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Evaluation of green service supply chain performance in urban management of Tehran Municipality, using simulation

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Abstract

The present study seeks to simulate the performance appraisal model of green service supply chain in urban management. The method of this research is a combination of qualitative and quantitative techniques. In the qualitative part of content analysis and Dolphy techniques for extracting and refining themes and in a quantitative part of fuzzy cognitive mapping techniques to determine the importance of each variable and system dynamics approach to simulation. The research model was used. For the interview and analysis of variables, the statistical population, which included 10 experts of Tehran Municipality from different fields, was used. The final model of the research, which included 34 independent variables, was simulated using vensim software. The simulation results showed that the policymaker's attention to pollution control, the optimality of urban transportation routes, the amount of pollution produced and the amount of waste produced with a gentle slope is decreasing; But technology budgets are rising steadily; In general, it can be said that the proposed model can lead to improving the efficiency of the green service supply chain in the municipal organization as a case study.

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Introduction

Today, most people in the world pay more attention to the protection of the environment and biological resources. This positive sensitivity has intensified to the point that even industry owners are trying to use it to take an effective step towards the acceptance of the product they offer to customers and use environmental considerations as a competitive advantage. In most countries, it has been concluded that development becomes continuous and sustainable when, when using limited and non-renewable resources, utmost care is taken to try to protect these limited resources. Governments are also trying to do more than ever by enacting environmental (green) laws; for this purpose, certain standards have been set. The mentioned factors (customer demand, government laws and standards) as a stimulus, have caused changes in this regard. Managing these changes in the supply chain, along with the flow of information that exists throughout the supply chain, introduces a new concept called green supply chain management. The use of green supply chain management strategies reduces waste, reduces resource utilization and, consequently, reduces energy consumption and environmental pollution. This ultimately increases efficiency and improves performance in organizations and companies (Imani and Ahmadi, 2009).

Rising concerns about environmental alerts have forced organizations to try to implement environmental management solutions. Perspectives such as green supply chain management, green productivity, cleaner production and environmental management systems have been applied to green management activities. In the meantime, since adverse environmental effects occur at all stages of the life cycle of operations and the management of environmental programs and operations is not limited to the boundaries of the organization, the green supply chain management view as a comprehensive view that all flows from suppliers to manufacturers and ultimately consumers, it has received a lot of attention. Green supply management is a set of supply chain management policies, in which all activities and communications are to address environmental concerns and areas such as design, production, and distribution. , Includes the use, reuse and disposal of the organization's products and services. Simultaneously with the expansion of the concept of supply chain management in various industries, the issue of supply chain performance evaluation was also considered. Performance evaluation is the process of quantifying the efficiency and effectiveness of activities. Effectiveness is the condition in which customer needs are met and efficiency is assessed by evaluating the economics of using resources to achieve customer satisfaction (Gunasekaran et al., 2004). In this regard, using the appropriate tools and having a performance scale in different industries and similar industries allows the organization to know its performance position in comparison with the performance range of other competitors. Making strategic decisions in supply chain management is an issue that needs a framework that can be based on relevant standards. If there is no appropriate model in this field, supply chain management cannot have the right factors to properly evaluate its activities. To this end, organizations should consider a model for solving their current problems that can be most effective in content analysis of problems with the least conflict. Therefore, to evaluate the performance of the supply chain, it is necessary to conduct research to identify important dimensions for the operational efficiency of supply chains, in areas such as staff skills development, customer responsiveness, flexibility and customer satisfaction to the evaluation. Pay them.

Obviously, not paying attention to any of these factors causes more problems.

In recent years, following the rapid industrialization of various service sectors, more attention has been paid to environmental shortcomings, and governments around the world have begun enforcing environmental protection laws. . Green service supply chain management, like any management approach to performance measurement system to identify success, determine the extent to which customer needs are met, assist the organization in understanding processes, discover knowledge that organizations have not been aware of before, and finally It needs to achieve improvement in planning (Karimi, 2009). Another issue is the lack of attention to studies and research needs in addressing the software and implementation context of integration and adaptation of database technology in this field. In most studies, only a conceptual model is presented and the implementation design is not done. Another noteworthy point is the summary of research literature in this field. No codified studies have been conducted to summarize the studies and take a critical look at this research process. In this regard, by designing a model to evaluate the performance of the green service supply chain of urban management and finally by simulating this model, the performance of the supply chain can be measured, changes can be identified and improvement strategies for better system performance for the service supply chain. Green defined urban management. Whereas little research has been done to evaluate the performance of the urban management green service supply chain; This research uses fuzzy cognitive mapping method along with simulation in order to design a model for evaluating the performance of green supply chain in urban management. In other words, in this study, in addition to using fuzzy cognitive mapping, the simulation method is used to understand the behavior of the system and evaluate various strategies for better system performance.

Literature Review and Research Background

Performance appraisal is one of the key management activities and the choice of appraisal system to achieve the strategic goals of the organization is at the heart of this issue. That is why designing a performance appraisal system is so important (Thanki, 2016). Supply chain management involves all the handling and storage of raw materials, on-the-job inventory, and finished product from the initial start to the end of consumption. (Label et al., 2018). Previous research is reviewed in this section.

The study of Salehi Barmi et al. (2019), with the aim of evaluating the environmental performance of Tehran Municipality based on the indicators of the green city to review and evaluate the performance of the municipality using ISO 14031 standards and prioritize its success in accordance with the indicators of the green city

Papen and Amin (2018) design a closed-loop supply chain network and optimize to reduce the impact of water bottle production on the environment and maximize total profits. Unlike a public closed-loop supply chain network, in-network recycling centers are located in one facility and warehouses are part of the retailer to reduce environmental issues. In addition to designing and optimizing a water bottle closed chain supply chain network, the authors select the best suppliers based on certain criteria such as cost, carbon, on-time delivery, and quality. To achieve this, a multi-objective planning model is developed. This proposed mathematical model is represented in Montreal, Canada, using real locations.

The article by Zarbakhshnia et al. (2018) seeks to consider the design and planning of a direct inverse logistics network through a hybrid integer linear programming model. This model applies to the multi-objective, multi-product, multi-step problem, where the first goal is to minimize the cost of operations, processes, transportation, and fixed costs. The second goal is to minimize carbon dioxide emissions, and the third goal is to optimize the number of devices on the production line. This model was tested for approval in the home appliance industry. In terms of the solution method, an Epsilon constraint method is developed as an optimization field to achieve fragmented solutions and sensitivity analysis to understand the effects of changes in demand, cost and rate of return of the product used on the value of the objective function. It becomes.

The purpose of Noah and Kim (2018) research is to examine the contract between a producer and several retailers with limited resources for a variety of products under greenhouse gas emission laws. Each retailer orders products based on limited budget and greenhouse capacity. In order to respond to orders, the manufacturer produces products and transports them after inspection. Demand for products can be specific or subject to uncertainty, which can be represented using fuzzy numerical demand. In order to investigate the demand, this paper presents a nonlinear integer programming model, a definite model and a fuzzy model. Dual Genetic Algorithm Pattern Search and Genetic Algorithm is developed to solve these models. Numerical experiments evaluating the efficiency of the algorithms showed that the HGAS method performs better than the genetic algorithm. It is also observed that the total average cost of the definite model is less than the total fuzzy model. Overall, the results show that models can evaluate contract performance and optimize shared supply chain management.

Rani et al. (2019) develop an inventory model for declining items in the green supply chain with a view to recycling, reverse logistics, and reproduction. Demand is dependent on carbon. Products degrade over time at a time-dependent rate of decline. A definitive model is developed to minimize the average total cost. In this definitive model, it is assumed that demand, rate of return, and decline are accurately determined. But in reality these parameters are not specific. To model this uncertainty, a fuzzy model is developed by considering these parameters as triangular fuzzy digits.

Abd al-Baset et al. (2019), in their paper, examine the evaluation of green supply chain performance with a new approach. In this paper, we use a robust ranking technique with a neutrophil set to manage performance in GSCM. The efficiency of the proposed method has been evaluated using the first case study of the oil industry in Egypt and the second case study of a manufacturing company in China. The results show that "reverse procurement", "supplier environmental cooperation", "gas management" are important items in GSCM actions.

Liu et al. (2020) present a strategic orientation model for green supply chain management. This study examines a company's core motivations for adopting a strategic green supply chain management (GSCM) orientation and the mechanisms that subsequently influence GSCM operations. The three components of GSCM orientation are examined, namely strategic emphasis, management support and resource commitment. Data were collected from a sample of 296 manufacturing companies in China. The results show that the most important motivation is environmental concern, followed by customer needs, cost savings and competitive pressure, while legal requirements have not been an important factor. The results confirm that strategic orientation plays a mediating role between real motivations and practices. In the three components of strategic orientation, resource commitment and strategic emphasis have a stronger direct impact on actions, while the impact of management support on GSCM practices is through indirect resource commitment. This study contributes to the research literature by elucidating the key role of strategic orientation in transforming GSCM motivations into actions.

Shou et al. (2020) in their research examined the behavioral perspective for green supply chain management. This study investigates the relationships between environmental performance feedback and green supply chain management (GSCM). This paper examines how environmental performance at high or low aspirations affects GSCM implementation (specifically Sustainable Production [SP] and Sustainable Financing [SS]) through the Company Behavior Theory (BTOF) lens, which pays little attention to it has been used in the operations management literature. The results show that organizations determine their efforts to implement two GSCM methods based on environmental performance feedback: The greater the difference between the desired performance and the environment, the greater the effort to implement GSCM practices.

Legbal et al. (2020) examine the zero waste strategy for managing the green supply chain while minimizing energy consumption. In this paper, to define a nonlinear mathematical model to minimize the total cost, a model for a centralized supply chain system (i.e., three common decision chains in the supply chain) is proposed. In particular, the minimum cost is obtained by searching for the optimal period on the planning horizon through an analytical optimization method. In addition, we minimize the energy used to produce primary and secondary products and recycle packaging materials. The strength of the model is confirmed through numerical tests and sensitivity analysis. The proposed model achieves 98.4% waste removal efficiency, which is shown through the results of numerical experiments. The optimal length obtained for the planning horizon provides optimal production time and minimizes energy consumption.

Kubasi et al. (2020) examined the relationship between green human resource management practices, green supply chain management practices, and their performance. This study examines the impact of green human resource management and green supply chain management practices on operational, market, financial, social and environmental performance. Green supply chain management practices have been shown to play a complementary intermediary role between green HR management and operational, market, social and environmental functions, while this role mediates the competition between green HR management and performance. Has the money. Then, the analysis shows that the synergy between green human resource management and green supply chain management creates the highest value in operational performance, followed by market performance, environmental performance, financial performance and social performance in the rankings. Are next.

As can be seen, there are various methods for examining the green supply chain, which often include multi-criteria decision making, mathematical modeling, statistical methods, Delphi technique, in other words, if we want Summarizing the methods of work on the above research in one model includes 5 general techniques. But among the above methods, there is still no comprehensive method that can examine the discussion of green supply chain in the form of a complete model. Lack of use of system dynamics techniques or techniques such as fuzzy cognitive mapping in research, lack of focus on green service chain discussion and failure to use simulation principles and quantitative techniques to rank the most important gaps found in research is the previous.

Research methodology

Due to the complex nature and special characteristics of the green service supply chain, for the present study, a sequential mixed exploration method has been used, which includes three steps that in order to achieve the research objectives, the research implementation steps are presented separately below. In the first step, because we are looking to explore and understand the dimensions of the service supply chain, the type of research method will be qualitative (fundamental). To perform the qualitative method, two main techniques can be used based on the recommendations of professors. Then, the first step is to extract variables from the research literature using the qualitative method, which is a combination of content analysis and meta-combination techniques, but after extracting these variables, these variables must be refined using the Delphi technique. In the second step, because we are looking to identify and determine the extent of relationships and test the model, the research method is quantitative (applied). The qualitative part of the research is done by using content analysis and Delphi method with experts in the field of performance and identifying the components and performance criteria of the green service supply chain of urban management. The type of research method in the second step is fuzzy mapping with the aim of identifying causal relationships between concepts.

At this stage, we seek to simulate the system obtained from the parameters extracted from the first and second steps in order to design an integrated model for performance appraisal. - Turn. According to the selected topic for this research, the purpose of this research is exploratory and qualitative methods should be used. In designing a model for evaluating the performance of the green service supply chain of urban management, reviewing the literature, collecting questionnaire data, conducting qualitative interviews with experts and document analysis should be used.

- *Variables*

The variables of this research are extracted from the following steps:

• First, in order to identify the components affecting the various stages of green supply chain management, the literature related to the subject will be studied.

• In the next step, organizational experts will be identified and semi-structured interviews will be conducted.

• Then the relevant components will be identified and the performance evaluation indicators will be coded.

• In the next step, the causal relationships between the variables in the FCM model will be determined.

• The above variables are then entered into the simulation process as input parameters to obtain the resulting model after simulation.

• In the last stage, the outputs will be analyzed and the necessary solutions and suggestions will be provided.

Data collection tools include two questionnaires. The first questionnaire is the Delphi questionnaire on a scale of 10 from 1 to 10, the items of which include all the variables extracted from the content analysis section. Of course, the Delphi questionnaire is divided into 3 to 4 stages, in each stage, the volume of variables is probably reduced, and in the third stage, only the variables about which experts disagree are observed, are included in the questionnaire. In other words, it can be said that in the Delphi method, 3 questionnaires are presented in this research. The validity of the questionnaire is confirmed by ten professors. Regarding the second stage, a fuzzy cognitive mapping questionnaire is presented, which also includes the final variables extracted from the Delphi method and includes a range of 1 to 10. This questionnaire is also distributed among the selected statistical sample.

In this study, the statistical population in question includes managers and urban management experts familiar with environmental issues and supply chain. In the present study, sampling is not based on the usual criteria of statistical sampling methods, but individuals and groups are selected based on theoretical criteria, their potential usefulness in advancing the research and agreeing to participate in the research process. Sampling in this study was done theoretically. Theoretical sampling is a kind of purposeful sampling in which the researcher tries to analyze and scrutinize the desired event and phenomenon by using the opinions and knowledge of the most knowledgeable people about the research topic. In other words, the type of sampling is not random but intentional and judgmental (Bazargan, 2012). The samples in this method are selected based on their content and not using abstract methodological criteria. For this purpose, the sampling method is theoretical and because the qualitative method is considered in the research, the statistical sample includes ten experts and in fact the statistical community, which according to the conditions of the respondents of the people in question. They will be selected to have practical and scientific readiness to answer and participate in the research.

Findings and numerical results of the research

- Extraction of performance evaluation indicators of green service supply chain

At this stage, the variables related to evaluating the performance of the green service supply chain are extracted. This is done by using content analysis and reviewing previous research in which the 10 main variables of research along with the basics of their definitions are listed in the table below.

As can be seen in Table 1, the 10 main research variables are listed along with the basics of their definitions. Based on this, basic themes consisting of 48 attributes and 121 themes are obtained. However, due to the fact that the extracted characteristics as a sub-variable must be refined using expert surveys, the Delphi method is used at this stage.

Table 2. The final main and sub- variables extracted from the content analysis and Delphi stages

Variables	Items.
Pollution rate	Reduce pollution
	Increase the efficiency of service operations with minimal pollution
	Waste generation management
Urban industries and jobs	Design of environmentally friendly products
	Mechanization of municipal services
	Recycling products at the end of life
Urban governance	Maintaining the requirements of the ISO 14000 environmental management system in urban projects
	Development of infrastructure to facilitate the implementation of environmental issues
	Senior management support and commitment to environmental issues
	Setting a sustainable development strategy for urban businesses
	Adjust the organization's environmental policies to comply with environmental laws
Improvements in service locations	Design the correct service delivery processes
	Reduce, recycle and reuse used resources
	Apply sustainable design features to service locations
Proper resource management	Use of renewable energy
	Use of energy saving technologies
	Use of water saving technologies
	Optimal use of the organization's financial resources for sustainable development and environmental protection
Transportation optimization	Optimization of transportation routes
	Maximum utilization of transport capacity
	Deployment of transportation tools with advanced design technologies
	Public transport demand management
	Upgrading transportation infrastructure for sustainable development
Orbital citizen	Motivate citizens to participate in environmental protection programs
	Optimize service demand management in the city
Human resources management	Provide training programs to train employees on environmental management characteristics
	Establish measurable environmental performance goals for employees
Interact with suppliers	Product sourcing from environmentally responsible suppliers
	Make purchasing decisions based on waste management
	Collaborate with suppliers to minimize environmental impacts
information system	Provide communication and information platforms to motivate citizens
	Creating and strengthening information systems
	Implementation of information systems to control and manage the characteristics of environmental management and its performance
	Use environmentally friendly media to report and share environmental information with citizens

- *Fuzzy cognitive mapping*

At this stage, after going through the qualitative stages of the research, we enter the quantitative phase and using the fuzzy cognitive mapping method, we seek to determine the relationships between the variables determined in the previous stages and refine in the Delphi stage and finally determine the importance of each variable. The importance of each variable is used in the simulation of system dynamics and therefore at this stage we seek to achieve it. First, the first stage of fuzzy cognitive mapping, which involves the formation of a decision matrix, is performed. At this stage, as with all matrix-based quantitative methods, the decision matrix must first be based on the opinion of experts, with the matrix column containing the criteria and the row containing the opinion of the 10 experts. It should be noted that the scale of scores is between 1 and 10. As it was observed, 34 extracted variables based on the opinion of 10 experts form the initial matrix of success. Then, based on the fuzzy cognitive mapping method, the fuzzy success matrix, which constitutes the second stage of the fuzzy cognitive mapping method, is created. This Matrix is obtained based on the fuzzy formula described in the table below.

Table 3. Fuzzy Success Matrix

۱۰	۹	۸	۷	۶	۵	۴	۳	۲	۱	Variables	Criterion number
۱,۰۰۰	۱,۰۰۰	۰,۳۳۳	۰,۰۰۰	۱,۰۰۰	۰,۰۰۰	۰,۵۰۰	۰,۰۰۰	۱,۰۰۰	۰,۰۰۰	Reduce pollution	۱
۰,۳۳۳	۰,۲۵۰	۱,۰۰۰	۰,۱۲۵	۰,۵۰۰	۱,۰۰۰	۰,۱۲۵	۰,۱۲۵	۰,۱۲۵	۰,۱۲۵	Increase the efficiency of service operations with minimal pollution	۲
۰,۵۷۱	۰,۰۰۰	۰,۵۷۱	۰,۰۰۰	۰,۱۴۳	۰,۴۲۹	۰,۱۴۳	۰,۸۵۷	۱,۰۰۰	۰,۲۸۶	Waste generation management	۳
۰,۱۲۵	۰,۳۷۵	۰,۱۲۵	۰,۱۲۵	۰,۱۲۵	۰,۰۰۰	۰,۱۲۵	۰,۲۵۰	۱,۰۰۰	۰,۲۵۰	Design of environmentally friendly products	۴
۰,۷۱۴	۰,۲۸۶	۱,۰۰۰	۰,۲۸۶	۱,۰۰۰	۰,۲۸۶	۰,۷۱۴	۰,۲۸۶	۰,۲۸۶	۰,۵۷۱	Mechanization of municipal services	۵
۰,۱۶۷	۱,۰۰۰	۰,۰۰۰	۰,۲۰۰	۱,۰۰۰	۰,۴۰۰	۱,۰۰۰	۰,۵۰۰	۰,۵۰۰	۰,۱۶۷	Recycling products at the end of life	۶
۰,۳۷۵	۱,۰۰۰	۰,۵۰۰	۰,۱۶۷	۰,۵۰۰	۱,۰۰۰	۱,۰۰۰	۰,۱۲۵	۰,۸۷۵	۰,۰۰۰	Maintaining the requirements of the ISO 14000 environmental management system in urban projects	۷
۰,۸۷۵	۱,۰۰۰	۰,۵۰۰	۱,۰۰۰	۱,۰۰۰	۰,۳۷۵	۰,۸۷۵	۰,۸۷۵	۰,۵۰۰	۱,۰۰۰	Development of infrastructure to facilitate the implementation of environmental issues	۸
۰,۶۶۷	۱,۰۰۰	۱,۰۰۰	۰,۱۶۷	۰,۰۰۰	۰,۱۶۷	۰,۰۰۰	۰,۱۶۷	۰,۶۶۷	۰,۵۰۰	Senior management support and commitment to environmental issues	۹
۰,۱۲۵	۰,۰۰۰	۱,۰۰۰	۰,۷۱۴	۰,۵۷۱	۰,۸۵۷	۱,۰۰۰	۰,۰۰۰	۰,۱۲۵	۰,۶۲۵	Setting a sustainable development strategy for urban businesses	۱۰
۰,۸۵۷	۰,۱۴۳	۰,۴۲۹	۰,۴۲۹	۰,۸۵۷	۰,۴۲۹	۰,۰۰۰	۰,۱۴۳	۰,۸۵۷	۰,۸۵۷	Adjust the organization's environmental policies to comply with environmental laws	۱۱
۰,۵۰۰	۱,۰۰۰	۰,۸۳۳	۰,۳۳۳	۰,۵۰۰	۰,۱۶۷	۰,۵۰۰	۰,۱۶۷	۱,۰۰۰	۰,۸۳۳	Design the correct service delivery processes	۱۲
۱,۰۰۰	۰,۱۴۳	۰,۸۵۷	۰,۴۲۹	۱,۰۰۰	۰,۱۲۵	۰,۶۲۵	۰,۲۵۰	۰,۳۷۵	۰,۸۷۵	Reduce, recycle and reuse used resources	۱۳
۰,۳۳۳	۱,۰۰۰	۱,۰۰۰	۱,۰۰۰	۰,۱۶۷	۰,۱۶۷	۰,۱۶۷	۰,۳۳۳	۱,۰۰۰	۰,۲۸۶	Apply sustainable design features to service locations	۱۴
۰,۸۷۵	۱,۰۰۰	۰,۲۵۰	۱,۰۰۰	۰,۶۰۰	۱,۰۰۰	۰,۳۷۵	۰,۸۷۵	۰,۰۰۰	۰,۸۷۵	Use of renewable energy	۱۵
۰,۰۰۰	۱,۰۰۰	۰,۲۸۶	۰,۱۴۳	۰,۴۲۹	۰,۱۴۳	۱,۰۰۰	۰,۵۰۰	۰,۱۲۵	۰,۸۷۵	Use of energy saving technologies	۱۶
۰,۶۲۵	۰,۸۰۰	۱,۰۰۰	۰,۶۶۷	۰,۱۶۷	۱,۰۰۰	۰,۱۶۷	۱,۰۰۰	۰,۱۲۵	۰,۶۲۵	Use of water saving technologies	۱۷
۰,۸۳۳	۰,۱۶۷	۰,۵۰۰	۰,۸۳۳	۰,۱۶۷	۱,۰۰۰	۰,۸۷۵	۰,۱۲۵	۰,۸۷۵	۰,۸۷۵	Optimal use of the organization's financial resources for sustainable development and environmental protection	۱۸
۰,۳۳۳	۰,۵۷۱	۰,۸۵۷	۱,۰۰۰	۰,۷۱۴	۰,۷۱۴	۰,۲۸۶	۰,۲۸۶	۰,۸۵۷	۰,۱۴۳	Optimization of transportation routes	۱۹
۱,۰۰۰	۰,۷۵۰	۰,۷۵۰	۱,۰۰۰	۰,۳۷۵	۰,۱۲۵	۰,۳۷۵	۰,۱۲۵	۰,۳۷۵	۰,۰۰۰	Maximum utilization of transport capacity	۲۰

۰,۵۷۱	۰,۳۳۳	۰,۰۰۰	۱,۰۰۰	۰,۳۳۳	۰,۰۰۰	۰,۰۰۰	۰,۳۳۳	۱,۰۰۰	۰,۱۲۵	Deployment of transportation tools with advanced design technologies	۲۱
۱,۰۰۰	۰,۶۲۵	۰,۱۲۵	۰,۰۰۰	۰,۱۲۵	۰,۵۰۰	۱,۰۰۰	۰,۳۷۵	۰,۷۵۰	۰,۸۷۵	Public transport demand management	۲۲
۱,۰۰۰	۰,۵۰۰	۱,۰۰۰	۰,۸۰۰	۰,۶۰۰	۱,۰۰۰	۰,۸۵۷	۱,۰۰۰	۱,۰۰۰	۰,۲۸۶	Upgrading transportation infrastructure for sustainable development	۲۳
۰,۴۲۹	۰,۱۴۳	۰,۸۵۷	۰,۵۷۱	۰,۴۲۹	۱,۰۰۰	۱,۰۰۰	۰,۲۵۰	۰,۰۰۰	۰,۷۵۰	Motivate citizens to participate in environmental protection programs	۲۴
۱,۰۰۰	۱,۰۰۰	۰,۸۰۰	۱,۰۰۰	۰,۰۰۰	۱,۰۰۰	۰,۱۴۳	۰,۱۴۳	۱,۰۰۰	۱,۰۰۰	Optimize service demand management in the city	۲۵
۰,۱۴۳	۰,۲۸۶	۰,۵۷۱	۰,۴۲۹	۰,۵۷۱	۰,۸۵۷	۰,۱۴۳	۰,۵۷۱	۰,۴۲۹	۰,۸۵۷	Provide training programs to train employees on environmental management characteristics	۲۶
۰,۲۵۰	۱,۰۰۰	۱,۰۰۰	۰,۸۳۳	۰,۳۳۳	۱,۰۰۰	۱,۰۰۰	۰,۷۵۰	۰,۱۲۵	۰,۳۷۵	Establish measurable environmental performance goals for employees	۲۷
۰,۰۰۰	۰,۰۰۰	۱,۰۰۰	۱,۰۰۰	۱,۰۰۰	۰,۳۷۵	۰,۰۰۰	۱,۰۰۰	۰,۳۷۵	۰,۲۵۰	Product sourcing from environmentally responsible suppliers	۲۸
۰,۷۵۰	۰,۸۷۵	۰,۸۷۵	۰,۱۲۵	۱,۰۰۰	۰,۱۲۵	۰,۲۵۰	۰,۷۵۰	۰,۸۷۵	۰,۶۲۵	Make purchasing decisions based on waste management	۲۹
۱,۰۰۰	۱,۰۰۰	۰,۱۴۳	۰,۱۴۳	۰,۱۴۳	۱,۰۰۰	۱,۰۰۰	۰,۰۰۰	۰,۸۵۷	۱,۰۰۰	Collaborate with suppliers to minimize environmental impacts	۳۰
۱,۰۰۰	۰,۰۰۰	۰,۰۰۰	۰,۰۰۰	۰,۲۰۰	۱,۰۰۰	۰,۱۴۳	۰,۲۸۶	۱,۰۰۰	۰,۱۴۳	Provide communication and information platforms to motivate citizens	۳۱
۰,۰۰۰	۱,۰۰۰	۰,۳۳۳	۱,۰۰۰	۰,۲۵۰	۰,۰۰۰	۰,۰۰۰	۰,۱۲۵	۰,۸۷۵	۱,۰۰۰	Creating and strengthening information systems	۳۲
۱,۰۰۰	۰,۲۸۶	۰,۱۴۳	۰,۷۱۴	۰,۵۷۱	۰,۲۸۶	۱,۰۰۰	۱,۰۰۰	۰,۴۲۹	۰,۷۱۴	Implementation of information systems to control and manage the characteristics of environmental management and its performance	۳۳
۰,۱۴۳	۱,۰۰۰	۰,۶۲۵	۰,۱۲۵	۰,۳۷۵	۰,۸۷۵	۰,۳۷۵	۱,۰۰۰	۱,۰۰۰	۰,۱۲۵	Use environmentally friendly media to report and share environmental information with citizens	۳۴

In Table 3, the fuzzy matrix of success is obtained according to the corresponding formula, the interval of which is between zero and one. This matrix is a prelude to the formation of the power matrix that shows the strength of relationships. Next, the success-power relationship matrix is formed based on the third and fourth steps of the fuzzy Shaft mapping method. In this matrix, the rows and columns are the same in number because they contain the variables used, which here form a 34 by 34 matrix. It should be noted that in the fourth stage of fuzzy cognitive mapping after the formation of the power relations matrix, according to experts, many relationships and in fact the figures formed in the matrix can be deleted due to the meaninglessness of the relationship. Based on the opinion of

Experts, this action has been done and as a result, the matrix of power relations is finally as described in Table 4.

Ta**ble 4.** Matrix of power relations

۳۴	۳۳	۳۲	۳۱	۳۰	۲۹	۲۸	۲۷	۲۶	۲۵	۲۴	۲۳	۲۲	۲۱	۲۰	۱۹	۱۸	۱۷	۱۶	۱۵	۱۴	۱۳	۱۲	۱۱	۱۰	۹	۸	۷	۶	۵	۴	۳	۲	۱	items	Variable
۰/۵۰۳		۰/۰۱۶		۰/۰۷۱	۰/۶۶۴			۰/۵۸۷			۰/۱۲۴		۰/۶۵۲		۰/۸۶۵		۰/۰۸۹				۰/۲۲۲	۰/۹۰۴			۰/۸۱۶			۰/۹۱۵				۰/۹۶۰		A	۱
						۰/۱۰۹					۰/۰۲۵				۰/۳۳۰			۰/۱۱۶			۰/۳۰۷	۰/۲۱۱								۰/۱۷۲	۰/۶۴۴		۰/۹۶۰	B	۲
		۰/۲۴۲				۰/۳۸۲							۰/۷۷۰	۰/۹۴۸			۰/۷۹۰													۰/۲۵۷		۰/۶۴۴		C	۳
					۰/۰۰۸								۰/۸۴۲					۰/۵۵۲			۰/۴۵۵				۰/۴۶۱						۰/۲۵۷	۰/۱۷۲		D	۴
		۰/۹۸۳		۰/۸۷۹	۰/۶۲۸					۰/۱۵۶							۰/۱۸۵		۰/۰۲۱		۰/۸۸۷				۰/۹۹۰	۰/۹۶۱		۰/۲۴۶						E	۵
				۰/۵۵۵					۰/۱۰۴		۰/۰۷۲		۰/۲۶۴					۰/۸۸۱									۰/۰۹۵		۰/۲۴۶				۰/۹۱۵	F	۶
				۰/۱۱۲									۰/۱۲۵	۰/۵۴۲			۰/۲۲۹	۰/۵۳۰						۰/۶۶۲				۰/۰۹۵						G	۷
		۰/۲۳۱		۰/۰۳۰									۰/۰۱۰	۰/۳۰۷										۰/۳۴۳	۰/۷۰۳				۰/۹۶۱					H	۸
		۰/۸۶۰															۰/۸۸۴	۰/۰۸۲	۰/۵۸۶							۰/۷۰۳			۰/۹۹۰	۰/۴۶۱			۰/۸۱۶	I	۹
			۰/۱۳۰				۰/۷۴۵					۰/۴۶۷	۰/۶۲۷					۰/۴۴۸		۰/۱۰۰		۰/۰۹۳				۰/۳۴۳	۰/۶۶۲							J	۱۰
			۰/۶۲۸			۰/۸۶۹		۰/۷۶۳			۰/۲۵۰	۰/۴۴۲	۰/۷۶۹	۰/۹۳۲		۰/۱۹۰	۰/۸۵۶			۰/۵۷۴		۰/۲۸۴												K	۱۱
۰/۶۷۸			۰/۹۱۶			۰/۴۱۸					۰/۷۶۲	۰/۴۳۰				۰/۴۴۰		۰/۳۱۴		۰/۶۰۷			۰/۲۸۴	۰/۰۹۳								۰/۲۱۱	۰/۹۰۴	L	۱۲
		۰/۲۲۸		۰/۱۷۰	۰/۰۱۹							۰/۴۳۵	۰/۹۹۵						۰/۶۷۲	۰/۵۰۲									۰/۸۸۷	۰/۴۵۵		۰/۳۰۷	۰/۲۲۲	M	۱۳
				۰/۲۴۱	۰/۰۵۳												۰/۱۲۸	۰/۴۰۶			۰/۵۰۲	۰/۶۰۷	۰/۵۷۴	۰/۱۰۰										N	۱۴
		۰/۹۱۱		۰/۴۹۶					۰/۵۰۶	۰/۱۷۸				۰/۹۷۴							۰/۶۷۲				۰/۵۸۶				۰/۰۲۱					O	۱۵
۰/۹۵۲		۰/۲۶۵					۰/۷۰۸	۰/۲۶۸		۰/۸۸۸						۰/۰۵۶				۰/۴۰۶		۰/۳۱۴		۰/۴۴۸	۰/۰۸۲		۰/۵۳۰	۰/۸۸۱		۰/۵۵۲		۰/۱۱۶		P	۱۶
													۰/۴۱۴			۰/۹۱۳				۰/۱۲۸			۰/۸۵۶		۰/۸۸۴		۰/۲۲۹		۰/۱۸۵		۰/۷۹۰		۰/۰۸۹	Q	۱۷
۰/۴۸۶		۰/۴۷۰										۰/۰۳۵	۰/۶۴۵	۰۹۰			۰/۹۱۳	۰/۰۵۶				۰/۴۴۰	۰/۱۹۰											R	۱۸
	۰/۰۱۳		۰/۲۴۴			۰/۶۲۸					۰/۰۶۵	۰/۶۴۶		۰/۲۲۲																		۰/۳۳۰	۰/۸۶۵	S	۱۹
		۰/۷۶۴		۰/۶۸۹		۰/۳۰۸						۰/۸۶۶	۰/۴۹۰		۰/۲۲۲	۰/۰۹۰			۰/۹۷۴				۰/۹۳۲			۰/۳۰۷	۰/۵۴۲				۰/۹۴۸			T	۲۰
	۰/۲۸۰	۰/۳۰۲		۰/۲۴۷	۰/۲۷۹				۰/۷۲۶			۰/۸۶۲		۰/۴۹۰		۰/۶۴۵	۰/۴۱۴				۰/۹۹۵		۰/۷۶۹	۰/۶۲۷		۰/۰۱۰	۰/۱۲۵	۰/۲۶۴		۰/۸۴۲	۰/۷۷۰		۰/۶۵۳	U	۲۱
									۰/۸۷۲				۰/۸۶۲	۰/۸۶۶	۰/۶۴۶	۰/۰۳۵					۰/۴۳۵	۰/۴۳۰	۰/۴۴۲	۰/۴۶۷										V	۲۲
		۰/۴۸۱					۰/۶۲۸								۰/۰۶۵							۰/۷۶۲	۰/۲۵۰					۰/۰۷۲				۰/۰۲۵	۰/۱۲۴	W	۲۳
																		۰/۸۸۸	۰/۱۷۸										۰/۱۵۶					X	۲۴
۰/۴۹۱		۰/۲۲۱		۰/۸۱۲				۰/۱۷۱				۰/۸۷۲	۰/۷۲۶						۰/۵۰۶									۰/۱۰۴						Y	۲۵
۰/۶۶۰				۰/۱۰۳					۰/۱۷۱									۰/۲۶۸					۰/۷۱۳										۰/۵۸۷	Z	۲۶
		۰/۶۹۳		۰/۱۱۱		۰/۸۳۵					۰/۶۲۸							۰/۷۰۸						۰/۷۴۵										AB	۲۷
	۰/۳۶۵			۰/۰۰۸			۰/۸۳۵							۰/۳۰۸	۰/۶۳۸								۰/۴۱۸	۰/۸۶۹							۰/۳۸۲	۰/۱۰۹		AC	۲۸
	۰/۷۸۱	۰/۶۲۵		۰/۲۰۸										۰/۲۷۹						۰/۰۵۳	۰/۰۱۹								۰/۶۳۸	۰/۰۰۸			۰/۶۶۴	AD	۲۹
		۰/۹۰۹			۰/۲۰۸	۰/۰۰۸	۰/۱۱۱	۰/۱۰۳	۰/۸۱۲				۰/۲۴۷	۰/۶۸۹					۰/۴۶۹	۰/۲۴۱	۰/۱۷۰					۰/۰۳۰	۰/۱۱۲	۰/۵۵۵	۰/۸۷۹				۰/۰۷۱	AE	۳۰
										۰/۷۴۵	۰/۷۵۱				۰/۲۴۴							۰/۹۱۶	۰/۶۲۸	۰/۱۳۰										AF	۳۱
۰/۴۲۴				۰/۹۰۹	۰/۶۲۵		۰/۶۹۳		۰/۳۳۱		۰/۴۸۱		۰/۳۰۲	۰/۷۶۴		۰/۴۷۰		۰/۲۶۵	۰/۹۱۱		۰/۲۲۸				۰/۸۶۰	۰/۲۳۱			۰/۹۸۲		۰/۲۴۲		۰/۰۱۶	AG	۳۲
۰/۸۹۱					۰/۷۸۱	۰/۲۶۵							۰/۲۸۰		۰/۰۱۳																			AH	۳۳
	۰/۸۹۱	۰/۴۲۴							۰/۶۶۰	۰/۴۹۱						۰/۴۸۶		۰/۹۵۲				۰/۶۷۸											۰/۵۰۳	AI	۳۴

As can be seen in Table 4, the principal diameter of the matrix is zero and the matrix is n in n or has the same row and column. While some cells of the matrix are empty, which shows that some of the relationships between the reasons for meaninglessness have been removed with the intervention of experts, and the final and meaningful matrix is presented in Table 4. After determining the power relations that indicate the effect of each variable on the other, the diagram of the desired relations can be drawn using net draw software. This diagram shows the network relationships between the variables and shows which of the variables affected the other and to what extent this effect is.

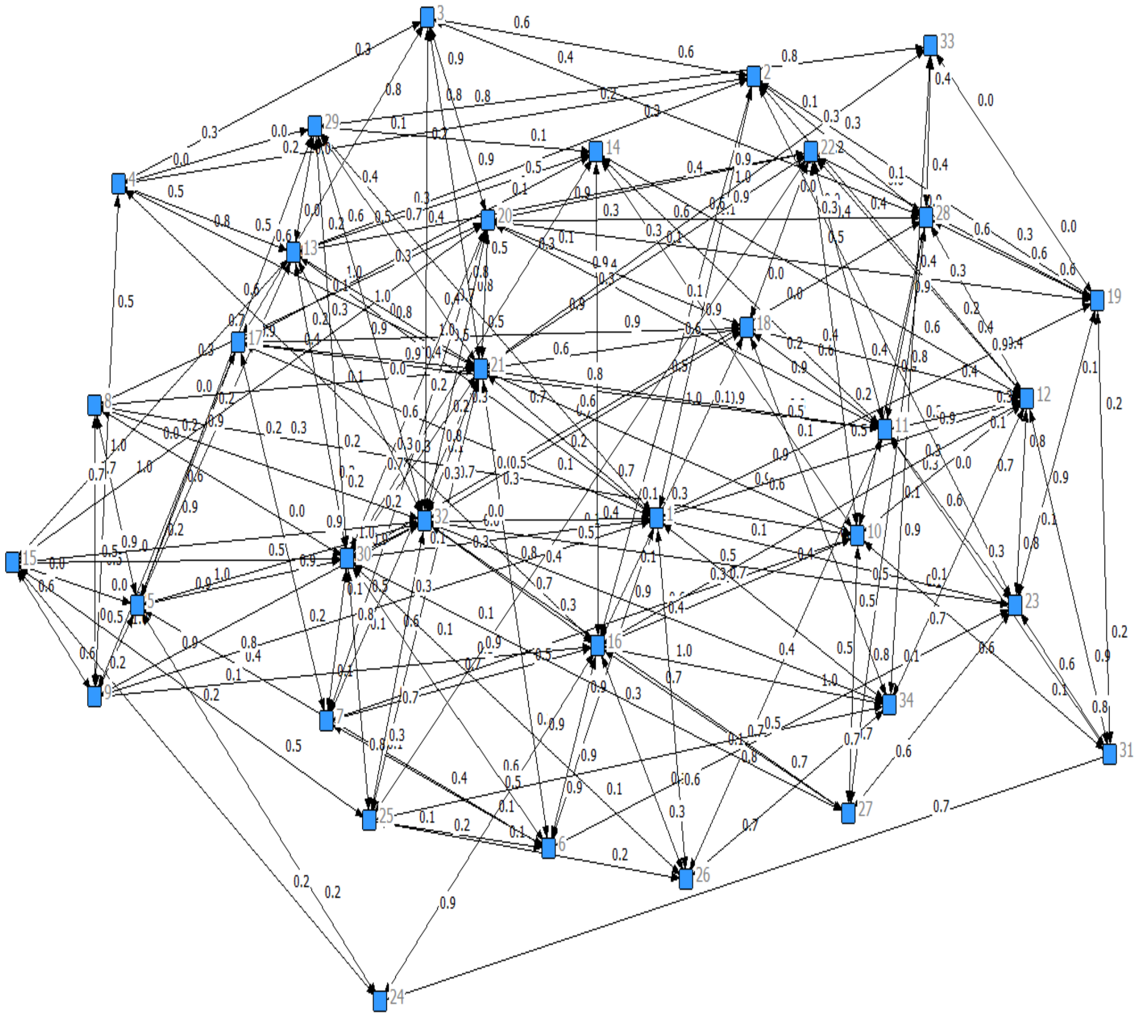

Figure 1. Diagram of causal relationships between research variables with the impact weight of each variable.

After determining the causal relations, it is time to determine the degrees of closeness, intermediate, centrality, and finally the degree of central compliance as the most important criterion for determining the importance of each variable. This is done using ucinet software. The results of ucinet software are as follows.

```
--------------------------------------------------------------------------------
Input dataset:                      alizadeh (C:\Users\hassan\Desktop\alizadeh)
Output dataset:                     alizadeh-cent (C:\Program Files\Analytic Technologies\alizadeh-cent)
Treat data as:                      Auto-detect
Type of scores to output:           Raw scores
Undefined dist in closeness:        replace with max dist + 1

Network Sheet1 is directed? YES

Value of Beta was:                  0.0957714617623781
Centrality Measures
```

	1 OutDeg	2 Indeg	3 OutBonPw	4 InBonPwr	5 Out2Step	6 In2Step	7 OutARD	8 InARD	9 OutClose	10 InClose	11 Between	12 2StepBet
1	14.000	14.000	2828.417	2822.110	32.000	32.000	23.333	23.333	53.000	53.000	53.532	46.419
2	9.000	9.000	1640.666	1632.997	31.000	31.000	20.667	20.667	59.000	59.000	23.592	19.652
3	7.000	7.000	1520.993	1527.316	30.000	30.000	19.500	19.500	62.000	62.000	9.094	8.167
4	7.000	7.000	1453.170	1457.307	32.000	32.000	19.833	19.833	60.000	60.000	8.580	7.133
5	10.000	10.000	1953.878	1969.902	30.000	31.000	21.000	21.167	59.000	58.000	25.835	20.719
6	8.000	8.000	1799.630	1811.406	32.000	33.000	20.333	20.500	59.000	58.000	12.300	10.590
7	7.000	7.000	1601.788	1619.394	33.000	33.000	20.000	20.000	59.000	59.000	6.707	5.950
8	7.000	7.000	1709.735	1729.172	32.000	32.000	19.833	19.833	60.000	60.000	8.877	6.569
9	8.000	8.000	1648.998	1655.731	29.000	29.000	19.833	19.833	62.000	62.000	11.790	10.371
10	9.000	10.000	1628.250	1750.893	32.000	32.000	20.833	21.333	58.000	57.000	31.966	25.400
11	11.000	11.000	1992.458	1963.907	33.000	32.000	22.000	21.833	55.000	56.000	36.548	30.033
12	12.000	11.000	2074.150	1914.204	31.000	31.000	22.167	21.667	56.000	57.000	34.377	28.119
13	11.000	11.000	2428.925	2435.532	32.000	32.000	21.833	21.833	56.000	56.000	26.525	22.571
14	8.000	8.000	1680.144	1677.471	32.000	32.000	20.333	20.333	59.000	59.000	14.362	11.867
15	8.000	8.000	1674.892	1688.550	29.000	30.000	19.833	20.000	62.000	61.000	16.591	12.000
16	14.000	14.000	2290.072	2296.541	33.000	33.000	23.500	23.500	52.000	52.000	86.856	74.402
17	9.000	9.000	1805.206	1806.328	32.000	32.000	20.833	20.833	58.000	58.000	22.790	19.838
18	9.000	9.000	2018.340	2002.947	33.000	33.000	21.000	21.000	57.000	57.000	12.003	10.583
19	8.000	8.000	1322.241	1307.981	31.000	30.000	20.167	20.000	60.000	61.000	21.222	16.533
20	12.000	12.000	2438.577	2445.445	33.000	33.000	22.500	22.500	54.000	54.000	38.810	32.700
21	18.000	18.000	3510.102	3528.062	32.000	32.000	25.333	25.333	49.000	49.000	90.337	83.969
22	9.000	9.000	1845.741	1840.097	31.000	31.000	20.667	20.667	59.000	59.000	17.669	14.933
23	8.000	9.000	1577.573	1626.652	32.000	32.000	20.333	20.833	59.000	58.000	17.945	15.169
24	3.000	4.000	569.856	638.329	23.000	26.000	16.333	17.333	73.000	69.000	4.728	3.500
25	8.000	8.000	1765.331	1770.477	31.000	31.000	20.167	20.167	60.000	60.000	11.933	10.552
26	6.000	6.000	1314.390	1312.377	32.000	32.000	19.333	19.333	61.000	61.000	5.348	4.586
27	6.000	6.000	1312.012	1334.880	32.000	32.000	19.333	19.333	61.000	61.000	6.130	5.050
28	9.000	9.000	1541.523	1569.372	31.000	31.000	20.667	20.667	59.000	59.000	22.467	20.000
29	9.000	9.000	2060.469	2067.245	32.000	32.000	20.833	20.833	58.000	58.000	15.666	12.871
30	16.000	16.000	3180.190	3197.172	32.000	32.000	24.333	24.333	51.000	51.000	66.620	61.774
31	6.000	4.000	883.700	668.365	26.000	21.000	18.333	16.500	67.000	74.000	7.247	5.300
32	17.000	17.000	3419.147	3434.903	32.000	33.000	24.833	25.000	50.000	49.000	75.450	67.590
33	5.000	5.000	966.493	968.751	30.000	30.000	18.500	18.500	64.000	64.000	6.851	6.433
34	8.000	8.000	1605.118	1590.365	33.000	33.000	20.500	20.500	58.000	58.000	16.254	13.652

```
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Running time:  00:00:04
Output generated:  07 Apr 20 18:49:04
UCINET 6.528 Copyright (c) 1992-2012 Analytic Technologies
```

Figure 3. The results of ucinet software to achieve the degrees of proximity, intermediate, centrality, central adaptation of each of the variables.

As can be seen, the significant values determining the importance of each variable are obtained based on the degrees of proximity, intermediate, centrality, and central conformity. It should be noted that the effect of each variable on the normalization result is the amount of central compliance of each extracted variable and the amount of central compliance is the sum of the values of proximity, intermediate and centrality, which are obtained using ucinet software.

- *Simulation*

In this stage, after going through the first stage of quantitative research, we enter the second stage, ie simulation using the system dynamics approach. The results of the fuzzy cognitive mapping method, the result of which is the weight and importance of each of the extracted variables, will be used as input to the system dynamics method. In this step, two diagrams are presented using Vensim software, which is a suitable software for simulation with a system dynamics approach.

The first diagram shows the causal relationships between the research variables based on the studies conducted in the previous sections. These relationships indicate which of the variables can affect the next variable. Some variables are affected by several variables, meaning that several variables may affect one variable or, conversely, several variables may be affected by one variable. The cause and effect diagram of the extracted variables is as follows.

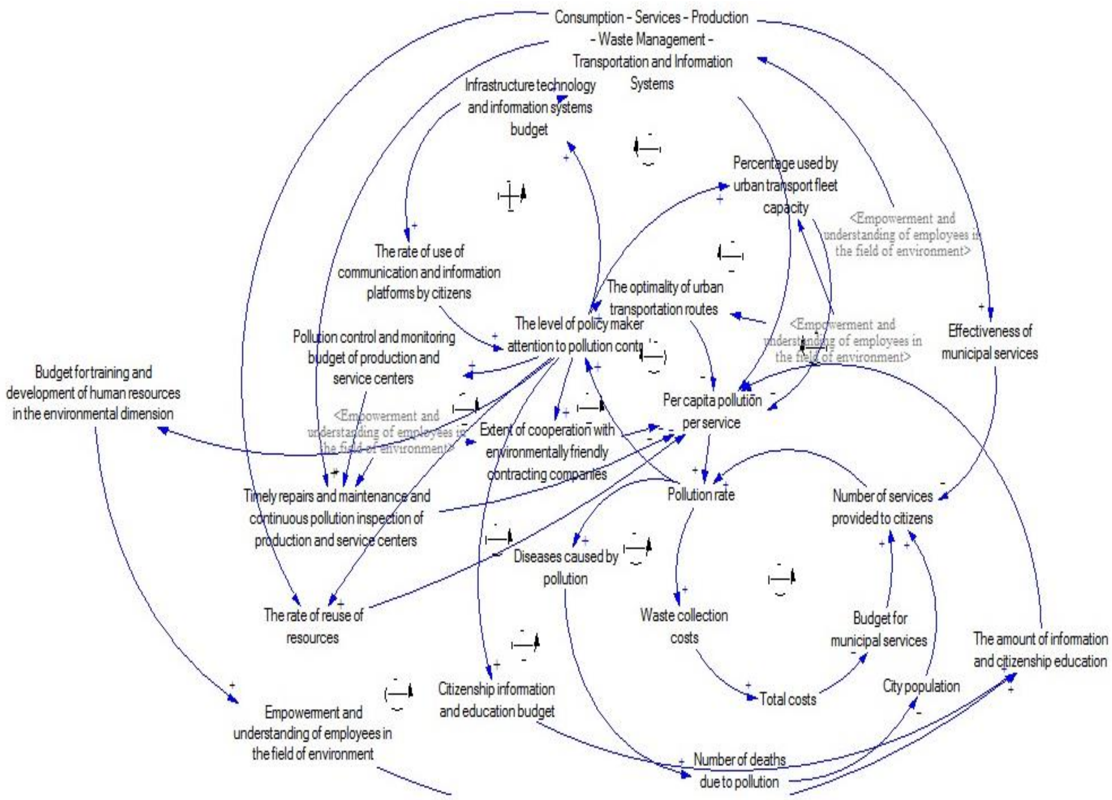


Figure 4. Diagram of cause and effect relationships between research variables.

As shown in the diagram above, for example, with increasing pollution; the level of policymaker's attention to pollution control will increase and in proportion to it, "budget for training and development of human resources in the environmental dimension" will increase and, consequently, "capability and understanding of employees in the field of environment" will increase. This leads to "the amount of information and citizenship education", "timely maintenance and continuous pollution inspection of production and service centers", "the degree of optimization of urban transportation routes", "the degree of cooperation with environmentally friendly companies", "Increase the use of technology in the areas of consumption, services, production, waste, transportation and information systems" and also "improve the percentage of capacity utilization of the urban transport fleet." The variable "The use of technology in the fields of consumption, services, and production, waste, transportation and information systems" is affected by variables such as "Empowerment and understanding of employees in the field of environment" and "Technology, infrastructure and information system budget". It affects variables such as "timely maintenance and continuous inspection of pollutants and production and service centers", "resource reuse", "per capita pollution of each service" and "effectiveness of municipal services".

Also, the variable "per capita pollution of each service from variables such as" rate of optimization of transportation routes "," percentage of capacity utilization of urban transport fleet "," rate of technology use in the areas of consumption, services, production, waste, transportation and " Information systems"," Cooperation with environmentally friendly companies", "Timely repairs and maintenance and continuous inspection of pollution and production and service centers", "Resource utilization rate", effective and on variables such as "Information rate" "Citizenship education" and "pollution level" are effective. These cases can be explained about the other variables related to the green service supply chain in urban management according to the above cause and effect circles. It should be noted that Figure 7 shows the causal relationship. Disability or in other words qualitative analysis is the dynamics of the system of variables studied in the present study and its quantitative analysis is presented in the form of storage and flow diagrams.

In this section, quantitative analysis of research variables is performed using the system dynamics approach. The stock and flow chart above shows this analysis. The chart above shows the current state of the green supply chain in urban management. This chart is based on historical data extracted by the researcher from municipal statistical centers and face-to-face interviews with urban elites. Validation of the above model indicates that the historical data confirms the current data. The following diagrams show some of these cases.

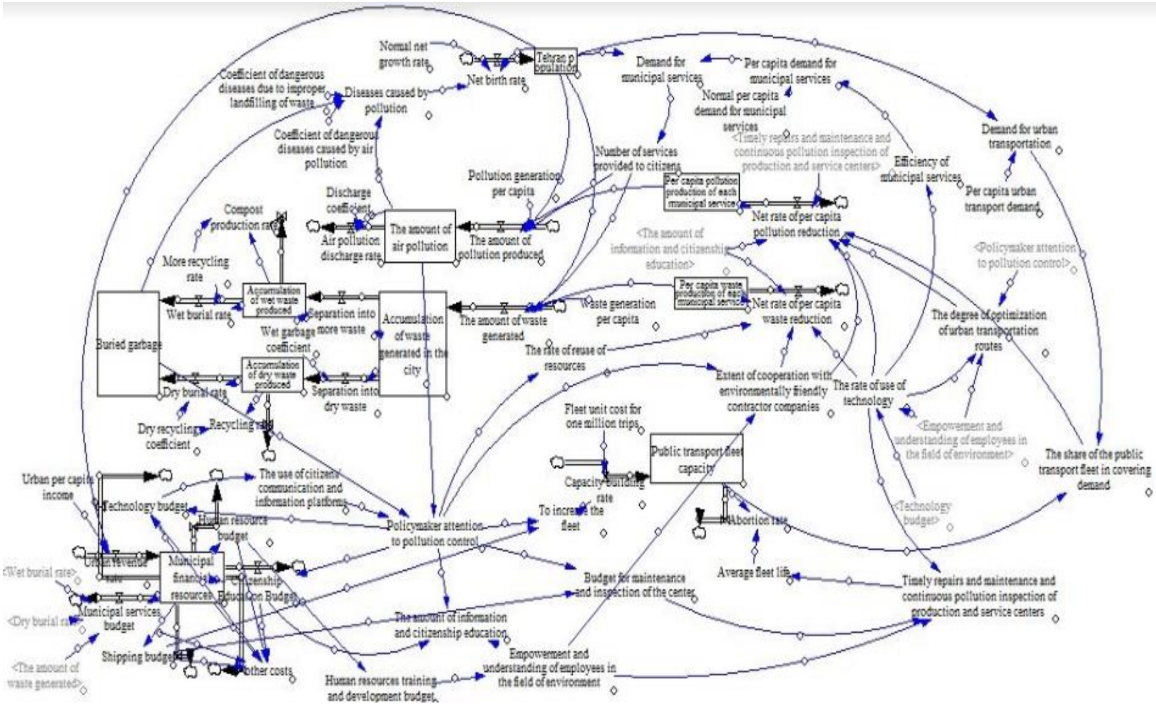
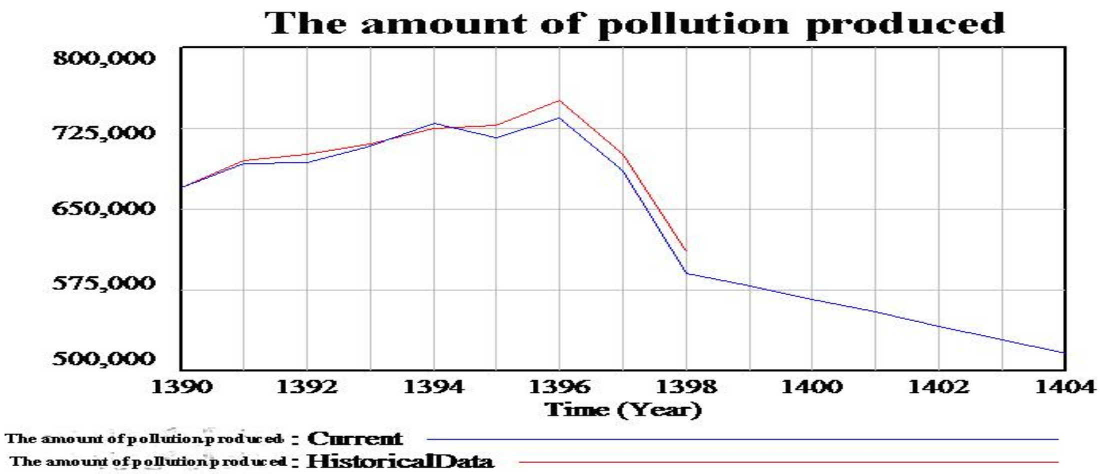
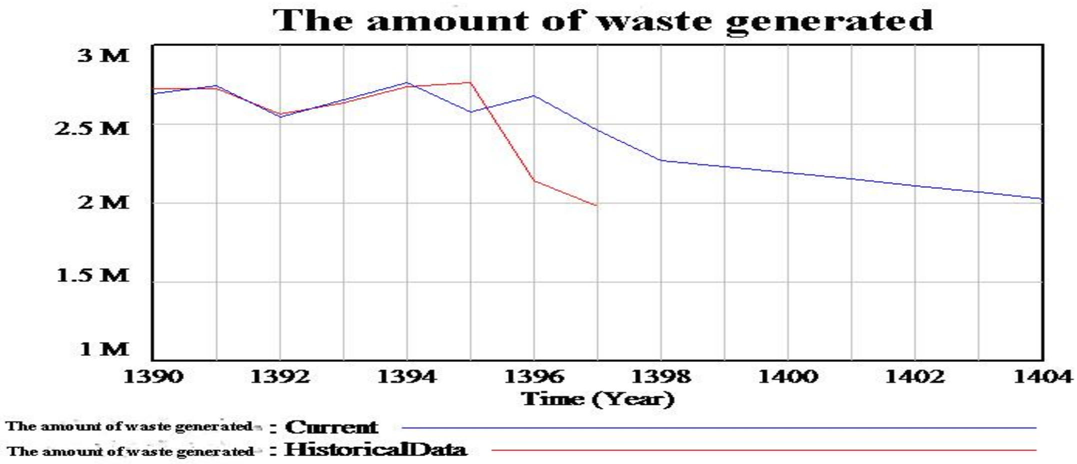


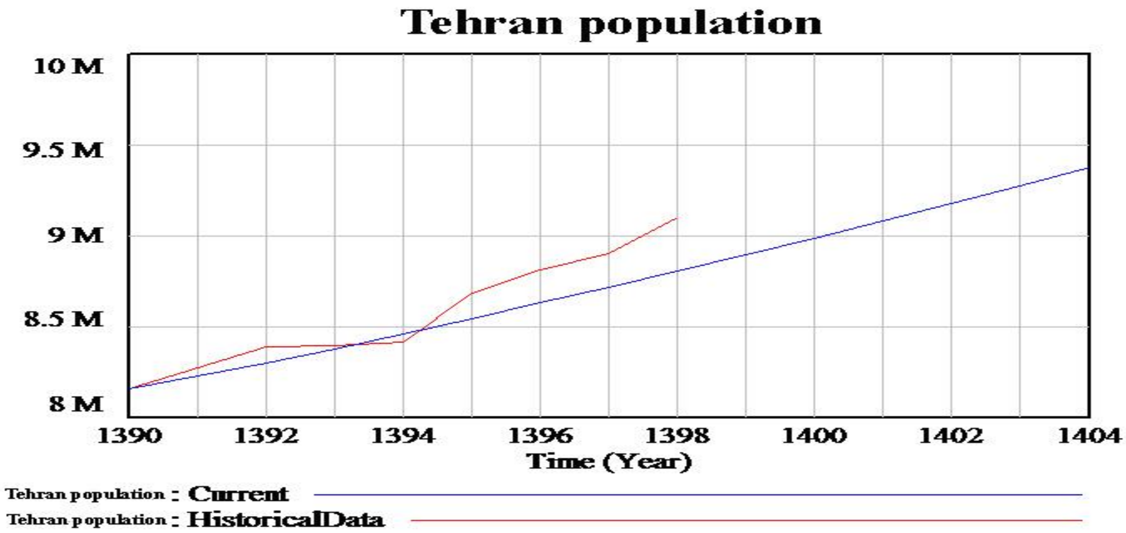
Figure 5. Storage diagram and flow of variables extracted in the research using the system dynamics approach



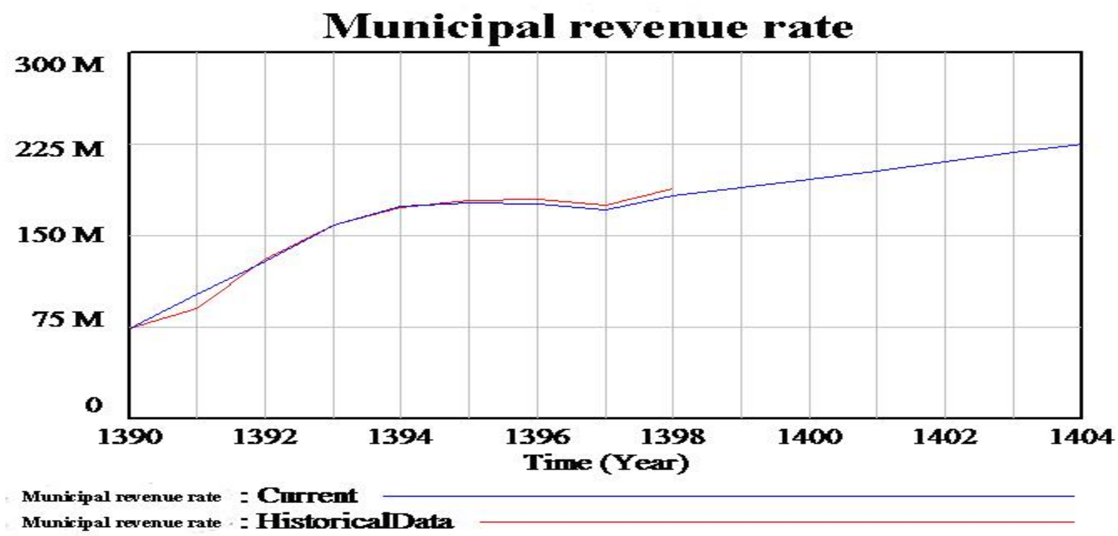
In this diagram, the trend of pollution production according to historical data and current data indicates the approval of the model and shows that in 1404 the amount of pollution produced will reach 520 thousand tons per year.



In this chart, it is observed that according to the studies done in historical data and current data in 1404, the amount of waste produced in Tehran will reach 2 million tons.



Also, in this chart, which shows the population of Tehran during the years 90 to 98 in historical data, according to the current data, the population of Tehran in 1404 will reach 9 million four hundred thousand people.



Also, historical and current data on municipal revenue rates confirm the above model and show that municipal revenue in 1404 will reach 23 thousand billion tomans.

Conclusion

The aim of the present study was to simulate the performance evaluation model of the green service supply chain of urban management. Since both the study and the concept of green service supply chain are almost new concepts, so the present study should be simulated after achieving a performance appraisal model. As a result, an exploratory phase that resulted in the derivation of a green service chain performance evaluation model was considered mandatory. The research was conducted in two qualitative and quantitative steps. In the qualitative step, first, by interviewing, the variables related to evaluating the performance of the green service supply chain of urban management were extracted and then refined using the Delphi technique. Variables extracted from interviews with experts consisted of 48 variables and the final results using the Delphi technique increased this number to 34 variables.

After determining the final variables validated using the Delphi technique, the research entered a quantitative phase. First, the relationship between the variables had to be determined using the fuzzy cognitive mapping approach in order to calculate the importance and power of each variable. Using the above method and using values such as degree of proximity, degree of intermediate degree, degree of centrality and finally the degree of central adaptation, the effect of each of the extracted variables was obtained. The reason for the need for the importance of each variable was its use in the model simulation using the dynamics approach. Then, the final step, namely model simulation, was performed using the system dynamics approach with Vensim software. First, the cause and effect diagram of the relationships between the research variables and then the stare and flow diagram were drawn. Using the simulation, the effectiveness of the model as a green service supply chain model of urban management was evaluated

The results of the present study can be explained based on the performance evaluation model of the green service supply chain. In other words, the present study seeks to explore the extent to which the extracted and presented model can fulfill the menus and necessities related to the environment and greenery in the field of urban management. Simulation of system dynamics as the final stage of the work can well explain the results of the research, which in this section deals with the results in detail.

Based on the findings of the present study, it is observed that the policy maker's attention to pollution control is decreasing with a gentle slope; this position will be worrying in the long run. The simulation results show that the amount of pollution produced as one of the important variables of simulation in this research has a decreasing trend and this issue will reach about 520 thousand tons per year in 1404.

The amount of waste generated was considered as another important variable that is in the category of green service supply chain in the present study. The simulation shows that this variable has a decreasing trend and this issue can be examined from two aspects. One of the important factors is due to unfavorable economic conditions that have reduced consumption over time and can also be due to proper citizenship education to reduce waste production.

Technology budget is affected as another important variable because not paying attention to this issue will increase costs and waste resources. The trend of this variable is increasing with a gentle slope. As explained, technology refers to the extent to which technology is used in the areas of consumption, services, and manufacturing, waste, transportation, and information systems. The budget of this technology is limited in Tehran Municipality, and with the increase of the technology budget, we will definitely see its favorable effects in a very short time.

Budget for training and development of human resources: The trend of this variable over time shows that the budget for training and development of human resources has not increased or decreased significantly (in the scenarios set out below, we will see the effects of increasing or decreasing this variable on the chain Green supply will have urban management).

Empowerment and understanding of employees on the issue of green supply chain: This variable, which is dependent on the variable of training and development of human resources, also has a uniform trend and indicates that if the budget of training and development of human resources increases (decreases), empowerment and understanding Employees will also increase (decrease).

The degree of optimization of urban transportation routes: The amount of this variable is decreasing with a slight slope, which can be an issue for city managers regarding the use of public transportation and the share of public transportation fleet in meeting the demands of citizens.

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