relationships with their clients by providing insurance services. Clients are the most important resource for service companies. And profitability of insurance companies undoubtedly hinges on clear analysis of client satisfaction and improved productivity of service providers. An important factor of client satisfaction with insurance services in insurance companies is short policy issuance lead time. Insurance companies have rarely paid enough attention to this problem; therefore, this paper aims to provide a strategy for improving policy issuance lead time by simulating the existing system and observing simulation results. After a software model was developed, the discrete-event simulation (DES) results were analyzed. Then model validation tests were conducted. After a valid simulated model was developed, it was decided to design system improvement scenarios. According to the results, policy issuance lead time decreased by changing each of these parameters: the number of operators issuing insurance policies, client referral time to a specialist, specialized test response time, and insurance representative referral time to a policy issuance center. As a result, the service process improved, and productivity increased. This indicates the effectiveness of the DES technique and expansion of operations research methods in the service industry.

Received: 28/11/2019 Accepted: 13/09/2020

[1] Department of Management, Roudehen Branch, Islamic Azad University, Roudehen, Iran
[2] Department of Management, Science and Research Branch, Islamic Azad University, Tehran, Iran- Corresponding Author, Email: toloie@gmail.com

Keywords *Modeling; Discrete- Event Simulation (DES); Scenario Development; Service Systems; Insurance*

1. Introduction

The increasing competition in the insurance industry market has made most of the managers and activists think about providing a solution to ever-lasting presence in the business. Thus, they have to formulate certain strategies to satisfy clients more than ever before in order to inspire their loyalty. This can be achieved by improving insurance services. Improving the internal services of an organization can increase client satisfaction (Abolhassani, 2008).Services industries play a significant role in the economic growth and development of countries nowadays, and the importance of the insurance industry, known as a productive industry supporting other industries, is evident to everyone (Nouraei and et al, 2013).At the same time, the insurance industry is rapidly changing, evolving, and becoming competitive, and insurance companies must perceive client needs correctly and satisfy them in order to improve and operate continuously in the market. Service process improvement is known as a key strategy for satisfying clients in the insurance industry, in which the quality of services provided by an insurance company plays a significant role in client decisions and loyalty because services are intangible (Kandampully & Menguc, 2000).Life insurance has a special position among different types of insurance and is an important and prominent service in the insurance industry. In the modern world, life insurance is an important economic tool which can be used for various purposes (Mehra Ara & Rajabian, 2006).Accordingly, this paper was authored to decrease and optimize the life insurance policy issuance lead time by employing the DES technique in order to increase client satisfaction and organizational employee productivity.Regarding systemic modeling, there is a belief that a designed model is actually a series of research hypotheses proven through tests. Therefore, the designed model is considered a researcher's response to the main research problem. In this paper, the proposed model was introduced as the research hypothesis and tested through implementation (Radfar, 2005).The research problem is the lengthy issuance lead time of life insurance and future insurance at an insurance company where managing directors seek a scientific method for decreasing waiting time for the issuance of an insurance policy. With the growing competition among insurance companies for larger shares of the market, these companies have to seek strategies for satisfying their clients more than ever before and inspire their loyalty. In this competitive atmosphere, companies will be successful if they are able to command the loyalty of their clients and always intend to provide clients with faster and better services by identifying client behavior. Insurance companies pay special attention to the quality of services provided at the time of insurance policy issuance; therefore, service reception duration has an important role in a client's perception of service quality at insurance companies. Different techniques have been proposed to analyze systems in a stable status with probabilistic data; simulation is a useful method for modeling and evaluating such conditions. Wherever they are used, mathematical analysis methods are considered the most appropriate and accurate techniques of system analysis because they usually require the least effort to generate solutions or results which can be calculated for different values of model parameters with %100 of accuracy. However, system analysis is conducted through simulation where analytic techniques are impractical due to model complexity or the need for generating system behavior more realistically. Simulation is defined as a test on a real system model. A test problem arises when there is the need for specific information of a system, which cannot be collected from the existing sources (Robinson, 2004).

2. Literature Review

Hossein et al. (2019) gave a paper, entitled Developing a DES Method for Supporting the Six Sigma Approach, to support manufacturing organizations. This method includes DES model development and analysis on the assembly line of an automotive manufacturing plant in addition to defining, measuring, analyzing, and improving the manufacturing cycle to help decision-makers, planners, and organizational managers perceive the current process behavior and make better decisions. Helal and Rabelo (2017) synchronized DES models and dynamic systems to simulate an entire organizational system. They merged the comprehensive system model of an entire organizational system with a number of discrete-event models. Integrating the discrete-event system with a dynamic system matched the symbiosis of discrete and continuous reactions with the certain and random nature of a corporate manufacturing system. Rabelo et al. (2015) analyzed the hybrid simulation and supply chain at organizational levels. They developed a framework for the integration of a dynamic system simulation with a discrete-event system to simulate a manufacturing system and a supply chain. According to their results, hybrid tools must be employed to simulate modern manufacturing systems and supply chains. Chahal et al. (2013) addressed the methodology of a conceptual framework for merging DES and dynamic systems for healthcare in order to develop a general framework for the hybrid simulation of discrete-event systems and dynamic systems in healthcare. The proposed framework analyzed accidents and emergencies. Alzraiee et al. (2012) proposed a hybrid framework for modeling construction operations by using DES modeling and dynamic systems. They designed a hybrid simulation method for modeling construction projects. The developed method integrates dynamic system simulation techniques with DES to model the project environment an operational and strategic level. Lee et al. (2012) analyzed the bank queueing system based on operations research. They addressed impatient clients and client satisfaction in the system. They proposed a model for the analysis of an input distribution function and customer churn to analyze the bank queueing system. Shafeiha et al. (2017) designed a brand equity model by using the simulation approach in an insurance company. They simulated the effects of decisive variables on brand equity such as brand loyalty, perceived quality of services, brand awareness, and brand association over time by developing specific scenarios addressing the change of each parameter. Taghavi Fard et al. (2017) analyzed improving the banking service process through simulation and scenario development approaches. Researchers employed the hybrid simulation-queue approach to simulate the banking service system by considering all of the effective factors. They also proposed specific strategies to improve and modify existing processes. They utilized the simulation software to identify different service processes in the bank to find the processes causing bottlenecks and reduce the efficiency of service providers and waste the time of clients. Various scenarios were designed to finally enhance the speed and efficiency of services provided by the bank with the purpose of satisfying clients. Azimi et al. (2015) analyzed the optimization of grains transportation based on a simulated model at Rajaei

Port. They tried to explain the attitude towards creating a temporary warehouse and its effect on loading performance indices and waiting time of ships. Modeling the grains circulation process at the port and using it as a decision support model, this study made port managers acquainted with the advantages and disadvantages of the temporary buffer plan so that they could decide properly whether to execute the temporary warehouse plan. For this purpose, the simulation technique was employed to show that developing the temporary warehouse at the customs would increase the number of ships leaving the port from 12 to 13.3 per year as a result of comparing the simulation model outputs in the temporary buffer plan. In addition, the ship presence duration decreased from 200 hours to 181 hours in the system, and the grains loading rate increased from 129 tons per hour to 143 tons per hour. Mashayekhi et al. (2013) analyzed the dynamic modeling of average reduction in the time of loss compensation payment at insurance companies through the system dynamics approach. According to the results of developing a nonlinear mathematical model analyzed in simulation, there were two main factors increasing the average time of loss compensation payment (increasing office bureaucracy and increasing number of clients at the insurance company) and two main factors decreasing the average time of loss compensation payment (improving manpower performance and improving the efficient use of information technology). Sepehri et al. (2013) measured and analyzed certain strategies for decreasing the waiting time of visitors at general health centers through simulation in order to determine DES-based strategies. Using DES, they modeled and optimized the patient flow. In this paper, seven scenarios were proposed and implemented in the simulation system to decrease the waiting time, and the best results were produced by the hybrid scenario including changing the start of working hours in the system and admitting %30 of visitors by setting predetermined appointments. Afshar Kazemi et al. (2012) simulated a rebar production line and determined unsolicited solutions for the production line cranes. The researchers tried to model the rebar production line by using the DES approach and determine the number of required cranes with respect to the production line speed, failure rate of each piece of machinery, required space, and other similar factors over time. They identified and modeled the production process to achieve the research goal by using the simulation software. The number of outputs, productivity coefficient, and average selection waiting time were three indices employed to develop an effective solution and improve the production line performance. Finally, eight different arrangements were determined to select the best scenario.

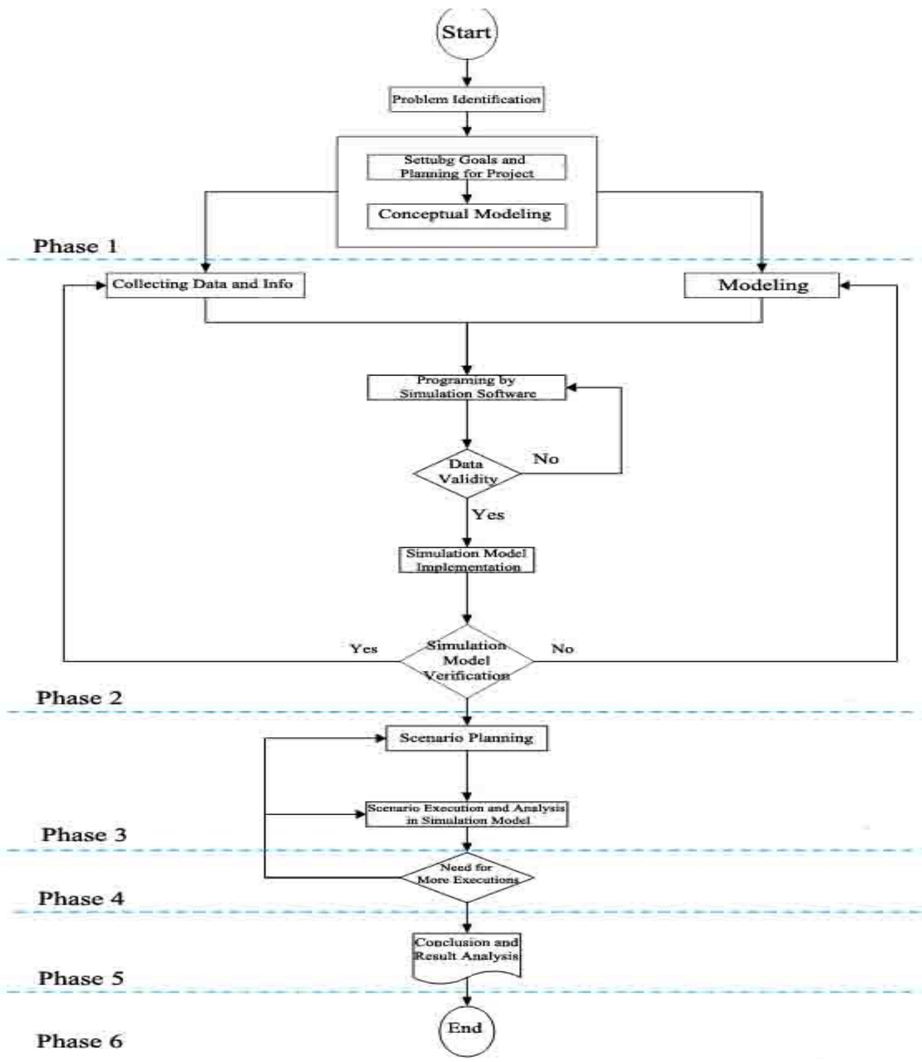

Figure 1. Research Steps

3. Method

The necessary data were provided by conducting field surveys of insurance to develop and evaluated the research model, and data analysis was based on the mathematical modeling approach integrated with a simulation paradigm. In this paper, the preliminary and research background information and data were collected desk studies and the surveyed system information by observing the system and interviewing managers and experts. After collecting the necessary data pertaining to the insurance policy issuance process in the current system laying the foundations for simulating the system and performing simulation, it was necessary to obtain accurate and actual results based on the accuracy of information. Regarding each class of data obtained from the software, the appropriate statistical function and distribution function were extracted and used as the basis for modeling the insurance policy issuance process in the simulation software. In this paper, simulation techniques and tools were employed. In fact, the simulation software was used as a simulation tool for problem-solving. After problem statement, system identification, and data collection, it was necessary to develop a DES model in AnyLogic (a software simulation environment).

Table 1.
Explaining the Process of Simulating the Life Insurance Policy Issuance Process

Stage No.	Process	Stage No.	Process
1	Admitting clients and letting them fill out the questionnaire	10	Representative's follow-up and announcing changes to client
2	Analyzing a file by the insurance policy issuance official	11	Client's agreement with the new terms of the insurance policy
3	Correcting defects (personal and insurance information) by the	12	Analyzing the files needing specialized examinations by the

Stage No.	Process	Stage No.	Process
	issuance official (no need for technical changes and medical tests) and sending the file for insurance policy issuance		medical department official and returning them to the trusted physician of the insurance company for signature
4	Sending the file to the management for making changes in the insurance policy premium and premiums of files needing medical tests (a checkup of 4 to 6 steps)	13	Issuing the specialist's report, announcing it to the representative, and delivering it to the client
5	Making changes in the insurance policy premium and sending the file to the insurance policy issuance official if the file needs no medical tests	14	Clients referral to a specialist and sending the report to the insurance company
6	Management order for a 4-step checkup and sending the file to the medical department official	15	Analyzing the specialist's report by the medical department official, taking account of the trusted physician's opinion, and sending the file to the medical official
7	Issuing a checkup report and announcing it to the representative for delivery to clients	16	The representative's follow-up and announcing changes to the client; the client's agreement to the new terms in the insurance policy
8	Client's referral to the relevant treatment center for checkup	17	The files on which insurance policies can be issued will be reanalyzed by the issuance official and then sent to operators in the issuance center.
9	Sending the checkup results of clients by the treatment center to the medical department official and returning the file to the trusted physician of the insurance company for making changes in the premium		

Table 2.
Explaining the Process of Simulating the Life Insurance Policy Amendment Issuance Process

Stage	Process
1	Admitting the clients and letting them fill in the amendment form
2	Analyzing amendment forms (in technical and medical changes) by the amendment issuance expert
3	Correcting the defects of amendment forms (personal information) by the amendment issuance expert
4	The amendment forms that need tariff changes and medical processes will undergo the same stages as the policy insurance issuance.
5	Resending amendment forms from the medical process to the amendment issuance expert and reanalyzing amendment forms
6	With the client's confirmation, the insurance policy will be issued if the management agrees.

3.1. Defining DES Model Parameters

Each of the requests entering the system is highlighted by the following parameters.

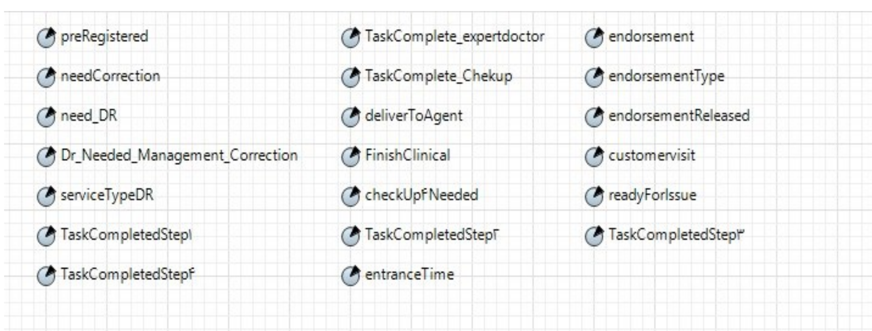

Figure 2. DES Model Parameters

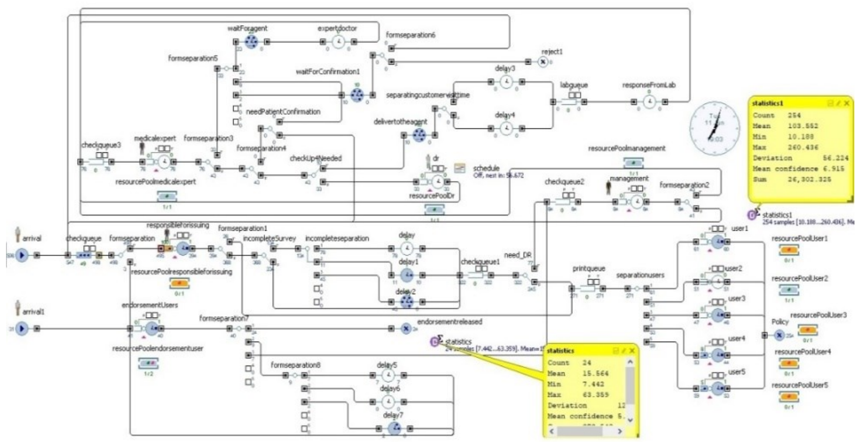

Figure 3. Simulated Model of Life Insurance Policy Issuance Process

The following assumptions were made in developing the simulation model:

I. The simulated model time is in minute.
II. The simulation model runs from the simulation zero time and continues running for 3 months, after which it stops running.
III. The system is terminable. Upon the start of servicing process (at the beginning of simulation time), clients are able to receive services. Moreover, the system continues operating until the last client leaves.
IV. Since the values of model variables are the same in working shifts, there is no need to define the working shift.
V. Unexpected incidents such as the insurance policy issuance system lag and issuance department employee absence were disregarded.

Planning every study or work of research starts with a question: what should be the sample size? It is very important to decide on the sample size because of determining the accuracy of sampling and saving time and resources. Obviously, a large sample requires a great deal of time and a large number of resources, although a small sample can cause the inaccuracy of estimates (Azar & Momeni, 2001).

For simulation, parameters and queue distributions are first determined through observation and timing. To determine the number of data required for system simulation, the number of required samples (N) should first be obtained. For this purpose, 25 samples (n initial samples) were randomly obtained at the time of client entry. Then the number of initial samples (N) was obtained from the following formula.

It should be mentioned that the number of initial samples was collected randomly on a weekday when it was considered, according to the management, the peak hour of insurance policy issuance.

Considering the obtained number of samples, 50 samples were determined to simulate the system.

The following formula was employed to determine the required number of samples for statistical fitness:

$$N \geq \left(\frac{t_{\frac{\alpha}{2},n-1} \times \delta}{\varepsilon}\right)^2$$

Table 3 shows the times between two client entries into the insurance policy issuance department in minutes:

Table 3.

Client Entry Rate in the System

Distribution of Client Entry into the System				
14.2	14.2	14.0	14.0	**14.0**
13.9	13.9	14.0	14.3	**14.3**
14.4	13.7	13.9	13.6	**13.6**
14.5	14.0	14.1	13.9	**13.9**
13.8	14.2	14.1	14.6	**14.6**

Therefore, the above formula can be utilized to determine the number of samples required for fitness. In this formula, ε is the maximum acceptable error (0.075), and δ shows the sample standard deviation (0.256).

$$N \geq \left(\frac{2.045 \times 0.256}{0.075}\right)^2 = 49.6 \cong 50$$

As a result, the number of required samples for simulation model data was 50. For instance, 50 samples were considered to obtain the statistical distribution function of system entry.

Table 4.

The Number of Samples Required to Obtain the Statistical Distribution Function

16.3	14.5	12.2	13.4	**13.6**
16.6	14.0	15.2	13.8	**14.3**
12.6	15.8	13.5	15.9	**14.5**
14.6	17.0	13.3	15.7	**15.3**
13.4	14.7	15.5	13.4	**15.9**
16.5	13.0	16.0	13.1	**15.3**
15.4	13.2	15.4	14.6	**13.1**
15.1	14.3	14.4	15.6	**13.2**
15.4	14.5	13.2	14.2	**13.8**
16.8	16.7	13.7	14.5	**15.1**

In addition, the probability distribution functions were obtained in Easy Fit. The fitness results are as follows:

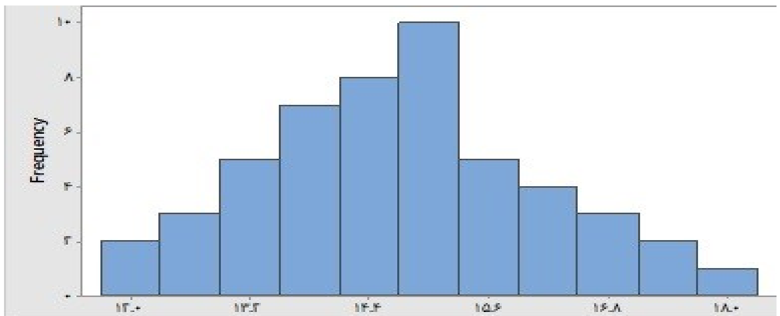

Figure 4. Triangular Distribution Function of Client Entry Time in System

According to the statistical output of Easy Fit, input rate data followed a triangular statistical distribution (p-value>0.05); therefore, H0 stating that data distribution followed a triangular distribution function was confirmed.

The collected information was used in the statistical software to determine the functions of probability distribution of data for modeling. For this purpose, it is necessary to first obtain distribution functions based on the collected data for modeling the life insurance policy issuance process. Other statistical distribution functions of servicing were fitted in the same procedure.

Table 5.

Distribution Functions Used in Simulation Model

Distribution Function	Max. Period	Probable Period	Min. Period	Distribution	Type	Activity
triangular(12,14.4,18)	18	14.4	12	Triangular	Source	Admitting clients into the system
triangular(1, 1.3, 1.5)	1.5	1.3	1	Triangular	Service	Analyzing questionnaires by the insurance policy issuance official
uniform(1,2)*hour()	2	-	1	Uniform	Delay	Defects need phone calls or correspondence via WhatsApp or Telegram between experts and representatives.
uniform(7,10)*day()	10	-	7	Uniform	Delay	Defects need that questionnaires should be sent by representatives to policyholders or clients.
triangular(1.5, 1.7, 2)	2	1.7	1.5	Triangular	Service	Analyzing the forms needing medical process by the management
triangular(1, 1.3, 1.5)	1.5	1.3	1	Triangular	Service	Analyzing forms by medical expert
uniform(24,48)*hour()	48	-	24	Uniform	Delay	Delivering a 3-step or 6-step checkup report

Distribution Function	Max. Period	Probable Period	Min. Period	Distribution	Type	Activity
						to the representative
uniform(7,15)*day()	15	-	7	Uniform	Delay	Clients of the first group visiting treatment centers
uniform(20,40)*day()	40	-	20	Uniform	Delay	Clients of the second group visiting treatment centers
uniform(40,50)*day()	50	-	40	Uniform	Delay	Sending 3-step or 6-step reports to the issuance department
uniform(24,48)*hour()	48	-	24	Uniform	Delay	Representative informing clients
uniform(24,48)*hour()	48	-	24	Uniform	Delay	Representative delivering the specialist's report to clients
uniform(2,10)*day()	10	-	2	Uniform	Delay	Clients following specialized tests
uniform(2,3)	3	-	2	Uniform	Service	Issuance operator controlling insurance policy information
uniform(3,4)	4	-	3	Uniform	Service	Sealing and signing the insurance policy and putting it inside a cover
uniform(4,5)	5	-	4	Uniform	Service	Making changes in drafted forms

A considerable part of every simulation study includes confirming and validating the simulation model. Without thorough confirmation and validation, there is no principle by which the simulation model results can be trusted. Confirmation is the process which guarantees that the conceptual model has accurately been designed in the computer model (Davis, 1992). At the same time, validation means ensuring that the model is accurate enough for the predetermined goal (Carson, 1986). There are two key concepts in validation: accurate ideas and models developed for specific purposes. Currently, it should be noted that no model is absolutely accurate. In fact, a model is not totally accurate, but it is a simple way of perceiving and analyzing reality (Pidd, 2003). The goal of confirmation and validation is to ensure that the model is accurate enough. In addition, the accuracy depends on the purpose for which the model is used. As a result, the goals of a model must be identified before validation. These goals might be determined at the beginning of the simulation study. The verification process was then conducted to ensure the accurate implementation of the model consisting of the necessary system components. In addition, the validation process was carried out to guarantee that the developed model was the actual system provider at an acceptable level. Given the fact that the model was simulated in AnyLogic, a software environment providing the tools for three simulation approaches simultaneously and using 3D simulation tools, the model validity was confirmed at a good reliance level. Experts and specialists working at the insurance policy center observed the simulation model outputs several times in an effort to make the output results match the real-world environment and perform the validation process continuously. Another view of model validation is to compare model outputs with statistics and figures obtained from the system performance in the past (Mohtashami & Firoozabadi, 2011).

For this purpose, after the model performance was ensured, relevant data were collected for the number of issued insurance policies for 30 days according to the data existing in the system in order to validate the simulation model. The simulation model was then executed 30 times separately with different random number cores. After the system warm-up time passed, the number of insurance policies issued on one day was recorded. Table 6 shows the collected numbers.

Table 6.

The Number of Insurance Policies Issued in the Real System

36	31	32	22	**30**
30	31	31	30	**35**
34	39	39	37	**25**
41	33	30	34	**26**
24	38	25	43	**39**
34	34	32	34	**35**

Table 7.

The Number of Insurance Policies Issued in the Simulation Model

35	34	32	28	**28**
38	33	38	32	**35**
37	36	32	46	**25**
33	24	28	30	**26**
43	22	25	24	**45**
34	31	32	27	**32**

In most of the statistical tests, a main assumption is the normal distribution of observations. Data normality, data dependency, and statistical tests were all checked in the statistical software.

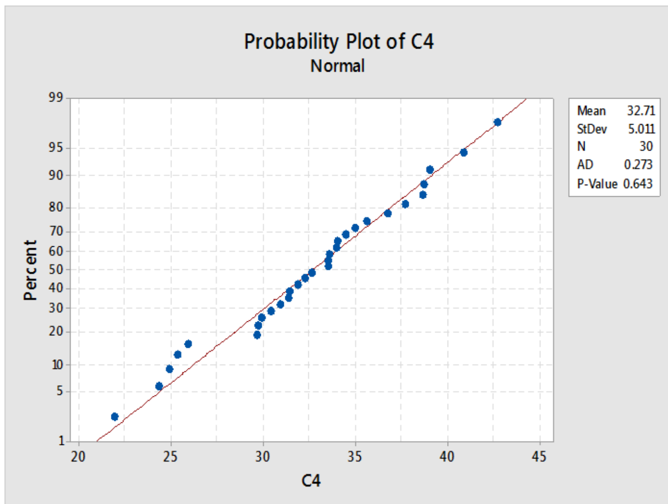

Figure 5. Normality of Observations in the Real System

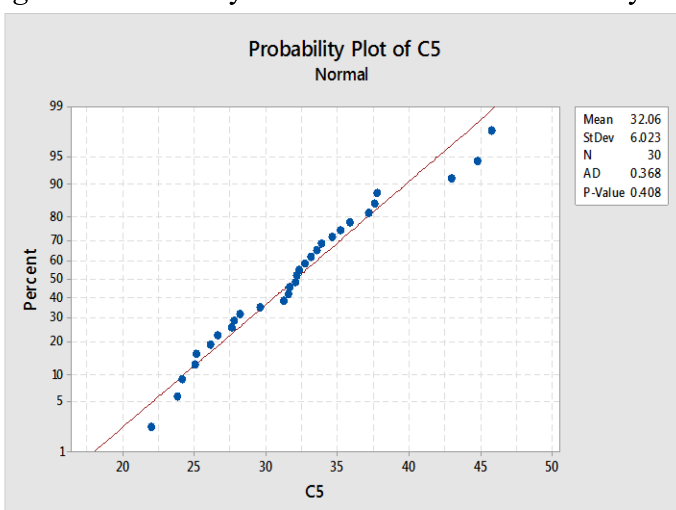

Figure 6. Normality of Observations in Simulation

The data dependency assumption should also be checked to determine the statistical test type. The dependency condition was analyzed through the Pearson method. Since p-value= 0.418, the dependency assumption was confirmed. In this step, the t-test was conducted to draw a comparison between the means of real-world observations and those of the simulation model. Since the p-value was greater than 0.05 (α was put 0.05), the equality of means was confirmed. Therefore, the simulation model behavior matches the real-world behavior, and it is fair to state that the simulation model is valid.

Most simulations are first conducted for a period of time, known as the system warm-up time, so that the system can establish a balance. After that period, the simulation results are collected. An appropriate model component for calculating the system warm-up time is the occupancy rate of model resources. According to Figure 7, the system behavior reached a balanced state after 4000 minutes (66 hours); therefore, the system warm-up time was put 4000 minutes in the DES model. During this period, the system passes an unstable state and reaches a relatively stable state.

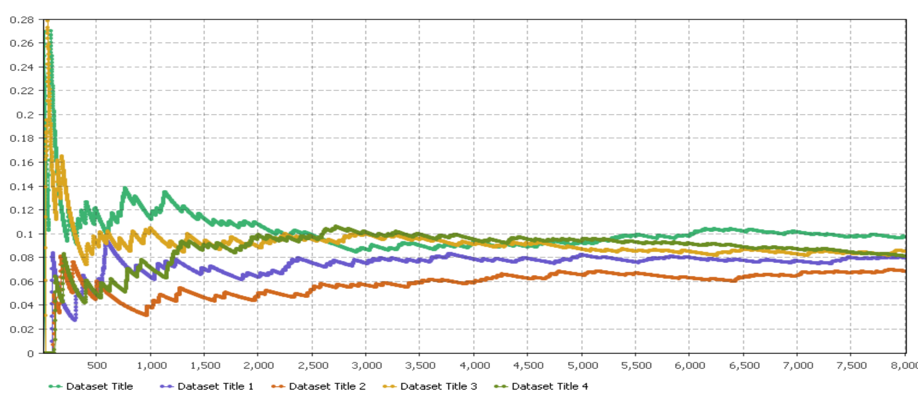

Figure 7. System Warm-Up Time Diagram

Table 8.

Reporting the Current System Status

Standard Deviation	Mean	Title
71.67525484	2732.230626	Life Policy issuance lead time
74.07251609	1794.036315	Amendment Issuance Time
21.9820634	8327.1	The Number of Issued Policies
13.23337531	7827.3	The Number of Issued Amendments
0.00194402	0.100073313	Operator 1 Busy
0.002946229	0.098700803	Operator 2 Busy
0.001708413	0.099328749	Operator 3 Busy
0.001891372	0.09848178	Operator 4 Busy
0.002115405	0.099588381	Operator 5 Busy
0.000633941	0.05646794	Management Busy
0.001917722	0.070003563	Physician Busy
0.001379527	0.060532231	Medical Expert Busy
0.000467262	0.107569224	Issuance Official Busy
0.000633941	0.05646794	Management Busy
0.002145861	0.491251503	Amendment Operator Busy
0.535209433	24.57933579	The Average Number of Policies Waiting for Confirmation (daily)
0.509162696	20	The Average Number of Policies Waiting for Visiting Representative (daily)
0.509162696	20	The Average Number of Policies Being Checked by Specialist (daily)
0.248719315	7.13800738	The Average Number of Policies Needing Delivery to Representative (daily)
5.220387551	116.9715867	The Average Number of Policies Needing Specialized Laboratory (daily)

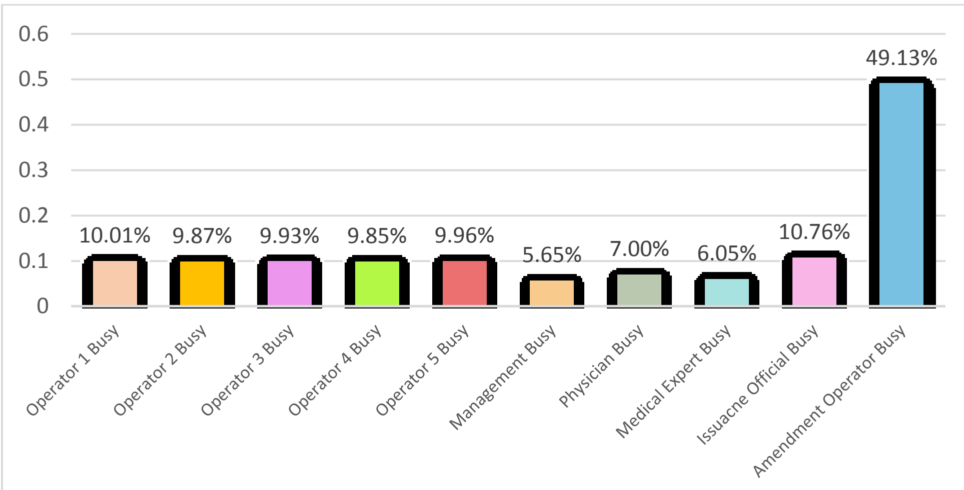

Figure 8. Operators Being Busy in Current Status (%)

The method used in this study is based on the purpose of the application and the data collected is descriptive and causal. Also based on the type of data collected is of little in this regard questionnaires for managers and companies listed in Tehran Stock Exchange in 2014 was distributed and the results have been published. Since in this research study is a causal relationship, method of causal relationships between variables is the conceptual model for comprehensive evaluation of structural equation modeling was used. This model is the best tool for exploratory analysis revealed that the variables are measured with error and complicated relationships between variables. Using this method you can use one hand carefully visible indicators or variables to be measured and the relationships between latent variables and the variance reviewed. A structural equation model of the measurement model and the structural model is composed of variables in the model and reveal hidden variables can be divided into two categories. The information technology and accounting information quality and size of each hidden variable are significant variables that are obvious. The study sample consisted of 425 managers from companies in Tehran Stock Exchange is using Cochran's formula, to determine the sample size for the population as possible. Cochran formula for its assumptions should be considered.

4. Findings

After implementing and validating the simulation model, it is necessary to develop a scenario, which is a simulation component used as a specific factor or a combination of different levels in specific conditions. In other words, the scenario (model status) can change by changing factors or levels in the model. The simulation model analyses are used for three purposes: resource analysis including evaluating the effects of changing the number of human resources and resource allocation; process analysis leading to the correction of some organizational rules and aspects of the process; and environmental factor analysis focusing the external variables (Khoshbin and et al, 2017).

1.1. First Scenario – Decreasing the Number of Insurance Policy Issuance Operators

Given the busy percentage of operators in the current status, the management has decided to decrease the number of insurance policy issuance operators. The number of issued policies in the current status was compared with that of the one-operator status. The model was executed 30 times for 3 months. Since p-value was greater than 0.05, it can be concluded that there was no significant difference between the number of insurance policies issued in the five-operator status and the number of insurance policies issued in the one-operator status. Therefore, the optimal number of operators is one in the system.

1.2. Second Scenario – Effect of Decreasing Medical Test Response Time on the Number of Issued Policies

Following the negotiations with the management, it was decided to provide specific incentives and procedures such as sending the test results electronically from the contracted medical centers on a daily basis and increasing the number of medical service centers in order to decrease the referral time of clients for tests and also reduce the response time of centers. This strategy decreased the time from 30-45 days to 20-25 days. The model was executed 30 times for 3 months. According to the results of implementing the first scenario, the number of issued insurance policies increased from 8327 to 8386. Confirming the normality and dependency of data, it was observed that this scenario increased the number of issued insurance policies, and the equality of means was rejected.

1.3. Third Scenario – Effect of Decreasing Client Referral Time to Specialists and Sending Examination Results on the Number of Issued Insurance Policies

In the third scenario, time constraints were imposed on clients visiting specialists; as a result, the time increased from 2-10 days to 2-6 days. The model was executed 30 times for 3 months. According to the results of implementing the second scenario, the number of issued insurance policies increased from 8327 to 8360, and the null hypothesis (equality of means) was rejected. Therefore, decreasing the specialist referral time and delivering the relevant report increased the number of issued insurance policies.

1.4. Fourth Scenario – Decreasing the Referral Time of Insurance Company Representatives to the Insurance Policy Issuance Center

In the fourth scenario, the management informed representatives of defects in client files and necessary changes in the insurance policy premium through SMSs and system messages. This strategy decreased the time from 24-48 hours to 6-8 hours. The model was implemented 30 times for 3 months, and the null hypothesis (equality of means) was rejected. Hence, decreasing the referral time of the insurance company representative to the insurance policy issuance center increased the number of issued insurance policies.

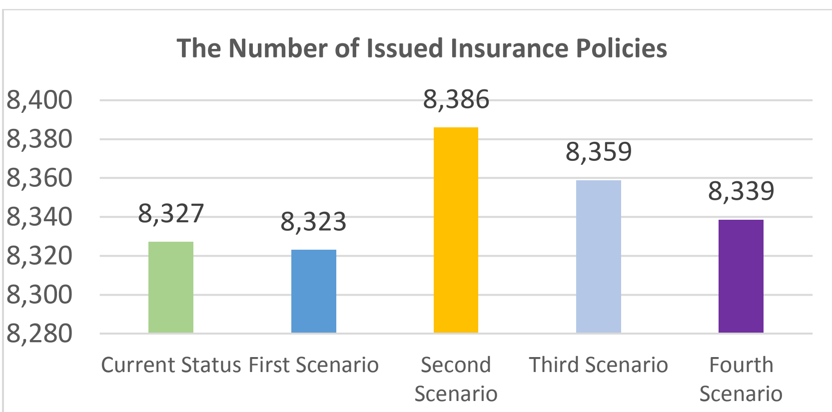

Figure 9. Comparing the Number of Insurance Policies Issued in the Current Status and Different Scenarios

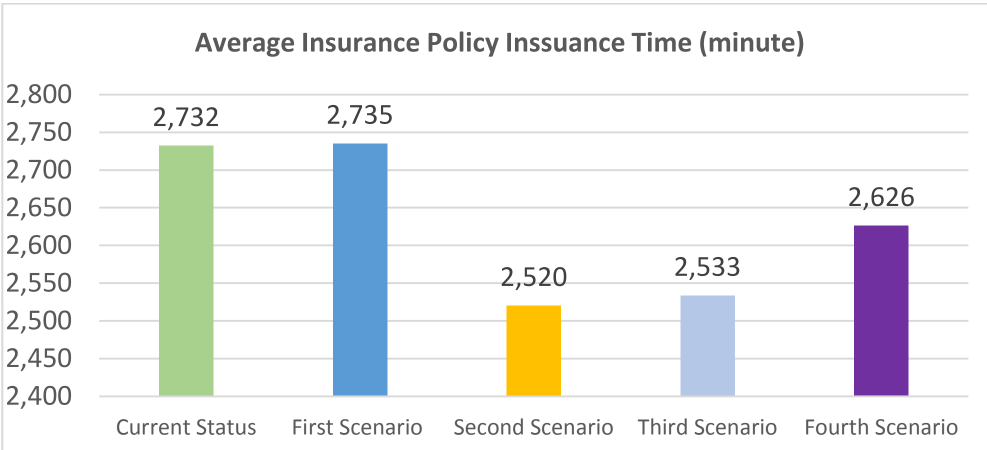

Figure 10. Comparing the Policy Issuance Lead Time in the Current Status and Different Scenarios

5. Discussion and Conclusions

This paper aimed to simulate the process of issuing life insurance by employing the DES approach and considering all the decisive factors affecting simulation. It was also decided to propose specific strategies to improve the number of issued insurance policies and decrease the policy issuance lead time. These goals were achieved by utilizing the simulation software to identify different service processes in the life insurance policy issuance center in order to detect the procedures causing bottlenecks and wasting client time by designing different scenarios. In this paper, the data collected from the insurance policy issuance center were analyzed and simulated by using statistical techniques in a simulation environment. The collected information was shown as descriptive statistics. After the model was simulated on the basis of collected information, it was validated through statistical methods. Then the proposed method was employed to run the tests. According to the results, laboratory response time decreased from 30-45 days to 20-25 days, and the specialist referral time reduced from 2-10 days to 2-6 days. In addition, the representative referral time to the insurance policy issuance center decreased from 24-48 hours to 6-8 hours, and the number of issued insurances increased. Finally, the client waiting time for receiving services decreased, something which increased the speed and efficiency. As a result, client satisfaction was achieved. An advantage of using the simulation method in service systems is to design an appropriate validated and simulated model for the process of issuing insurance policies based on the empirical information obtained from the system which simulates the real-world behavior in the insurance industry. This method also lays the foundations for analyzing information and scenario results without needing any interruptions in the system.

References

Abolhassani, Zahra (2008).Measure the Internal Divide of Seven Service Quality and Prioritize the Dimensions of the Quality of Domestic Services in the Insurance Industry. Master's thesis. University of Isfahan, Faculty of Economics and Administration.

Afshar Kazemi, M., Alborzi, M., Mahjoubravesh, S. (2012). Simulating the Production Line of Reinforcement Bars and Determining the nondominant Solutions for the Number of Cranes., 23(94-95), 13-26.

Alinaghi, M., Adel, A., & Abouzar, Z. (2014). A dynamic modelling for decreasing of loss time average in insurance companies: system dynamics approach. Managment, 5(10), 45-64.

Alzraiee, H., Moselhi, O., & Zayed, T. (2012). A hybrid framework for modeling construction operations using discrete event simulation and system dynamics. In Proceedings of Construction Research Congress (pp. 1063-1073).

Azar, A., Momeni, M. (2001). Statistics and its use in management. Organization for the Study and Compilation of Humanities Books of Universities Third Edition, Tehran.

Azimi, P., ghanbari, M. (2015). Optimization of Cereal Transportation System at Shahid Rajaee Container Port based on a simulation optimization model. Industrial Management Studies, 13(38), 133-161.

Carson, J. S. (1986). Simulation Series. 2. Convincing Users of Models Validity is Challenging Aspect of Modelers Job. Industrial engineering, 18(6), 74.

Chahal, K., Eldabi, T., & Young, T. (2013). A conceptual framework for hybrid system dynamics and discrete event simulation for healthcare. Journal of Enterprise Information Management, 26(1/2), 50-74.

Davis, P. K. (1992). Generalizing concepts and methods of verification, validation, and accreditation (VV&A) for military simulations (No. RAND/R-4249-ACQ). RAND CORP SANTA MONICA CA. Pidd, M. (2003) Tools for Thinking: Modelling in Management Science, 2nd edn. Chichester, UK: Wiley.

Helal, M., & Rabelo, L (2017). Synchronizing Discrete Event Simulation Models and System Dynamics Models. Proceedings of the 2017 International Conference on Industrial Engineering and Operations Management (IEOM) Bristol, UK, July 24-25

Hussain, A., Munive-Hernandez, J. E., & Campean, I. F. (2019). Developing a Discrete Event Simulation Methodology to support a Six Sigma Approach.

Kandampully, J., & Menguc, B. (2000). Managerial practices to sustain service quality: an empirical investigation of New Zealand service firms. Marketing Intelligence & Planning, 18(4), 175-184

Khoshbin, A., sepehri, M., Raissi, S. (2017). Optimum Staff Leveling of Hospital Emergency Department Using a Simulation Based Approach. Journal of healthcare management, 8(no 2), 7-19.

Mehra Ara, M., Rajabian, M. A. (2006). Demand for Life Insurance in Iran and Oil Exporting Countries. Journal of Economic Research (Tahghighat- E- Eghtesadi), 41(3), 57-81.

Mohtashami A, Khatami Firoozabadi S. Proposing a Methodology to Allocate the Equipments and Facilities to the Harbors using Multiple Criteria Decision Making Tools and Simulation (Case Study: Shahid Rajaee Port). IJIEPM. 2011; 22 (2):162-170

Nouraei, M., Asgari, F., Masoumi, F. (2013). A Study of the Relationship Between Using the Internet with Life Insurance Marketing, 4(3), 89-100.

Rabelo, L., Sarmiento, A. T., Helal, M., & Jones, A. (2015). Supply chain and hybrid simulation in the hierarchical enterprise. International Journal of Computer Integrated Manufacturing, 28(5), 488-500.

Radfar, Reza (2005). Provide a Dynamic Model of Network-Based Enterprise Planning for Problem Solving. PhD Thesis. Islamic Azad University Science and Research Branch.

Robinson, S. (2004). Simulation: The Practice of Model Development and Use. Inglaterra: John Willey and Sons. Inc. Cap, 1(2), 5.

Sepehri, M., Pedram, Y., Teimoor Poor, B., & Matlabi, M. (2013). Measurement and Analysis of Strategies to Reduce Referral's Waiting Time to Public Health Centers Based on Simulation. Health System Research, 9(5), 550-560.

Shafeiha, S., Saleh Ardestani, A., Afshar Kazemi, M., Mirabi, V. (2017). Designing the Brand Equity Model and Forecasting the Future Process in Alborz Insurance Company with Using a System Dynamics Approach., 28(109), 75-89.

Taghavifard, M., Dadvand, A., Aghaei, M. (2017). Improving Service Processes in Bank Using Simulation & Scenario Approach (Case Study: Pasargad Bank). Second International Industrial Management Conference, Babolsar, Mazandaran University.