

# Analyzing the theoretical gap in the explanation of the factors affecting the loyalty of policyholders and proposing a powerful technique in data analysis

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## Abstract

The insurance industry in Iran is considered as one of the key areas in the development and support of economic activities. In order to make maximum use of the potential in Iran's insurance market and to increase the insurance penetration rate and the share of annual insurance premium production in the GDP, it is necessary to address the issue of loyalty of insurers. Comparing Iran's insurance penetration with similar countries in the region shows a significant gap. The insurance penetration rate in Iran is about 3, which is a significant gap compared to the average insurance penetration rate, which is about 9. The main purpose of writing this article is to try to understand the necessity and importance of loyalty of policyholders in order to get the most premium income for insurance companies and also to formulate effective strategies in order to create satisfaction and loyalty of policyholders. Therefore, the main problem that insurance companies face in relation to the loyalty of policyholders is to determine the variables that have the greatest impact on creating satisfaction and loyalty, and there is also a need for techniques and techniques that can establish cause-and-effect relationships between broad variables. Show the influencer well. In order to achieve these goals and solve the mentioned problem, we collected and summarized at least 50 research articles in the field of loyalty of insurance policyholders in order to identify the variables that were analyzed in previous research. In this research, 23 indicators were identified, which were the variables that were most used in the analysis of the loyalty of insurance policyholders in the research. Due to the fact that the frequency of using these indicators in past research has been different, we summarized it. Among the indicators used, the variables of satisfaction, age, gender, insurance premium received, the duration of the policyholder's relationship with the insurer and the discounts provided by the insurer were identified as the most important indicators used. Also, we came to the conclusion that each of these techniques alone has weak points, the most important of which is the inability to examine the interrelationships between indicators and the dynamics between them. Therefore, in order to solve this problem, we introduced the method of system dynamics, which is an extremely powerful technique related to the analysis of cause and effect relationships. Also, at the end, we made a summary in relation to the indicators and variables affecting the loyalty of insurance policyholders and the theoretical gap of the research both from the aspect of theoretical and theoretical foundations and from the aspect of techniques and techniques used in order to examine their impact on each other. We classified and identified.

Keywords: loyalty, insurers, system dynamics, insurers' satisfaction, theoretical gap

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## 1 Introduction

The loyalty of policyholders in the insurance industry is one of the biggest challenges facing insurance companies. In this research, a model will be developed to determine the dynamics related to the mutual influence of effective indicators while formulating the concept of loyalty of policyholders. In today's business world, the correct identification of customer needs and quick response to them is the key to business success. Increasing customer loyalty has an effect on profitability, and organizations can guarantee their long-term benefits by planning in this area. On the other hand, the services provided by competing companies are becoming more similar to each other day by day, and it is difficult to surprise the customer by offering a new service in the long term because the latest services are quickly imitated by competitors and put on the market. Therefore, investing in customer loyalty is considered an effective and beneficial investment for companies. Understanding the relationships between service quality, perceived value and satisfaction of policyholders is very important in designing their loyalty strategies [10]. The effect of service quality on the loyalty of insurers and customers of service companies has been investigated and analyzed in many researches. In many researches, the role and importance of customer satisfaction and insurers have been investigated as an intervening and mediating factor [23].

In the third millennium, the insurance industry is one of the vital factors in the development of countries. In this way, customers, as the reason for its existence, have a special priority in the continuation of the life of the insurance industry. Today, insurance, as a strong economic tool, provides various services to different strata of society, and in addition to playing an essential role in strengthening the economic structure of society, it also creates security and confidence at the level of society [21]. A look at the process of changes in the insurance industry in the country shows that during a period of time due to the exclusive and limited provision of insurance services by a few insurance companies, insurers were forced to accept whatever was offered by these companies, and the conditions governing the insurance industry It was known as "seller's market" in economics.

Historical studies have shown that customer satisfaction has increased over the past 15 years. During the same period, research has shown that the trust and loyalty of customers have decreased [13].

In such a situation, insurance companies usually dictated their services to policyholders and many competitive tools and behaviors were ignored. Little by little, with the changes that took place in the insurance system, such as the establishment of private companies and the gradual liberalization of tariffs, customers gained more power of choice and more diverse services, better behaviors, and increased readiness for transformation and competition. In the insurance industry, "buyer's market" replaced "seller's market". In these changes and transformations, the attitude and approach of the decision makers of the country's insurance industry changed to some extent, and words and concepts such as competition, market orientation, customer orientation, and marketing were gradually taken into consideration. In such a situation, neglecting the needs of customers can lead to the loss of customers. Companies that neglect or pay little attention to the satisfaction of their customers will not only lose their customers, but they will also witness the announcement of this dissatisfaction by dissatisfied customers to others. Research shows that on average, one unsatisfied customer will tell 11 other people, directly reducing a company's market share. On the other hand, researchers have shown that the cost of attracting a new customer is on average 6 times the cost of keeping an actual customer [24], so this issue makes the need to pay attention to the issue of customer loyalty even more colorful.

Research has shown that the insurance industry is unable to effectively retain its policyholders and is constantly trying to establish long-term relationships with policyholders [18].

Considering that insurance companies act as credit institutions, its main capital is provided by providing services to customers, therefore customer loyalty is considered as a key factor in the success and profitability of the insurance industry. This feature, when it shows a high level in customers, makes customers want to continue and develop their relationship with the institution. The issue that should be taken into consideration today is that institutions should believe that any action to retain customers is useful and beneficial because most research shows that the cost of attracting a new customer in practice is many times higher than the cost of keeping an existing customer. Also, the profitability of current customers is based on the assumption that their life cycle value is positive. In this industry, the customer and his interaction with companies is the key principle of success, and a company that can create more customer satisfaction and loyalty by observing ethical principles is considered more successful [22]. The issue of customer loyalty and the effect of various customer loyalty programs has always been an important issue for the insurance industry, especially in the stagnant and inflated economic situation of the country in recent years. This issue has become more important with the entry of private insurance companies into the market and the workspace

becoming more competitive [25]. Customer loyalty to the insurance company can have a significant effect in reducing advertising costs and increasing revenues from the sale of new insurance services to the same customers or people they introduce to the company. This is while international research shows that the number of people participating in loyalty programs has increased from 1 billion people in 2000 to 3.3 billion in 2015. Some researchers have shown that loyalty has increased growth by 26% compared to 2013 [6]. Despite all the progress that has happened in the insurance industry in recent years, currently, the insurance industry accounts for only a little more than 2% of Iran's gross national product, and researchers believe that by relying on customer loyalty programs, increasing this number to 8 percent. The insurance penetration rate in Iran is lower than the world average of 5.5% [14].

Also, in many researches, relationships between factors that can strengthen loyalty among policyholders in the insurance industry and their consequences have been investigated [9].

Identifying, categorizing, analyzing and specifying the cause-and-effect relationships between the intervening structures in creating loyalty among policyholders in Iran's insurance industry is one of the main challenges of insurance companies. Examining the statistics, a few figures regarding the loss of policyholders of an insurance company are evidence of the fact that every year policyholders are trying to leave their first insurer and find a new insurer.

Therefore, considering the importance of insurance policyholders in the insurance industry, this study examines the concept of their loyalty in the insurance industry by examining the effect of the main influencing variables on the loyalty of insurance policyholders. In line with how the aforementioned variables form loyalty in an insurance company, an attempt has been made to identify key variables to enable the managers of the insurance industry to design and implement appropriate and effective strategies to make policyholders loyal. Considering the wide range of variables involved in the field of loyalty of insurers and the complex relationships between these variables that eliminate the possibility of linear analysis, in this research, simulation tools based on system dynamics are used to formulate their effects in causal relationships and a disability derived from a review of theoretical foundations is used. According to the topics mentioned above, the main question is how to develop a comprehensive model to analyze the loyalty of policyholders in Iran's insurance industry, which, while having effective indicators, cause and effect relationships and dynamics between the analyzed indicators and be analyzed?

## 2 Research background

In this section, in order to study and review the research that has been done in the past regarding the loyalty of insurance policyholders, a summary of these records is provided first for the foreign background and then for the domestic background.

### 2.1 Foreign background

Leiria et al. [18] believe that the insurance industry is not able to effectively retain policyholders and is struggling to create and maintain a long-term relationship. Therefore, the main purpose of writing this article is to identify the main factors that cause car insurance policyholders to not renew their contracts in the following years. The data of this research was selected from a sample of 3500 car insurance policyholders in Sanab Insurance Company who had purchased insurance policies from January to July 2017 and another 3500 samples in the same period who did not have an insurance policy. 1. With the help of the binary logistic regression technique, the research results showed that policyholders who bought more expensive insurance policies had a higher degree of loyalty than those who had cheaper insurance policies.

Gidaković and Zabkar [12] stated that historical studies have shown that customer satisfaction has been on the rise in the last 15 years. 1. While their trust and loyalty have decreased during this period. These findings are in contradiction with the findings that showed that there is a direct relationship between trust and value and loyalty. The purpose of this research is to investigate more closely the relationship between trust, value and loyalty in the insurance industry. In order to investigate research hypotheses, a random sample of 476 customers from five job categories and service industries was selected. The results of the research showed that both the type of industry and job categories can affect the trust and judgments of customers regarding loyalty.

The main purpose of [23] was to investigate the effect of service quality on the loyalty of insurers and to analyze the mediating role of customer satisfaction and value perceived by insurance customers in Malaysia. Research data was collected by questionnaire and non-probability method. The number of samples was 456. The hypotheses were tested through the structural equation modeling technique. 1. The results of the research showed that there is a positive and meaningful relationship between customer satisfaction and perceived quality with its loyalty. It also shows the

perceived quality of the mediator's role in the relationship. Customer satisfaction also plays a mediating role between perceived quality and customer loyalty.

Liu et al. [19] claim that very few researches have been done in the field of health insurance policyholders' satisfaction so far and the satisfaction of policyholders is not high in this type of insurance policies. 1. The reason for this is the complexity of the health insurance policy and the differences between insurers. The main purpose of this research is to investigate the factors affecting the satisfaction of health insurance policyholders in China in order to find solutions to increase satisfaction. The methodology of the research is mixed, first the qualitative phase and then the quantitative phase were implemented. A random sample of 1335 insurers were selected and the hypotheses obtained from the qualitative phase were tested using the structural equation method. The research results showed that the satisfaction of insurance policyholders can be increased in three ways. The results showed that service quality, perceived quality, trust and perceived value have an effect on the satisfaction of policyholders.

Méndez-Aparicio et al. [20] show that the advances in digital marketing have enabled insurance companies to create more value in terms of usage, experience and relationships with their customers. Insurance companies traditionally seek to create value for policyholders by creating shared value. The present research pursues three goals. First, it seeks to find the real role of expectations and perceived quality in the digital experience space by insurers. The second goal is to investigate the relationship between the insurance policyholders' experience and their satisfaction in using internet shopping, and the third is to identify the most attractive aspects of internet shopping by insurance policyholders. 1. A random sample of 4175 was selected from Gzazan insurance and the research hypotheses were tested with the help of PLS technique. The results of the research showed that word-of-mouth advertising had a great impact on the satisfaction of policyholders and also the expectations of policyholders before purchasing an insurance policy can be effective.

Larsson and Broström [17] examined customer feedback and believe that this feedback can lead to a key indicator in retail sales. Although, customer retention is one of the main challenges of insurers in the world of digital competition. 1. The insurance industry is digitizing its business processes and trying to retain customers. In this research, articles and research sources published from 2000 to 2018 were documented and summarized using the PRISMA technique. WEB OF SCIENCES and SCOPUS profiles were used for this documentation. The interesting and challenging topics pursued by academic researchers were categorized. Most of the articles were published in England, followed by America. In most of the articles, the emphasis was on the strategic retention of customers, which leads to the creation of loyalty among them.

The main purpose in [9] was to identify and explain the relationship between the antecedents and consequences of customer loyalty in the insurance and banking industry of India. A random sample of individual customers was selected and the research hypotheses were tested by the structural equation modeling technique. Confirmatory factor analysis with the maximum likelihood criterion was used to confirm the validity of the construct. 1. An independent t-test was conducted in order to compare the loyalty of customers of D.L.T. and private insurance companies, as well as public and private banks. Also, ANOVA test and structural equation modeling were used, which showed that customer loyalty has an effect on business performance.

In 2003, the country of Ghana designed a free medical insurance plan for its policyholders at the country level. Then the author in [3] implemented another plan by collecting money from the insurers. 1. The main purpose of this research project was to investigate the impact of the conditions of payment of damages by the insurer and the willingness of policyholders to receive insurance services in the coming years. A mixed methodology was used. First, the conceptual model was created using the foundational data theory method. Then the relationships between the model structures were tested by structural equation modeling. The results of the research showed that there is a significant relationship between the speed of payment of claims and the duration of retention of policyholders.

## 2.2 Domestic background

In 2016, Baghai and Hosseini [5] modeled the prediction of customer turnover in the insurance industry. These researchers investigated the effect of the variables of relationship length, purchase delay, purchase frequency, financial value, profitability and the purchased product group in the valuation of the studied customers, and for this purpose, they used a questionnaire survey tool in order to know the opinions of experts regarding the effective variables. It was used on customer valuation. The results show that the variables of frequency of purchase, duration of cooperation and the number of purchased insurance groups are the most important in the valuation of customers from the point of view of experts. Then, by extracting important variables and factors on the orientation of insurance policyholders, the influence and importance of these factors on the orientation of valuable customers was investigated, and then, using the variables identified in the previous stage, the development of the predictive model of orientation was carried

out. Prediction modeling was done with different models (neural network, decision tree, support vector machine, and logistic regression) and the accuracy of the built models was evaluated. The results show that the C5.0 decision tree model has a higher accuracy and accuracy in predicting diversion than other models [5].

In 2014, Heydari and Abdulvand targeted the factors affecting customer churn in the insurance industry in order to determine which factors and with what intensity cause customer churn. By studying the literature on the subject, they extracted factors such as the quality of services provided, price appropriateness, customer satisfaction, customer loyalty, and the cost of customer turnover and formed a structural equation model based on them. The correctness of the research hypotheses was tested based on the data collected from the questionnaire. In the analysis of the collected data, partial least squares method was used. Based on the analysis, the fit of the model and some research hypotheses were confirmed. The findings of the research of these researchers show the opposite effect of customer loyalty on the tendency of customers to turn. On the other hand, the findings show that the quality of the services provided and the appropriateness of the price affect customer satisfaction and customer loyalty. Therefore, these researchers recommend that insurance companies try to provide high quality services and use appropriate pricing strategies, value-added services, fast and efficient services, promotional activities to gain customer satisfaction, and convert current customers into loyal customers. Finally, in order to keep customers, reduce the tendency to turn away from the current insurance policyholders [2].

In 2013, Noushin Hossein Khani and his colleagues identified the factors affecting customer turnover in the insurance industry. These researchers investigated the effect of these factors by extracting effective factors on customer orientation in the insurance industry and using one-way analysis of variance, and for this purpose, they used a questionnaire survey tool in Parsian Insurance Company to know the opinions of customers regarding satisfaction and factors affecting They used turning. The results of their research showed that variables related to customer perception and awareness are more effective than demographic variables and contract level on customer turnover. Also, they found that although 62.6% of the sample people evaluated their satisfaction with the performance of Parsian Insurance as favorable, the level of customer satisfaction varies depending on the communication channel with Parsian Insurance Company [15].

Tavakoli et al. used the data mining process in research to predict the patterns of customers turning away in the field of fire insurance. Using the CRISP-DM standard data mining methodology, they researched the databases of one of the public insurance companies in the field of fire insurance. The results of their research showed that the customer attraction channel is the main predictor of customer turnover or customer retention in the company, and the purchase history and use of the insured place are next in line as a predictor of turnover [27].

In 2016, Dust Mohammadi et al., in their research with the aim of providing a model for predicting customer turnover using customer lifetime value in the insurance industry, five features (payment, installments, value, customer lifetime value, number of contracts and discounts) They know that it is one of the most important features in the modeling of customer orientation in Iran's insurance industry (car insurance). In other words, according to them, characteristics such as demographic variables and the use of the insured car do not have a significant effect on customer turnover. Among the extracted characteristics, the number of installments and payments and the amount of discount have an inverse effect on customer turnover, but other variables show a direct effect. Among these features, having appropriate policies for the amount of discount, installments and having more contracts with customers can be useful for successfully managing customer turnover [11].

Soeini and Rodpysh in their research in the insurance industry (2012) obtained their variables through a questionnaire and considered them to be mostly demographic and conceptual and less environmental and behavioral. The result of their research shows that most of the customers who turn away are managers and engineers, and they are not satisfied with the services provided and tend to turn away. In the educated category, the main reason for customers to turn away was the behavior of the insurer, and for those who work in the market, the good reputation of the insurer and knowing him is very important. In the labor group, who are less inclined to insurance, the time intervals of the insurance policy and the insurer's obligations are important factors [26].

One of the most important developments that occurred in the field of performance improvement in the last decade of the 20th century Attached was the issue of customer satisfaction being recognized as one of the main management requirements in service institutions [16]. The efforts made to improve performance management tools show the importance of customer satisfaction and loyalty in determining the success of organizations in terms of business and profitability. In the current research, the dimensions of service quality and its impact on customer loyalty in the insurance industry have been investigated. In this research, random sampling is used. Data collection was done using a questionnaire whose validity was confirmed by experts and the reliability of the questionnaire was measured using Cronbach's alpha test. In this research, SPSS and AMOS software were used to analyze the collected data. The



statistical population under study is all people (customers) who use the services available in Iran Insurance Company agencies in Tabriz city.

The purpose of this study is to investigate the role of perceived value, customer satisfaction and commitment as a mediating effect of service quality on customer loyalty. During this research, the following relationships are examined: 1) the positive effect of service quality on perceived value, 2) perceived value as a mediating variable between service quality and customer satisfaction, 3) the positive effect of customer satisfaction on emotional commitment and Customer loyalty 4) Emotional commitment as a mediating variable between customer satisfaction and customer loyalty.

With the increase in competition between insurance companies in terms of gaining more market share, the managers of these companies are inevitably looking for ways to gain more satisfaction and loyalty of their customers. Meanwhile, the role of employees in this industry is not hidden from anyone. Satisfied employees can focus all their efforts on attracting and maintaining and satisfying customers [1]. Internal marketing is a concept that can help insurance companies in achieving their goals. Therefore, the current research was conducted with the aim of investigating the effect of internal marketing on the customer-oriented behavior of employees in the insurance industry. The used research method is descriptive-survey based on structural equation modeling. In this regard, the researcher used a questionnaire to examine the opinions of a selected sample of the statistical community (frontline employees of insurance companies in Tehran). Also, according to the background and hypotheses of the research, a model has been identified to show the effect of internal marketing on customer orientation, the fit of which was shown to be appropriate according to the output of Laserl, and it was tested using Laserl software. The results of analyzing the questionnaire data showed that job satisfaction has a mediating role in the relationship between internal marketing and customer orientation.

**Calculation of insurance payment**

$$\text{Probability} = \frac{\text{The number of damaged companies}}{\text{Total Companies}}$$

$$\text{Average} = \frac{\text{The number of damage}}{\text{Total}}$$

$$\text{Average} = \frac{\text{The number of damage}}{\text{Total}}$$

$$\text{Average payment} = \text{Probability of occurrence} * \text{moderate damage}$$

$$\text{net premium rate} = \frac{\text{The average premium of each company}}{\text{Average value of each company}}$$

$$\text{Technical insurance premium} = \frac{\text{The amount of stock value reduction}}{\text{Total value of shares}} \times 100$$

$$\text{Damage committed (payable)} = \frac{\text{Insured amount} \times \text{amount of damage}}{\text{The real value of the stock before the loss}}$$

$$\text{premium rate} = \text{Probability of risk} \times \text{total insured amount}$$

**Risk management in the insurance industry**

Value at risk is the most common measure of market risk, which is equal to the maximum loss that may occur in a given period of time, given a certain level of confidence. Value at risk is defined as the following relationship.

$$p(r_t) \leq VaR_t(a, k) = 1 - a \tag{2.1}$$

where  $r_t$  represents the return on assets at time  $t$ ,  $a$  is the level of confidence or risk aversion of insurance, and  $k$  is the time period for which the value at risk is calculated. In other words, it is equal to the probability that the loss of the insured is not greater than the value at risk. An insurance contract can be interpreted as an option due to the common content of a random payment in the future. An option is a contract between a buyer and a seller, so that the buyer buys the right to buy or sell an asset from the option seller at a certain price, and the buyer pays the option price to the seller.

One of the important financial models that has been proposed for the pricing of option contracts with a certain maturity is the Black-Scholes model. Consider a European call option on the base asset S at time t with an agreed price K and maturity time t+T, which is Because of this, the owner of the option has the option to pay a fixed amount

K at time and receive a random amount Bjork [7]. The Black-Scholes pricing equation for the European call option traded at time t is in the form of equation (2.2) which where N is the cumulative distribution function of the standard normal distribution and T is the interest rate of the risk-free asset [8].

$$C_{BS}(S_t, K, \tau, \sigma, r) = S_t N(d_1) - e^{-rt} K N(d_2)$$

$$d_1 = \frac{\ln\left(\frac{S_t}{K}\right) + \left(r + \frac{\sigma^2}{2}\right)\tau}{\sigma\sqrt{\tau}}, \quad d_2 = d_1 - \sigma\sqrt{\tau} \tag{2.2}$$

**Risk management contract**

The random process of the value of a risky asset is in the interval [0,1] and  $r > 0$  is the interest rate of the risk-free asset. If a broker invests in this asset at zero time, the problem of managing the risk of possible loss is that this loss is  $L = (S_0 e^{-rt} S_T)^+$ . It is considered that where  $a^+ = \max\{a, 0\}$ . For risk management, the broker's loss buys a contract X (such as a normal insurance contract at the price  $(X)\pi$  where  $0 \leq X \leq L$ , because to prevent arbitrage, the value of the contract should not be greater than the broker's loss. and in the best conditions it can be equal to the amount of loss and cover the total loss, therefore, the overall position of the broker's loss is in the form of relation (2.3).

$$P = L - X + \pi(X) \tag{2.3}$$

**Optimization of risk criteria**

According to the fundamental theorem of asset pricing in mathematics, the arbitrage-free property of the financial market leads to the existence of a martingale measure Q, which is the discounted price process.

$(0 \leq X \leq L e^{-rSst})$  is a martingale with respect to Q [7]. In addition, when the market is complete, this probability size is unique. The most important thing to note here is the price that the market sets for the contract, and the risk management institution is not allowed to price the contract based on its organizational strategies. Therefore, in a complete market, we assume that the contract price is equal to (Relation (2.4)).

$$\pi(X) = E^Q(X) \tag{2.4}$$

which represents the expected return value of the contract under the martingale size Q. In risk management contract pricing, the most common method is to minimize the overall risk position. We also assume that the criterion used by the broker to measure the risk of loss is value at risk (VaR). Therefore, the general position of the loss that the broker needs to minimize is equal to (equation (2.5)):

$$\min_{0 \leq X \leq L} VaR_a(L - X) + \sup_{Q \in \Delta} E^Q(X), \quad X, L - X \text{ are co-monotone} \tag{2.5}$$

The reason for using value at risk in this issue is that because the stock price at maturity is unknown, a numerical value can be obtained using this criterion. To eliminate the risk of selection bias, we assume that X and L-X have the homogeneity property. This hypothesis allows the use of marginal compensation functions (MIF), which were proposed in Assa [4] and improved by Zhang et al. [28] and play a fundamental role in proving the pricing formula proposed in the theorem. have the following. Now we present the following theorem, by which the problem of pricing the risk management contract becomes the problem of pricing European call options.

An optimal solution for equation (2.5) is equal to equation (2.6).

$$X = \min \{ (S - e^{-rT} S_T)^+, (S - e^{-rT} VaR_{(1-a)}(S_T))^+ \} \tag{2.6}$$

And the form of this answer in terms of asset price at time T is equal to the following equation

$$f(S_T) = (S_0 - e^{-rT} VaR_{(1-a)}(S_T))^+ + e^{-rT} (S_T - S_0 e^{-rT})^+ - e^{-rT} (S_T - VaR_{1-a}(S_T)) \tag{2.7}$$

In order to prove this, we first assume that the risk faced by both insurance and reinsurance institutions must be an upward function of the value of the general claim X. According to Assa [4], the collection of permitted reinsurance contracts based on the space of compensation functions in the form of equation (2.8):

$$C = \{0 \leq R(x) \leq x | R(x) \text{ and } x - R(x) \text{ are non-decreasing} \} \tag{2.8}$$

where  $(x)$  is the reinsurance contract. With this hypothesis, the optimization problem of the risk management contract becomes equation (2.9).

$$\begin{cases} \min\{VaR_\alpha(L - R(L)) + E^Q(R(L))\} \\ R \in C \end{cases} \tag{2.9}$$

By using the Lipschitz function and the lemmas proposed in Zhang et al. [28] and also by calculating the Radon Nicodemus derivative of the martingale size  $Q$  for each  $(X = R(L))$ , the management problem risk (2.9) knowing that  $xxx$  is bullish can be expressed as equation (2.10).

$$\begin{aligned} & \min_{R \in C} VaR_\alpha(L) - \int_0^\infty I_{[0, VaR_\alpha(L)]}(z)R'(z)dz + \int_0^\infty (1 - F_{L_1}(z))R'(z)dz \\ & = \min_{R \in C} VaR_\alpha(L) - \int_0^\infty ((1 - F_{L_1}(z)) - I_{[0, VaR_\alpha(L)]}(z))R'(z)dz \end{aligned} \tag{2.10}$$

Therefore, the optimal solution is obtained in the form of the following equation.

$$R'(z) = \begin{cases} 1, & 1 - F_{L_1}(z) < I_{[0, VaR_\alpha(L)]}(z) \\ 0, & 1 - F_{L_1}(z) > I_{[0, VaR_\alpha(L)]}(z) \end{cases} \tag{2.11}$$

And if  $(z)$

$$(I_{[0, VaR_\alpha(L)]}(z) = 0)I_{[0, VaR_\alpha(L)]}(z) = 1, (z \notin [0, VaR_\alpha(L)])z \in [0, VaR_\alpha(L)]$$

The second (first) rule cannot occur and

$$(R'(z) = 0), R'(z) = 1$$

Therefore, the optimal solution can be in the form of the following equation.

$$R(x) = \int_0^\infty I_{[0, VaR_\alpha(L)]}(z)dz - \min(x, VaR_\alpha(L)) \tag{2.12}$$

Knowing that  $(S_0 - e^{-rt}x)^+x$ , is ascending, the solution to the risk management problem is obtained in the form of the following relationship

$$X = R(L) = \min((S_0 - e^{-rT}S_T)^+, (S_0 - e^{-rT}VaR_{1-a}(S_T))^+)$$

As it is shown, we will have  $(S_T)S_0 < e^{-rt}VaR_{1-a}$  and therefore the result is the same.

$$\begin{aligned} X = R(L) &= \min((S_0 - e^{-rT}S_T)^+, (S_0 - e^{-rT}VaR_{1-a}(S_T))^+) \\ &= \begin{cases} ((S_0 - e^{-rT}S_T)^+, & S_T \geq VaR_{1-a}(S_T) \\ (S_0 - e^{-rT}VaR_{1-a}(S_T))^+, & S_T < VaR_{1-a}(S_T) \end{cases} \\ &= \begin{cases} 0, & S_T > e^{rT}S_0 \\ S_0 - e^{-rT}S_T, & VaR_{1-a}(S_T) \leq S_T \leq e^{rT}S_0 \\ (S_0 - e^{-rT}VaR_{1-a}(S_T))^+, & S_T < VaR_{1-a}(S_T) \end{cases} \\ &= (S_0 - e^{-rT}VaR_{1-a}(S_T))^+ + e^{-rt}(S_T - S_0e^{-rT}(S_T - VaR_{1-a}(S_T)))^+ \end{aligned} \tag{2.13}$$

### 3 Summarizing the studies conducted in relation to the loyalty of policyholders and customers in the form of gap analysis

In this part of the thesis, in order to focus on new structures and develop theoretical and theoretical foundations in the field of loyalty of insurance policyholders and guide the thesis in the scientific direction, the studies were analyzed from two dimensions:

#### 3.1 From the techniques and techniques that were used to analyze the data

In order to analyze the techniques used to examine the data of different types of studies that were conducted around loyalty, the results are presented in Figure 1. As can be seen, by reviewing the previous studies, it was found that until now the technique and method of system dynamics have not been used to analyze the data related to loyalty, or if it was used, the researcher could not find it.



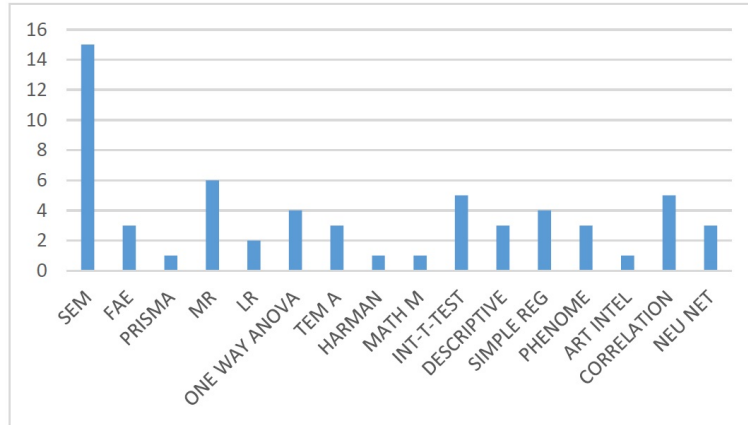


Figure 1: Summary of techniques and techniques used

### 3.2 From the development of the theoretical foundations of research

As seen in Figure 2, previous researchers have identified various constructs and variables in order to analyze the loyalty of insurers and customers. Since the researcher has a lot of experience and studies in the insurance industry, he believes that in Iran’s insurance industry, other variables can be identified and taken into account in the analysis of the loyalty of policyholders, which has remained far from the scope of previous researchers’ research. For this reason, in this dissertation, the researcher will first conduct interviews with insurance marketers, heads of insurance sales agencies, branch managers and assistants, and some university professors who have experience in teaching insurance and marketing courses in order to be able to determine those other variables.

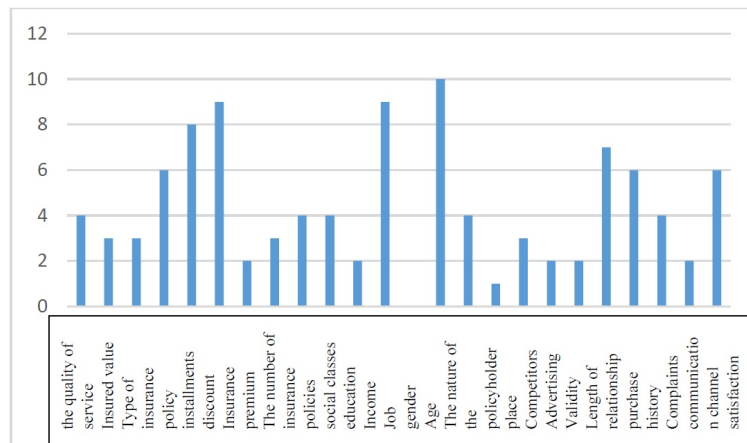


Figure 2: Variables affecting the loyalty of policyholders

## 4 Summary and conclusion

As seen, in order to explain the important structure of loyalty of insurance policyholders, various indicators and variables were identified and introduced in the studies of previous researchers. If we want to categorize these variables, they can be divided into several groups and classes. Variables and indicators can be attributed to more general structures, for example, one category is related to demographic characteristics, one category can be attributed to firmographic characteristics, one category is related to the psychological characteristics of the insured, and one category is related to the specifications and factors related to the product or service.

In any case, it seems that in order to benefit from the maximum potential in Iran’s insurance market, it is possible to identify variables that can help insurance companies better explain the loyalty of policyholders, in addition to formulating effective marketing strategies. In relation to the techniques used, a clear gap is also seen. Using the techniques and methods of system dynamics as a powerful tool can show the cause-and-effect relationships and effectiveness in order to increase the loyalty of policyholders.

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