

Presenting a chicken supply chain model based on challenges, success factors and human resource limitations

Omidreza Ali Hosseini^a, Hamidreza Rezaee Kelidbari^{b,*}, Mehrdad Goudarzvand Chegini^b

^aDepartment of Public Administration, Rasht Branch, Islamic Azad University, Rasht, Iran

^bDepartment of Management, Rasht Branch, Islamic Azad University, Rasht, Iran

(Communicated by Sirous Moradi)

Abstract

This research was conducted with the aim of providing a chicken supply chain model based on challenges, success factors and human resource limitations. The information required for the research was collected from 15 experts and managers of poultry farms of Behparvor Group in the whole country and their opinions were obtained through interpretive structural modeling (ISM) interviews with a qualitative approach. In this research, using interpretive structural modeling, an integrated model for the chicken supply chain based on challenges, success factors and human resource limitations was designed. The results of interpretive structural modeling in this research showed the challenges of human resources with the dimensions of not paying attention to employee training, competitors' attempts to attract the company's experts, the nature of hard work, the inability to retain the company's experts, employees' resistance to change and leaving the job. Expert employees of the company as negative factors of the optimal supply chain of chicken production and also, the success factors of human resources with the dimensions of employee training, employee empowerment, employee welfare, job justice, financial justice and attracting and retaining employees as positive factors of the optimal supply chain of chicken production, along with the limitations of human resources with the dimensions of the lack of specialized labor in the labor market, the supply of labor by non-specialists and the lack of financial resources to attract specialized labor as negative factors of the optimal supply chain of chicken production constitute the integrated model of the chicken supply chain based on human resources.

Keywords: supply chain, optimal chicken supply chain, human resources
2020 MSC: 90B06

1 Introduction

In today's world, supply chains for goods and services have become an important part of life, although it may not be so obvious at first glance. What began as small-scale regional trade networks centuries ago have evolved in recent decades into an interconnected system spanning all inhabited continents. The geographic scope and value of supply chains have grown and now have more stakeholders than at any time in the past; Owners and agents with direct financial interests, private citizens who depend on vital goods such as food and medicine every day, and local and national governments who are responsible for providing energy and other services needed by their population [5]. Food

*Corresponding author

Email addresses: omid.hoseiny@yahoo.com (Omidreza Ali Hosseini), hrezaee41@yahoo.com (Hamidreza Rezaee Kelidbari), goodarzvand@iaurasht.ac.ir (Mehrdad Goudarzvand Chegini)

supply chains face challenges of sustainable supply chain management such as waste management and environmental issues. The integration or integration of the system for chicken and poultry production, which is managed by the main companies, is one of the food supply chains to achieve the goals of sustainable development in a poultry supply chain [19]. One of the major elements in management is planning with a human resource management approach. Planning in the field of human resources is the foundation of management elements and a process that organizations combine and integrate in the form of all their activities and efforts regarding the desired goals, the way to reach them and how to go along the path, and the purpose of its implementation is to achieve organizational results. So the management should have proper planning for all the resources under its authority. One of these resources, which is considered a strategic resource for organizations, is human resources, which is one of the most important issues of strategic planning [24]. Organizations are trying to find ways to be flexible and improve responsiveness to remain competitive by changing their operation strategy, methods and technologies, which is noteworthy and reflective in the selection and implementation of the supply chain management paradigm. Today, the use of supply chains in business has become global [23].

Usually, until more than four decades ago, the management and scientific principles used in production organizations were used in service organizations, and the belief that achieving economic scale leads to a reduction of unit costs is considered as the main feature in management decisions. It would be [4]. From the late 1970s onwards, there is evidence of the transfer and application of lean manufacturing concepts to the service sector; Because this approach focuses on cost management and employee activities; Increasing the productivity of the organization has brought with it [6]. Derived from the definitions and principles of the lean approach, lean human resources management is a set of strategic actions that by strengthening the role of the human resources unit, improves the functions of human resources and minimises the waste of employees' abilities and talents, improves financial results and increases customer satisfaction in It follows and follows the supply chain of pure human resources with the aim of meeting the needs of businesses for human resources, by applying the principles of the lean approach in order to employ people aligned with the pure culture in order to make maximum use of their talents and abilities [22]. Getting to know all the nodes in the supply chain of pure human resources, a better understanding of their dynamic behavior and how each element of this chain is related to the overall operation of the organization makes it possible to separate these relationships and understand that their relative importance is constantly changing. It puts management in a position to develop optimal workforce strategies [26].

Supply chain management is considered as one of the most powerful operational paradigms for improving the competitive advantage of manufacturing and service organizations. Organizations claim that people are their competitive advantages, whether in the form of technical experts, experts specializing in providing appropriate services to customers or insightful managers. In today's era, human resources are paradoxically a success or failure factor for all organizations, especially for their entrepreneurial type. Human resources and supply chain management are important in the sense that they are one of the requirements to access competitive advantage in the industry. Therefore, the integration between human resource functions and supply chain management enables the company to have a unique strategy, which will consequently improve the company's performance. Human resources and supply chain are fields of study that were previously studied separately despite the secret link among most business environments. For the first time, due to the importance of the topic, Taylor and his colleagues proposed that the two be investigated simultaneously in the place where the research is conducted. To ensure success in implementing supply chain management, companies need to fully commit themselves to improving human dimensions [16]. In the research literature, it is stated that the effective human resources system is an important factor in the implementation of the supply chain to improve operational performance. Most authors state that human resource management plays a very important role in supporting and as a mechanism to operationalize responsibilities and relationships in the supply chain [14].

Using the method of organized thinking can help to identify the challenges and problems in the supply chain of livestock products and be effective in adopting policies to solve these challenges. Searching for the challenges in the production and distribution of livestock and agricultural products to achieve a competitive advantage and increase the income of activists, requires the identification of the value chain of these products. By identifying the strengths and weaknesses of the food supply chain, policymakers and planners can improve the efficiency of these chains [12]. Nejati et al.[18] found that employees' resistance to change moderates the relationship between dimensions of green human resource management on the green supply chain. This can be one of the dimensions and challenges of the supply chain. Therefore, empowering employees is one of the basic solutions to solve this problem [21].

In terms of macroeconomics and the development process, the category of employment and employing trained human resources is very important. The employment market, like other economic markets, has two sides: supply and demand. Most of which is affected by demographic changes including population growth rate, education and culture of the society. The demand side is also affected by the amount of activity and economic and investment activities such

as agriculture, industry and services. The chicken supply and demand chain can also benefit from this development process of the employment category [11]. Quality management functions such as identifying and training employees, empowering employees and teamwork can improve organizational performance in the industry by affecting supply chain management [17].

Like any other commodity, fluctuations in agricultural products also have consequences for both the supply and consumer sides. A high price leads to a decrease in consumer welfare and a low price leads to damage for producers. Therefore, it is important to know the structure of the production market of these products, and if this structure is accurately identified, excessive price fluctuations in the market's equilibrium value can be prevented by timely intervention. In the broiler chicken market, each of the stakeholders of the market receives feedback from each other and other economic components which leads to the formation of the market structure. For example, as the price increases, the demand for the product decreases and its supply by producers increases. Analyzing the market structure of agricultural and animal husbandry products requires a tool that, in addition to considering various variables, can well model the feedback and reactions that occur by suppliers and consumers [9]. In Iran, due to the lack of pastures and the high rate of use of the poultry industry, and on the other hand, due to the low level of connective tissue and fat in poultry meat and as a result of its digestibility and high nutritional value, the development of the poultry industry to prepare protein from It is of great importance. Based on a general and brief review of the chicken meat supply chain in Iran, this chain has missing critical links based on previous studies. These studies do not calculate the relevant circles accurately [3]. Based on the mentioned contents, this research seeks to provide a chicken supply chain model based on challenges, success factors and human resource limitations.

2 Literature and empirical research background supply chain

Supply chains usually involve separate business organizations rather than just one organization. In addition, a valuable supply chain for any organization has two parts: A supply side and a demand side. The supply sector starts from the beginning of the chain (the beginning of the chain) and ends with the internal operations of the organization. The demand part in the chain starts from the point where the organization's command is delivered to its immediate customer and ends with the final customer in the chain. The demand chain is the sales and distribution part of the value chain. The length and size of each segment depend on where a particular organization is located in the chain; The organization that is closer to the final customer, its demand side is shorter, and its supply side is longer. All organizations, regardless of where they are in the chain, must deal with issues of supply and demand. The purpose of supply chain management is to link all parts of the supply chain so that the market demand is met as efficiently and effectively as possible throughout the whole chain. This requirement is to match supply and demand at each stage of the chain. Note that except for the primary supplier or suppliers and final customers, organizations in a supply chain are both customers and suppliers [13].

2.1 Human resources management

Human resource management is a new term because it has been used since the 1970s. When many people want to refer to this field, they use its abandoned and more traditional titles such as personnel affairs administration, personnel affairs management, and industrial relations. All these words are basically synonymous and can be used interchangeably, and the use of each of them depends on personal taste. However, there are people who believe that the current position of human resource management is very different from the old profession that existed before it. In the era of globalization and rapid advancement of technology, human capital is considered as the most important capital of organizations. Human capital is a collection of skills, knowledge and general characteristics of people in the organization and can indicate the capacity to do work today and the potential of work tomorrow [10].

2.2 Experimental background

Intermediaries and distribute these products to customers. Supply chains exist in manufacturing and service organizations, although chain complexity may vary greatly from industry to industry and from company to company. Organizations can create a competitive advantage by leveraging human resource development to provide a wide range of change-oriented and growing characteristics related to the set of critical characteristics of supply chain managers. Supply chain management decisions are extremely important and have a significant impact on the company's financial performance because 75% of the expected income of organizations is based on supply chain activities. Also, the professional capabilities of human resources development in training and growth, organizational growth and development, and change management, help the organization achieve a deeper understanding of supply chain management and

supply chain managers achieve more success. Human resource development professionals can improve the skills and competencies of supply chain managers. Also, the impact of human resource management on improving responsiveness and product quality and reducing costs in the supply chain. Human resource management also plays a significant role in the implementation of supply chain management. The conducted studies state that factors such as information sharing and strategy formulation play an undeniable role in supply chain management and its implementation. Human resource management measures increase customer satisfaction and increase organizational performance [16].

Haq et al. [8] in a research entitled *Enhancing Supply Chain Learning and Innovation Performance Through Human Resource Management* investigated the effects of high-performance human resource management (HRM) on different types of SC learning (for example supplier, customer and internal learning) and innovation performance. This study uses structural equation modeling to examine the conceptual model based on data collected from 213 manufacturing companies in China. Findings show that empowerment improves all three dimensions of supply chain learning, while it improves learner training, and internal learning and teamwork are not related to any dimension of supply chain learning. Human resource management practices also interactively affect the learning dimensions of the supply chain. In addition, customer learning is directly related to innovation performance.

Pohlmann et al. [19] in their research titled *the role of the focal company in the sustainable development goals: a case study of the chicken supply chain in the Brazilian food market* discussed the role of the focal company to achieve the Sustainable Development Goals (SDG) in the chicken supply chain in Brazil. Contract. The results showed that the agricultural and food focal company has a strategic role in sustainable development. Brazilian chicken supply chains must manage waste and environmental issues. Cooperation and interaction are the strategies of companies to achieve sustainability. Supply chains need guidelines to achieve sustainable development goals. Sustainable Brazilian chicken supply chains use vertical integration.

Acquah et al. [1] in research entitled *examining the link between green human resource management practices, green supply chain management practices and performance* to examine the impact of green human resource management and green supply chain management practices on operational, market, and financial performance. social and environmental issues. This study was conducted using the partial least squares structural equation modeling approach to analyze data collected through structured questionnaires from supply chain and human resource managers in manufacturing and hospitality companies in Ghana. The results showed that green supply chain management practices have a partial complementary mediating role between green human resource management and operational, market, social and environmental performance.

Rajabpour and Afkhami Ardakani [20] investigated the role of green human resources management in the green supply chain in a research titled *the relationship between green human resource management and green supply chain*. The statistical population of the research consisted of about 700 managers, heads, supervisors and experts of Berzoye Petrochemical Company, and the statistical sample was selected based on Morgan's formula of 207 people. The validity of the questionnaire was examined in terms of form, content and structure, and its reliability was obtained by testing it and calculating Cronbach's alpha coefficient, equal to 0.87. The collected data were analyzed using SPSS and LISREL statistical software. The research results showed that there is a strong significant relationship between green human resource management and green supply chain. Also, the research findings showed that there is a positive and significant relationship between the dimensions of green human resource management (green recruitment and hiring, green training and development, green service compensation and green performance evaluation) and the green supply chain variable.

Selgi et al. [22] in research titled *Designing a lean human resources supply chain model: a qualitative research based on foundational data theory* with the aim of analyzing the issue of lean human resources supply chain. This research is a qualitative research based on the foundational data theory, relying on the philosophical foundations of the interpretation school. The statistical population of the research included senior and middle managers and experts from the Ministry of Cooperatives, Labor and Social Welfare and university experts, 19 of whom were selected as members of the statistical sample using a purposive sampling method. The identifiers of the lean human resource supply chain model were collected using semi-structured interviews and analyzed using Strauss and Corbin's three-step coding method (252 key concepts, 43 subcategories, and 25 main categories). Based on the findings of the research, the concept of pure human resources was chosen as the central phenomenon. Causal conditions were placed in the form of two categories of environmental and organizational factors, and the five main categories of preventive planning of demand management, efficiency of search resources, efficiency of evaluation and screening, preparation for recruitment and efficiency of succession system were selected as strategies. Managers' personal characteristics, evaluation of the effectiveness of recruited human resources, candidate's employability were identified as strengthening intervenors and illegal relationships, environmental uncertainty, time pressure for recruitment, inefficiencies of the government management system as weakening intervenors. The degree of purity of organizational culture, playing the

strategic role of the human resources unit, the flexibility and adaptability of managers, the stability of management, the management of career paths, and the availability and limitations of the organization's resources were determined as the background factors and the foundation of the supply chain of pure human resources. Finally, the consequences of achieving the supply chain of pure human resources were determined at three levels: micro, medium and macro.

2.3 Mathematical model of research

The demand for chicken feed including corn and soybean meal (kg) is calculated based on equation (2.1). In this equation, the amount of feed demand is calculated directly based on broiler production values.

$$\begin{aligned} DG(1)t &= TPt * 0.8 \\ DZ(3)t &= DGt * 0.2 \end{aligned} \quad (2.1)$$

On average, each chicken is 1211 grams and each day-old chick is 21 grams, which is necessary to produce one-sixtieth of the weight of each chicken. Therefore, the amount, the demand of day-old chicks is obtained by a simple ratio between the weight of day-old chicks and chickens based on equation (2.2).

$$DC(1)t = TPt/60 \quad (2.2)$$

To calculate the price of each of the goods used for the production of broiler according to the amount of demand for each, the following relationships have been used:

The price of soybean meal

$$PSt = 16000 + DSt/90000 \quad (2.3)$$

The price of corn seeds

$$PZt = 8500 + 4DZt/90000 \quad (2.4)$$

The price of a day-old chicken

$$Pct = 2000 + 5Dct/1000 \quad (2.5)$$

To calculate the wholesale price of chicken meat (Rials per kilogram) using the results of Gilanpour et al.'s study [7] and with a slight change in some coefficients, equation (2.6) has been used.

$$WP(1)t = (0.2 * 2.2 * PZt)0.86 * (0.8 * 2.2 * PSt)0.56 * (Pct)0.9 * 7/10000 + Oct + 9000 \quad (2.6)$$

Considering that the retail price of chicken meat, which is influenced by the ratio of demand to supply, increases with a profit margin of 0.11, it has been obtained [2].

$$RPt = WPt * (D/S) * (1 + 0.11) \quad (2.7)$$

In equation (2.8), the weighted moving average of the price of the same period, the previous period and the previous two periods are used to obtain the forecast price of the next period.

$$PPt = (1/2)WPt + (1.5/4)Pricet - 1 + (0.5/4)Pricet - 2 \quad (2.8)$$

The amount of changes in broiler chicken demand is used from equation (2.9) [2].

$$Drate = 1 + e * (n/100 - Dprice * \epsilon/100 + Pothers * \epsilon_j/100) \quad (2.9)$$

Since the demand is higher in the months close to Eid-e Nowrouz [7] (in equation (2.10)) using a monthly demand coefficient increases near the holidays.

$$De = Dt * Demand \text{ lookup} \quad (2.10)$$

In equation (2.11), the production rate of chicken is calculated as a function of the amount of demand and the ratio of price to production cost.

$$Br = Delay1I(P/C * De, 1, 130000000) \quad (2.11)$$

Finally, the amount of import and export of frozen meat chicken is calculated using the following models.

$$\begin{aligned} It &= \max(De - TCt - YCt, 0) * Pw \\ Et &= \max(TIt + YIt - DT, 0) \end{aligned} \quad (2.12)$$

2.4 Chicken demand at different times

In this model, the amount of expected order (DP) represents the demand forecast for chicken meat. The necessity of defining DP is because it is possible to establish a relationship between the real demand for chicken meat and the desired amount of chicken breeding, and it is calculated in terms of tons per day. In order to adjust the effect of the expected order amount and the openness of the policy maker to change the time period of changing the market demand, the average time variable for the change of 4 demands (ADCT) is used. Finally, the DP mathematical relationship that indicates the total demand at different times can be presented as follows.

$$\text{Expected order quantity} = \int_0^t \frac{(t) \text{Actual demand} - (t - dt) \text{Amount of pending order}}{\text{Average time to change demand}} dt + (t_0) \text{Amount of pending order}$$

Based on the optimal order amount for chicken meat in the previous stage, the optimal amount of production is defined, which is equal to the product of the time (days) of the completion of the production cycle (depending on the opinion of the policy makers and the time conditions of production can be changed) by the amount of optimal breeding. tons) which can be presented as follows.

$$(t) \text{The optimal amount of production} = (t) \text{Optimal breeding rate} * \text{Completion of the production cycle}$$

The following formula will be used to adjust the actual production (tons per day) until reaching the expected and desired production level

$$(t) \text{production adjustment} = \frac{(t) \text{Optimal production} - (t) \text{Actual production}}{\text{Duration of production adjustment}}$$

To obtain the optimal amount of retail inventory, it is equal to the appropriate amount of chicken meat inventory that covers all the expected demand for this product at a given time.

$$(t) \text{Optimum amounts of retail inventory} = (t) \text{Expected order quantity} * \text{Time required to cover demand}$$

80% of the production cost of each kilo of chicken is spent on feed and purchase of one-day-old chickens (DOC). The highest weight in the compositions of poultry farms is related to the two inputs of corn and soybean meal. According to the conversion rate of chicken meat, the conversion rate of feed to live weight, until the end of the period, for each piece of chicken with CW weight, the amount of POF kg of feed will be consumed. The percentage of the total price is related to this input for other factors and inputs that make up the remaining 20% in the cost basket [25]. A fixed amount (Incost) will be considered, which of course can be changed. Finally, the cost of producing one kilo of chicken meat is obtained as follows:

$$COP_{(t)} = \frac{POF(\text{corn}_{(t)} + \text{soy}_{(t)}) + Doc_{(t)}}{CW} + incost$$

2.5 Research questions

The main goal of this research is to provide a chicken supply chain model based on challenges, success factors and human resource limitations. In order to achieve the goal of the research, the following questions must be answered:

1. What are the challenges of implementing the chicken supply chain from chicken production to the final product based on human resource management activities?
2. What are the effective factors in the success of the chicken supply chain from chicken production to the final product based on human resource management activities?
3. What are the operational limitations of the chicken supply chain from chicken production to the final product based on human resource management activities?
4. What is the framework (pattern) of integrated optimization of the chicken supply chain from chicken production to the final product with the process of human resource management activities?

3 Research methodology

The current research is fundamental research in terms of dealing with theoretical foundations. It is also practical research due to providing practical recommendations. Therefore, it can be said that this research is of fundamental-applied type. The present research is exploratory in nature; Below is an issue that has not been addressed in this way and at this level before. For this purpose, a mixed approach was used, the purpose of which is to combine qualitative and quantitative research methods to achieve a suitable method in order to achieve the research objectives. This research is exploratory research. In exploratory research projects, the researcher tries to find out about an uncertain situation. For this purpose, qualitative data was first collected in this research. Carrying out this step leads the researcher to describe countless aspects of the phenomenon under investigation. By using this initial identification, the desired components for designing the model are provided to the researcher. Next, the researcher designs the research model using Interpretive Structural Modeling (ISM).

3.1 The community and sample studied

The statistical population of the current research is all the experts and managers of poultry farms of Behparvor Group in Iran.

In this method, 2 types of sampling have been done:

1. Snowball sampling considering theoretical saturation for interviews with experts: in such a way that sampling continues until no new findings are obtained in the interviews. At this stage, the researcher reached theoretical saturation after interviewing 15 people.
2. Targeted judgmental sampling to use the Interpretive Structural Modeling (ISM) method: Lashkar Baluki et al.[15] in their research (who used the ISM method) stated the number of experts between 4 and 14 people. However, in this method, the same 15 people who were used for the interview were used.

In order to achieve the desired results and perform it properly, the following methods were used:

1. Library studies: library resources were used to compile theoretical foundations, definitions and concepts, which have been the most important and useful source of articles, theses, conferences and books related to the research topic, databases and information sources and libraries of the country's universities.
2. Field research: in order to collect the desired information for "providing an integrated optimization model of the chicken supply chain from chicken production to the final product (with the process of human resources studies)" interview and questionnaire methods have been used.

3.2 Data analyzing method

The correct classification and analysis of data and the correct use of existing techniques will ultimately lead to reliable results. After the researcher has collected, extracted and classified the data and prepared the frequency distribution table and distribution ratios, a new stage of the research process, which is known as data analysis, should begin. The important point in the analysis is that the researcher should analyze the information and data in the direction of the goal, answering the research questions and also evaluating them. Therefore, after the researcher determined his research method and collected the necessary data using appropriate tools, now it is his turn to categorize and analyze the collected data by using appropriate techniques that are compatible with the research method, and finally questions who have guided him in the research up to this stage, put them in the test crucible and clarify their task and finally be able to find an answer to the question that this research was a systematic effort to obtain. Interpretive Structural Modeling (ISM) method has been used in this research, and each of them will be explained below. The steps of using Interpretive Structural Modeling (ISM) include seven main steps that were carried out to reach the final model of the research. These seven steps are; The first step of identifying the variables related to the problem of this stage can be done by reviewing past studies and receiving experts' opinions. The second step; Forming the structural self-interaction matrix after determining the factors, a questionnaire with a matrix format is designed and the experts of these factors are examined in pairs, and the relationships between the factors are determined using the following scale. the third step; Forming the initial access matrix. The initial access matrix is obtained by determining the relationships as zero and one and from the structural self-interaction matrix and in two steps. The fourth step; Creation of the final access matrix After the primary access matrix is obtained, the secondary relations of the indicators are controlled. The secondary relationship is such that if index i leads to index j and also index j leads to index k, then index i will also lead to index k. If this condition was not established in the initial access matrix, the modified matrix and the missing relationships should be replaced; This process is called adapting the

initial access matrix. In this matrix, the power of penetration and the degree of dependence of each variable are also shown. The influence of a variable is obtained from the sum of the number of variables affected by it and the variable itself, and the degree of dependence of a variable is obtained from the sum of the variables that are affected by it and the variable itself. The fifth step; Determining the relations and leveling of indicators in this step, using the final access matrix, after determining the input and output sets, the share of these sets is obtained for each of the factors. The sixth step, drawing the final model. In this step, according to the levels of variables and the final access matrix, a preliminary model is drawn, and by removing transferability in the preliminary model, the final model is obtained. The seventh step; Analyzing the power of influence and the degree of dependence of the graph (MICMAC) In this step, the variables are classified into four groups.

4 Research findings

First, according to the topic of the current research, an open questionnaire was prepared and it became the basis of interviews with experts. The purpose of conducting these interviews was to extract the necessary components for designing the model. By analyzing the collected questionnaires, 19 components were identified in the form of four dimensions.

Table 1: Classification of items in the form of components

Row	Components	Dimensions
1	Lack of attention to employee training	Challenges
2	Competitors' efforts to attract the company's experts	
3	The nature of hard work	
4	Inability to maintain the company's expert staff	
5	Employee resistance to change	
6	Leaving the job of the company's expert employees	
7	Staff training	Success factors
8	Empowering employees	
9	staff welfare	
10	Employment justice	
11	Financial justice	
12	Recruitment and retention of employees	Limitations
13	Lack of skilled labor in the labor market	
14	Provision of labor by non-specialists	
15	Lack of financial resources to attract specialized labor	
16	Increase market share	Optimum supply chain for chicken production
17	Supply chain coordination	
18	Efficiency and effectiveness	
19	Improve performance	

In the first step, the components related to the problem were identified for interpretative structural modeling. First, according to the topic of the current research, an open questionnaire was prepared and given to the experts to express the necessary components for the design of the model from their perspective. By analyzing the collected questionnaires, 19 components were identified in the form of four dimensions. To verify these components, the content relative coefficient (CVR index) was used. All 19 components were approved by experts. Therefore, these 19 components are used to compile the model. The results of applying the content relative coefficient (CVR) are shown in Table 2.

In the second step, to form the structural self-interaction matrix after determining the components, another questionnaire with a matrix format was designed and the experts examined these components in pairs and determined the relationships between the components using the considered scale. The results of the questionnaires about the investigated components are given in the form of Table 3.

In the third step to form the initial access matrix, the initial access matrix is obtained by determining zero and one relations and from the structural self-interaction matrix and in two steps. Table 4 presents the structural autocorrelation matrix.

In the second step, we add the matrix obtained in the first step (Table 4) with the unit matrix to obtain the initial access matrix. By doing this, all the numbers of the main diameter are converted from 0 to 1. Table 5 shows the basic access matrix.

In the fourth step, to create the final access matrix, after the primary access matrix is obtained, the secondary relationships of the components are controlled. The secondary relationship is such that if component i leads to

Table 2: CVR value of each component

Row	Components	CVR value	Result	Dimensions
1	Lack of attention to employee training	1	confirmation	Challenges
2	Competitors' efforts to attract the company's experts	1	confirmation	
3	The nature of hard work	1	confirmation	
4	Inability to maintain the company's expert staff	1	confirmation	
5	Employee resistance to change	1	confirmation	
6	Leaving the job of the company's expert employees	1	confirmation	
7	Staff training	1	confirmation	Success factors
8	Empowering employees	1	confirmation	
9	staff welfare	1	confirmation	
10	Employment justice	1	confirmation	
11	Financial justice	1	confirmation	
12	Recruitment and retention of employees	1	confirmation	
13	Lack of skilled labor in the labor market	1	confirmation	Limitations
14	Provision of labor by non-specialists	1	confirmation	
15	Lack of financial resources to attract specialized labor	1	confirmation	
16	Increase market share	1	confirmation	Optimum supply chain for chicken production
17	Supply chain coordination	1	confirmation	
18	Efficiency and effectiveness	1	confirmation	
19	Improve performance	1	confirmation	

Table 3: The results obtained from the questionnaires

Row	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	0	41	40	45	41	39	19	28	10	26	20	8	7	10	6	42	44	45	45
2	14	0	16	36	15	42	6	8	6	10	10	10	9	12	8	44	39	42	45
3	39	34	0	32	42	41	12	22	23	23	23	16	7	6	4	39	40	45	45
4	12	42	8	0	10	45	5	20	11	20	14	6	11	10	6	42	43	44	45
5	33	40	41	37	0	31	15	26	12	8	7	8	4	10	2	39	42	45	45
6	9	26	6	17	10	0	9	5	4	3	4	10	4	4	3	42	43	44	45
7	22	10	25	26	22	20	0	42	39	25	26	28	14	10	12	39	41	43	45
8	4	2	26	6	16	23	26	0	24	29	28	15	4	4	2	45	45	45	45
9	5	10	11	6	14	20	34	43	0	15	12	10	3	3	3	39	39	42	41
10	2	9	22	5	15	20	40	41	39	0	39	41	2	3	2	42	43	44	45
11	4	10	20	10	12	28	41	42	40	40	0	40	3	3	2	40	41	42	42
12	2	16	3	9	5	12	42	40	42	41	42	0	2	2	3	39	40	41	45
13	3	28	26	27	6	22	10	12	6	19	8	28	0	39	36	38	39	42	45
14	4	27	29	28	10	26	11	22	14	28	19	22	18	0	32	39	38	40	42
15	4	25	22	26	11	23	18	26	20	27	18	25	28	27	0	39	40	41	43
16	5	5	12	6	5	14	15	14	12	14	16	18	4	11	4	0	42	45	42
17	2	3	2	3	2	3	11	16	10	11	9	18	5	3	2	45	0	45	45
18	2	10	12	6	3	4	14	18	16	18	12	14	4	4	7	26	20	0	45
19	3	14	8	8	7	2	18	22	26	23	25	18	7	5	1	28	28	44	0

component j and also component j leads to component k, then component i also leads to component k. If this condition was not established in the initial access matrix, the modified matrix and the missing relationships should be replaced; This process is called adapting the initial access matrix. In this step, all the secondary relationships between the components were checked, but no secondary relationship was discovered. Therefore, the final access matrix is the same as the initial access matrix. In this matrix, the power of penetration and the degree of dependence of each component are also shown. The influence of a component is obtained from the sum of the number of components affected by it and the component itself, and the degree of dependence of a component is obtained from the sum of the components that are affected by it and the component itself.

In the fifth step, the relationships and leveling of the components were determined, which is mentioned in Table 7. This operation is repeated until the constituent components of all levels of the system are determined.

In the sixth step, the final model is drawn. In this step, according to the levels of the components and the final accessibility matrix, an initial model is drawn, and by removing transferability in the initial model, the final model is obtained. Therefore, the final ISM model, which is obtained from the components related to the presentation of the chicken supply chain model based on challenges, success factors and human resource limitations, is drawn as Figure 1.

As it is clear in the figure, components 1 to 6 in the form of "challenges" dimension, components 8 to 12 in the form of "success factors" dimension, components 13 to 15 in the form of "constraints" dimension, and components 16 to 19 in the form of "chain" dimension "Optimum supply of chicken production" are categorized.

Table 4: Structural autocorrelation matrix

Components	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	0	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	1
2	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1
3	1	1	0	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	1
4	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1
5	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
7	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	1	1	1	1
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
9	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	1	1
10	0	0	0	0	0	0	1	1	1	0	1	1	0	0	0	1	1	1	1
11	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	1	1	1	1
12	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	1	1	1	1
13	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0

Table 5: Basic access matrix

Components	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	1
2	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1
3	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	1
4	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1
5	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	1
6	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1
7	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1	1	1
8	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1
9	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1	1	1
10	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1
11	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1
12	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1
13	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
14	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1

In the seventh step, the power of penetration and the degree of dependence (MICMAC chart) were analyzed. At this stage, the components are classified into four groups. The first group includes autonomous components (area 1) that have weak influence and dependence. These components are somewhat separate from other components and have little connection. The second group includes the dependent components (area 2) that have weak influence but high dependence. The third group is the link components (area 3). These components have high influence and dependence. In fact, any action on these components leads to the change of other components. The fourth group is independent components (area 4). These components have high influence and low dependency. Components that have high influence are called key components. It is clear that these components are placed in one of the two groups of independent or linked components. By adding the entries of "1" in each row and column, the power of influence and the degree of dependence of the components are obtained. Based on this, the influence-dependence power diagram is drawn.

To determine the coordinates of each component in the MICMAC matrix, the power of influence and the degree of dependence of that component should be used. These values are obtained from the final access matrix. Table 8 shows the power of influence and the degree of dependence of each component.

Using the coordinates of the components in Table 8, the MICMAC matrix in Table 9 is formed.

As can be seen in the MICMAC matrix, components 16, 17, 18 and 19 are located in the dependent area, which means that they have a low penetration power but a high degree of dependence compared to other components.

Table 6: Final access matrix

Components	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	Penetration power
1	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	1	10
2	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1	7
3	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	1	10
4	0	1	0	1	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1	7
5	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	1	1	1	1	10
6	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	1	1	5
7	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1	1	1	7
8	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	5
9	0	0	0	0	0	0	1	1	1	0	0	0	0	0	0	1	1	1	1	7
10	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1	10
11	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1	10
12	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	1	1	1	1	10
13	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	7
14	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	6
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	5
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	4
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	4
18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	2
The degree of dependence	3	5	3	5	3	6	5	6	5	3	3	3	1	2	3	17	17	19	19	-

Table 7: Final access matrix

repetition	Components	Output set	Input set	Common collection	level
Second	16	17, 16	17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1	17, 16	2
	17	17, 16	17, 16, 15, 14, 13, 12, 11, 10, 9, 8, 7, 6, 5, 4, 3, 2, 1	17, 16	2
Third	6	6	6, 5, 4, 3, 2, 1	6	3
	8	8	12, 11, 10, 9, 8, 7	8	3
	15	15	15, 14, 13	15	3
Fourth	2	4, 2	5, 4, 3, 2, 1	4, 2	4
	4	4, 2	5, 4, 3, 2, 1	4, 2	4
	7	9, 7	12, 11, 10, 9, 7	9, 7	4
	9	9, 7	12, 11, 10, 9, 7	9, 7	4
	14	14	14, 13	14	4
The fifth	1	5, 3, 1	5, 3, 1	5, 3, 1	5
	3	5, 3, 1	5, 3, 1	5, 3, 1	5
Repetition	5	5, 3, 1	5, 3, 1	5, 3, 1	5
	10	12, 11, 10	12, 11, 10	12, 11, 10	5
Second	11	12, 11, 10	12, 11, 10	12, 11, 10	5
	12	12, 11, 10	12, 11, 10	12, 11, 10	5
Third	13	13	13	13	5

Components 1, 3, 5, 10, 11 and 12 are located in the influence area. These components have high penetrating power with minimal dependence. Components 2, 4, 6, 7, 8, 9, 13, 14, and 15 are located in the autonomous region, which means they have little influence and little dependence. Here, the process of interpretative structural modeling to develop an integrated model of the optimal supply chain of chicken production based on HRM ends.

5 Conclusion

Finally, the results based on the levelling of interpretive structural modeling showed that human resource challenges with the dimensions of not paying attention to employee training, competitors' attempts to attract the company's experts, the nature of hard work, the inability to maintain the company's experts, and employees' resistance to change. And leaving the job of the company's expert employees will reduce the market share, coordination of the supply chain, efficiency and effectiveness, and improving the performance of the factors of the optimal supply chain of chicken production. Also, the success factors of human resources with the dimensions of employee training, employee empowerment, employee welfare, job justice, financial justice and employee recruitment and retention increase the market share, supply chain coordination, efficiency and effectiveness, and performance improvement among the factors of the optimal supply chain of chicken production. Limitations of human resources with the dimensions of lack of specialized labor in the labor market, provision of labor by non-specialists and lack of financial resources to attract

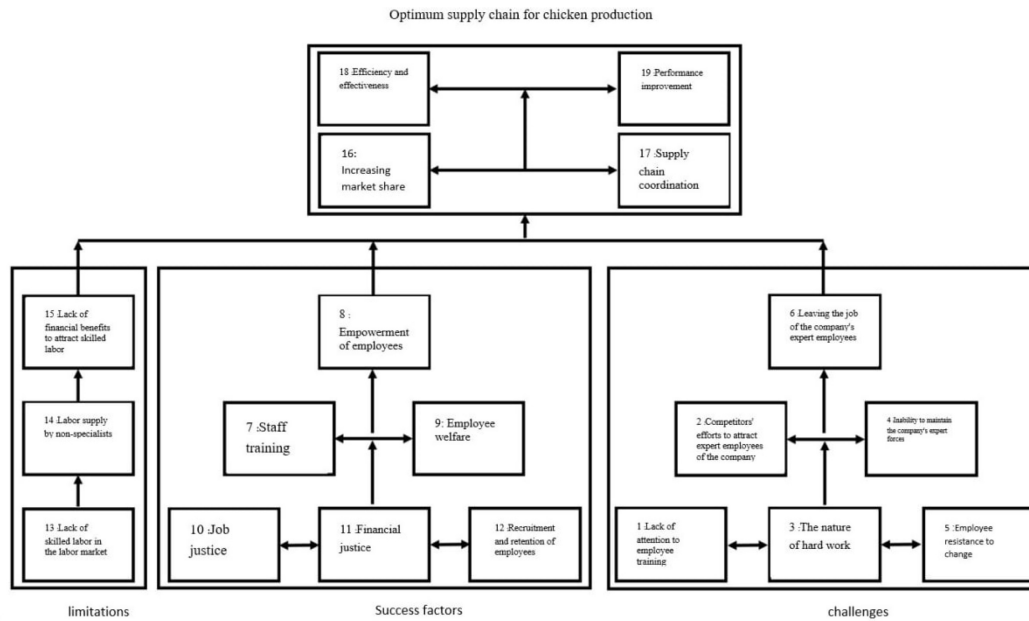


Figure 1: Final ISM model

Table 8: The power of influence and the degree of dependence of each of the components

Row	Components	The degree of dependence	Penetration power
1	Lack of attention to employee training	3	10
2	Competitors' efforts to attract the company's experts	5	7
3	The nature of hard work	3	10
4	Inability to maintain the company's expert staff	5	7
5	Employee resistance to change	3	10
6	Leaving the job of the company's expert employees	6	5
7	Staff training	5	7
8	Empowering employees	6	5
9	staff welfare	5	7
10	Employment justice	3	10
11	Financial justice	3	10
12	Recruitment and retention of employees	3	10
13	Lack of skilled labor in the labor market	1	7
14	Provision of labor by non-specialists	2	6
15	Lack of financial resources to attract specialized labor	3	5
16	Increase market share	17	4
17	Supply chain coordination	17	4
18	Efficiency and effectiveness	19	2
19	Improve performance	19	2

specialized labor lead to a decrease in the market share, coordination of the supply chain, efficiency and effectiveness and improvement of performance are the factors of the optimal supply chain of chicken production. becomes Haq et al. [8] one of the challenges of the supply chain is the lack of learning, i.e. (lack of training of employees), which is a desirable obstacle for the chain. This can be solved through human resource management practices. In some ways, this finding is in agreement with the findings of the present research. Nejati et al. [18] found that employees' resistance to change (challenge) moderates the relationship between dimensions of green human resource management on the green supply chain. In some ways, this result is in agreement with the findings of the present research. Rastgar et al. [21] showed that it is one of the dimensions and challenges of the supply chain. Therefore, empowering employees is one of the basic solutions to solve this problem. The second hypothesis showed that the success factors of the supply chain of chicken production based on human resource management will increase the optimal supply chain of chicken production. Rajabpour and Afkhami Ardakani [20] showed that there is a positive and significant relationship between the dimensions of green human resource management (green recruiting and hiring, green training and development, green service compensation and green performance evaluation) and the green supply chain variable. In some ways, this result is in agreement with the findings of the present research.

- [6] L. Eirian, *Better for Less' Lean Sigma for the Public Sector*, TEAL Consulting Ltd. London, 2013.
- [7] H. Gilanpour, M. Kohansal, Z. Parmeh and E. Ismailipour, *Investigation of government intervention in the chicken meat market*, Iran. J. Trade Stud. **16** (2011), no. 63, 137–168.
- [8] M.Z.U. Haq, M. Gu and B. Huo, *Enhancing supply chain learning and innovation performance through human resource management*, J. Bus. Ind. Market. **36** (2021), no. 3, 552–568.
- [9] J. Heydari, R. Zareyan Mazra'e Khosro, E. Heydari, B. Hezarkhani, and R. Karimi, *Modeling factors affecting price fluctuations in chicken meat supply chain: systems dynamics approach*, Sci.-Res. Quart. Agricul. Econ. Res. **11** (2018), no. 42, 237–262.
- [10] M.A. Hitt, C.C. Miller, and A. Colella, *Organizational Behavior: A Strategic Approach*, John Wiley & Sons, 2006.
- [11] J. Hosseini Dolama, S.A. Saifi Shishvan and E. Farokhizadeh, *Developing an executive model for creating sustainable employment using system dynamics by designing a model for employment development in the supply chain of the country's chicken industry*, Int. Ind. Eng. Conf. Sci. Assoc. Iranian Industr. Assoc., 2015.
- [12] H. Kadirzadeh and P. Alizadeh, *Examining the challenges of the chicken meat supply chain with a systematic thinking approach*, Agricul. Econ. **15** (2021), no. 3, 121–143.
- [13] D. Simchi-Levi, P. Kaminsky, and E. Simchi-Levi, *Designing and Managing the Supply Chain*, McGraw-Hill, 2003.
- [14] S. Lamba and N. Choudhary, *Impact of HRM practices on organizational commitment of employees*, Int. J. Adv. Res. Technol. **2** (2013), no. 4, 407–423.
- [15] M. Lashkar Baluki, S.H. Khodadad Hosseini, S.M. Hosseini, and M.R. Hamidizadeh, *Designing a sustainable strategy process model using a hybrid approach (scientific paper of the Ministry of Science)*, Strat. Manag. Thought **6** (2011), no. 2, 1–21.
- [16] M. Lotfi and M. Ebrahimi, *Investigating the mutual effects of supply chain management and human resource management*, Second Int. Conf. Manag. Account. Econ., Tehran, 2015.
- [17] H. Mehrmanesh and A. Ghasemi, *Investigating structural relationships between total quality management, supply chain management and organizational performance (case study: Manizan factory in Kermanshah)*, Bus. Manag. **10** (2017), no. 38, 137–168.
- [18] M. Nejati, S. Rabiei, and C.J.C. Jabbour, *Envisioning the invisible: Understanding the synergy between green human resource management and green supply chain management in manufacturing firms in Iran in light of the moderating effect of employees' resistance to change*, J. Cleaner Prod. **168** (2017), 163–172.
- [19] C.R. Pohlmann, A.J. Scavarda, M.B. Alves and A.L. Korzenowski, *The role of the focal company in sustainable development goals: A Brazilian food poultry supply chain case study*, J. Cleaner Product. **245** (2020), no. 1, 118–798.
- [20] E. Rajabpour and M. Afkhami Ardakani, *The relationship between green human resource management and green supply chain*, Human Resource Manag. Oil Ind. **11** (2019), no. 44, 317–342.
- [21] A.A. Rastgar, S. Bagheri Qarabelag, M. Keshavarz, and M. Ain Ali, *A reflection on green supply chain management: Examining the role of empowering green employees on green purchasing in green food manufacturing companies*, Bus. Rev. **98** (2018), 30–43.
- [22] Z. Selgi, H. Vahdati, S.N. Mousavi, and A.H. Nazarpuri, *Designing a pure human resource supply chain model: A qualitative research based on data base theory*, Organ. Resource Manag. Res. **10** (2019), no. 2, 95–122.
- [23] X.F. Shao and M. Dong, *Supply disruption and reactive strategies in an assemble-to-order supply chain with time-sensitive demand*, IEEE Trans. Engin. Manag. **59** (2012), no. 2, 201–212.
- [24] A.R. Talebian, *Human resource planning article with a strategic approach*, Tadbir Month. **14** (2012), no. 139. [In Persian]
- [25] Trade Association of one-day chicken, *Poultry industry in 2014*, Tehran, Association of day-old chicken producers, 2014. [In Persian]
- [26] J. Wang, *Path and policy analyses: a sustainability study of military workforce supply chains*, J. Defense Model. Simul. **17** (2020), no. 4, 389–397.