J. Agric. Sci. Technol. (2024) Vol. 26 (2): 259-272

Productivity of Arian Broiler Industry in Kurdistan Province: Integrating ANP and DAMATEL Methods

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ABSTRACT

The poultry industry is one of the most important agricultural subsectors, significantly contributing to protein supply and holding a unique position in terms of production and employment. To expand and boost profitability in this industry, it is important to analyze the economic factors of production, so that the factors influencing the rise in productivity of broiler production units may properly be recognized. As a result, the effective factors on the productivity of the Arian broiler sector in Iran's Kurdistan Province were investigated and prioritized in the current study. In order to evaluate the productivity of the industry, four main factors including human capital, economic, technical, and environmental variables were evaluated. The DEMATEL-ANP integrated approach was then used to determine the relative weights of the factors. The results revealed that the human capital component had the highest impact and the economic component was identified as the most influential factor among the other factors. Furthermore, the economic indicator had the highest priority, with a weight of 0.17. Of the 29 research components (sub-criteria), the "broiler farmer experience", with a weight of 0.042, exerted the greatest impact on the productivity of the province's broiler sector. The "feed cost", "day-old chicks cost", and "health care cost" ranked the second to fourth, respectively. According to the findings, more attention should be devoted to the production chain, such as input production and poultry vaccinations, in order to accomplish and also enhance productivity in the broiler industry.

Keywords: Broiler market, Human capital indicator, chicken meat production.

INTRODUCTION

Rising population growth in developing countries, as well as food insecurity in some parts of the world, have retained socioeconomic policymakers focused on the issue of adequate access to healthy food to meet the population's basic needs (Maisonet-Guzman, 2011). Findings show that a significant portion of the world's population, especially in developing societies, suffers from protein deficiency (Mlambo and Khuwayo, 2021). Protein is a crucial component of human nutrition, especially animal protein, thus its quantity and quality must be acceptable.

The poultry industry is one of the most notable and important sub-sectors of the agriculture sector, accounting for the majority of protein nutritional needs. In Iran, per capita consumption of chicken meat has increased from 22.9 kg in 2010 to 31.26 kg in 2019 (Statistical Center of Iran, 2020). While in the same period, per capita consumption in the world has increased from 12.78 kg to 14.30 kg (OECD, 2020). Also, in the same period, Iranian chicken meat production and the world climbed from 1666 and 100,479 thousand tons to 2,186 and 125,637 thousand

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[DOI: 10.22034/JAST.26.2.259]

tons, respectively, accounting for approximately 1.7 percent of total global production (OECD, 2020). Statistics show that the consumption of chicken meat has increased significantly among Iranians. (FAO, 2019). Figure 1 depicts the evolution of chicken and red meat production in Iran. The massive rise in chicken meat production in recent years shows that a decent percentage of the country's funding goes to this sector. However, according to FAO (2019), the fact that Iran's contribution to world production has decreased shows that this sector is not operating efficiently or at its best. Despite the fact that neighboring countries such as Saudi Arabia (600 thousand tons) and Russia (185 thousand tons) are the major importers of chicken meat (OECD, 2020), the export of this product is not taken seriously and is only imported periodically. Increasing productivity while lowering costs improves the country's competitiveness and exports; while fostering societal welfare may all be accomplished through efficient and optimal utilization of production and existing facilities (EESC, 2018).

Arian is a broiler line with a long history of intensive selection breeding. Few countries in the world hold broiler lines, making it one of the country's unique potentials and lucrative assets. The most essential strategy and the present necessity for the country's poultry sector is to focus on Arian to become more compatible with Iranian local settings and competitive against other globally famous broiler lines that are a hindrance to self-sufficiency. In addition to self-sufficiency and food security, it might yield big return for the poultry sector as well as currency for the country.

Today's broiler farmers aim for maximum output at the lowest possible cost. In conclusion, a comparison of production (2,641,000 ton), number of poultry (386,891,610 piece), and average carcass weight (1950 kg) demonstrates that the major challenge for the country is not the quantity of poultry, but low productivity of output factors, inefficiency of production, and poor management of units, disregarding economic principles, failure to recognize factors affecting production and their relative importance, fluctuations in input and output prices, health and treatment ailment etc. (Statistics Center of Iran, 2020; Motemed and Pourkand, 2011; Haji Rahimi and Karimi, 2009). The literature emphasizes the importance of upstream chains in controlling the price volatility of the downstream chains of the Iranian chicken meat value chain. Thus, reducing reliance on day-old chick imports may protect the country from international shocks (Zamani *et al*., 2021). To boost profitability in this industry, it is necessary to consider the economic aspects of production, so that the factors affecting the increase of production productivity and the broiler market are identified, helping to increase profitability and, as a result, increase investment in broiler production (Zamani *et*

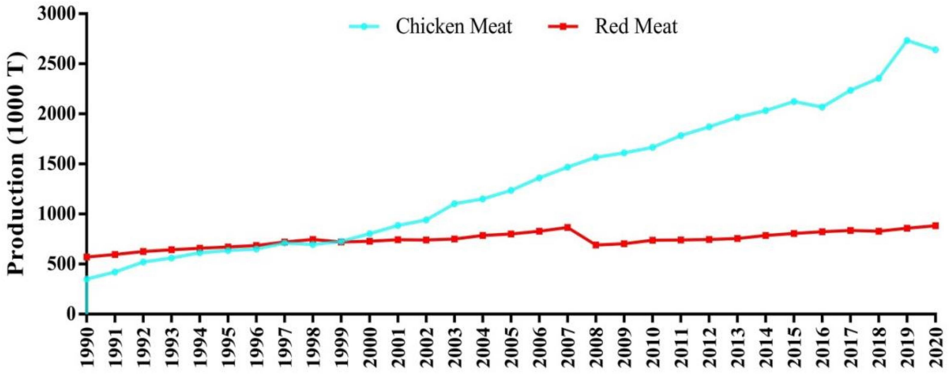

Figure 1. The amount of chicken and red meat production in Iran from 1990 to 2020 (Source: (Statistical Center of Iran, 2020)

[DOI: 10.22034/JAST.26.2.259]

al., 2019). The first step in this regard is to measure and determine productivity so that it may be used to assess the performance of production units. In general, improving productivity in an economic sector or manufacturing unit means lowering the cost of production and the cost price of each product unit (Houedjofonon *et al*., 2020; Maureen, 2016).

Productivity is a broad notion that refers to the efficient use of production resources to produce the most and best output possible, whereas efficiency refers to producing the most output with the least amount of input (Kumbhakar *et al*., 2021). Given the significance of productivity and efficiency to economic activity, it is essential to assess productivity and pinpoint the influencing factors, so that recognizing these characteristics can serve as a reference for planners and broiler farmers. In this regard, many investigations have been carried out to assess the variables influencing the productivity and the units of the poultry sector worldwide.

According to Yusuf and Malomo (2007), broiler farmers became more technically proficient as the number of poultry units increased. Onubuogu (2012), however, perceives poultry farming as a factor that drives efficiency and Aboki *et al*. (2013) consider increased food, capital, and medication as efficiency boosters. According to Haji Rahimi and Karimi (2009), the marginal productivity of broiler feed and labor inputs is 0.13 and 2,250.4, respectively, for a total productivity of 92.3. In another study, Motemed and Pourkand (2011) found that broiler feed, labor, health, and day-old chick inputs all have a substantial impact on productivity. The impact of live chicken selling price and breeding period has been highlighted in Nasrollahi and Asgharizadeh's (2019) study. Ike and Ugwumba (2011) also examined the effects of employment experience, broiler feed, labor, and loan availability factors. Houedjofonon *et al*. (2020) found that over the study period, economies of scale increased but total factor productivity growth decreased. However, according to Sadat Saei *et al*. (2021), the average productivity index has increased. In certain ways, technological advancement has been an effective factor in boosting the productivity of all production factors. Birhanu *et al*. (2021) have demonstrated that the level of technological efficiency in three African countries (Ethiopia, Nigeria, and Tanzania) countries is exceptionally low, implying tremendous opportunities to increase output using available resources.

In terms of capacity, Kurdistan Province is one of the major centers of chicken meat production in Iran, ranking seventh in the country in 2019 with 3.8% of total production. Furthermore, in 2019, the proportion of chicken meat produced in Kurdistan Province was nearly 85,000 tons, with around 52% consumed within the province and the remaining 48% exported to neighboring provinces and central regions. (Kurdistan Agri-Jahad Portal, 2018). The poultry industry in this province, owing to the support of the Agricultural Organization and the collaboration of the province's banks, has now grown to be one of the province's largest and first industries, contributing to the outstanding portion of the province's employment. Given the fact that Kurdistan Province has open border with Iraq, if we aim to improve output by focusing on chicken as a competitive advantage in the province's exports, the factors impacting broiler productivity must be properly recognized and investigated.

According to the studies completed in this area, there is no theoretical consensus regarding the investigated parameters in measuring poultry sector productivity. Indeed, several studies have each zoomed in on particular criteria and indicators, based on which the effect of variables exerting influence on productivity and efficiency has been evaluated. The majority of these studies have focused on the effect of variables such as labor, broiler feed, health, and day-old chicks on output, reporting findings indicating that some factors have a greater impact on the industry's performance. Other findings of the present study demonstrate that

[DOI: 10.22034/JAST.26.2.259]

the total productivity of broiler poultry production factors varies greatly depending on the study location and the technical aspects of production. In all these studies, econometric methods and, in particular, estimation of production functions have been used to estimate productivity. To our knowledge, no detailed investigation has been found to date to identify and prioritize the factors influencing the increase of chicken meat production productivity. To reach the highest degree of productivity, it is necessary to first identify and prioritize the aspects relevant to poultry units based on scientific criteria, then, consider appropriate measures to improve productivity. Furthermore, none of the previous research used the ANP-DEMATEL hybrid model to evaluate the productivity of the industry-influencing components, prompting us to explore this systematically in the current study.

MATERIALS AND METHODS

We conducted a survey to gather data. The sample population includes all Arian broiler units in Kurdistan Province. The information was acquired at random using the unit numbers provided by official organizations. To complete the questionnaire, we conducted interviews with active broiler production units (84 poultry units) having Arian breed from March and December, 2021. Finally, 41 units were chosen as the sample size based on each city's share. The descriptive statistics of numerous major variables of poultry farms are in Table 1. The DEMATEL technique was then utilized to demonstrate the effective and reciprocally influential relationships of the criteria on each other, allowing us to extract the parameters affecting the productivity of this industry. The criteria influencing productivity were discovered and used for weighting and prioritization using the ANP technique. We used MS Excel 2019 software for analyzing data hiring the DEMATEL approach and Supper Decision 2.6.0-RC1 software for ANP method analysis.

Classification of Indicators

To accomplish the research's objective, we evaluated factors affecting broiler unit's productivity in the literature, as well as the opinions of experts and broiler farmers. Overall, the influencing factors are classified into four major groups including human capital, economics, technical, and environmental factors. As shown in Figure 2, various indicators are defined for each factor. Human capital factors are concerned with the demographics and experiences of farm labor, whereas economic factors are concerned with the cost of production. Furthermore, the technical and environmental factors reflect aspects of production technology and ecological indicators, respectively.

DEMATEL Method

Decision Making Trial and Evaluation Laboratory (DEMATEL) is considered as an

Table 1. Descriptive statistics of variables of poultry farmers. [a]

Variable name	Unit	Results of descriptive statistics		
		Max	Min	Mean
Total Production Cost (per piece)	Rial[a]	185800	164751	174000
Broiler unit capacity	Piece	83000	5000	26419
Feed intake	Ton	280	15.5	89.39
Flock age	Day	60	42	51
Labor	Man-day	6	1	2.4
Age	Year	67	32	44.7

[a] Source: Research findings (1 US Dollars equals 385,000 Iranian Rial).

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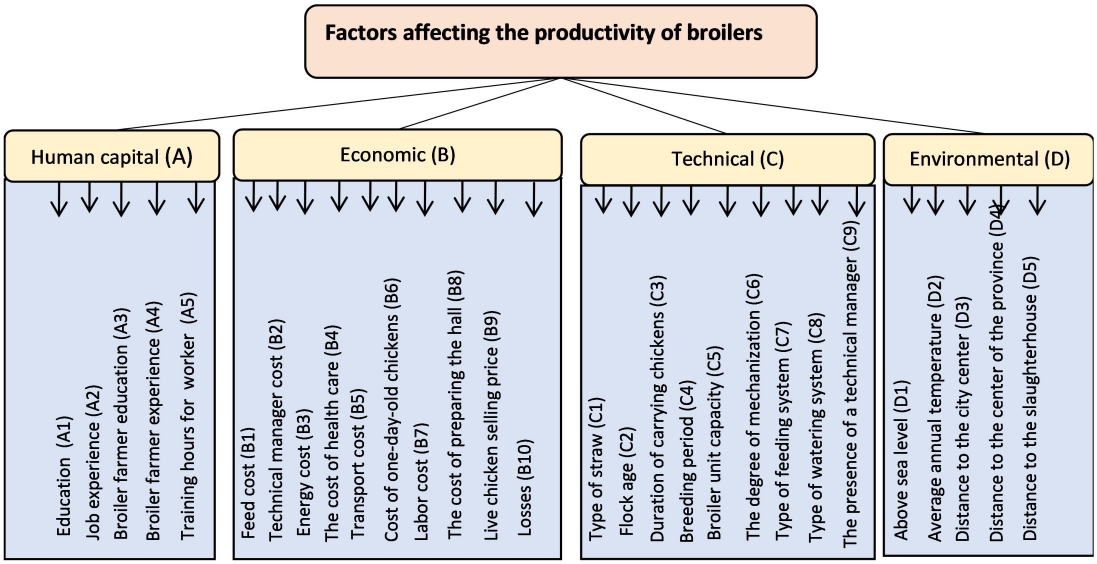

Figure 2. Classification and identification of research indicators and components (Sources: Pun and Hosein, 2007; Haji Rahimi and Karimi, 2008; Romero *et al*, 2010; Adegbite *et al*., 2014; Heidari *et al*., 2011; Nasrollahi and Asgharizadeh, 2019; Ike and Ugwumba, 2021; Hassan, 2021).

effective knowledge-based method developed by the Geneva Research Center for the identification of cause-effect chain components of a complex system. It not only converts factors into a structural model, but also creates both power and influence among factors (Shieh *et al*., 2010). This method can divide the components into two groups based on cause and effect by illustrating the cause-and-effect interaction between the system's components and elements. Causal diagrams are created by plotting pairs in which the horizontal axis represents the intensity of impact and the vertical axis reflects the cause or effect of the factor. If an index is positioned above the horizontal axis, it belongs to the effect group; if it is located below the axis, it conforms to the causal group (Büyükozkan and Güleryüz, 2016; Lin and Tzeng, 2009).

The identity matrix is initially constructed before employing the DEMATEL approach to calculate the Total-relation matrix (T). The resulting matrix must then be inverted after being subtracted from the identity matrix. The normal matrix is then multiplied by the inverse matrix. Then, the threshold value must be calculated to determine the Network Relation Map (NRM). By doing this, incomplete relations can be disregarded, whilst drawing a network of significant relations. Only relations with T matrix values greater than the threshold will be shown in the NRM. The DEMATEL method can be summarized in the following steps (Büyükozkan and Güleryüz, 2016; Salehi *et al*., 2021):

Step 1: Build the Survey Matrix of Respondents

In the first stage, each respondent is asked to identify the direct effect he or she believes element i exerts on elements j. The effect size of criterion i on criterion j, as evaluated by the expert k, is shown as X_{ij}^{k} (Equation 1).

$$X^{k} = \left[X_{ij}^{k}\right]_{n\times n}, \quad i = 1.\ldots.n, \quad j = 1.\ldots.n, \quad k = 1.\ldots.H \tag{1}$$

Step 2: Form the Direct-Relation Matrix (A)

This matrix is derived using the previous step's arithmetic mean of the respondents' opinions (Equation 1). Matrix A represents the average of H responses to each element.

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$$A=\begin{bmatrix} a_{11} & a_{12} & \dots & a_{1n} \\ a_{21} & a_{ij} & \dots & a_{2n} \\ \dots & \dots & \dots & \dots \\ a_{n1} & a_{n2} & \dots & a_{nn} \end{bmatrix} \quad (2)$$

$$a_{ij} = \begin{cases} \cdot & i = j \\ \frac{1}{H}\sum_{k=1}^{H} X_{ij}^{K} & i \neq j \end{cases} \quad . \quad i.j = 1, 2, \dots, n \quad (3)$$

Step 3: Normalize the Direct-Relation Matrix (D)

This matrix is obtained by normalizing the direct relation matrix A.

$$D = S \times A \quad (4)$$

$$S = Min\left\{ {}^{1}/_{Max_{1\le i\le n}\sum_{j=1}^{n} a_{ij}} , {}^{1}/_{Max_{1\le j\le n}\sum_{i=1}^{n} a_{ij}} \right\} \quad (5)$$

In Eq. 5, the sum of the elements from each row i of matrix A indicates the total direct effect that factor i has on other elements, while $Max_{1\le i\le n}\sum_{j=1}^{n} a_{ij}$ shows the direct impact of the factor positing the greatest direct effect on other factors. In addition, the sum of the elements in each column j of matrix A shows the direct effect received by factor j from other factors. $Max_{1\le j\le n}\sum_{i=1}^{n} a_{ij}$ reflects the most important general direct effect received by a specific factor from other factors.

Step 4: Calculate the Total-Relation Matrix (T)

The Total-relation matrix (T) is computed using Equations (6 and 7), where "I" is the Identity matrix (Zhou *et al.*, 2017).

$$T = D + D^2 + D^3 + \cdots = \sum_{i=1}^{\infty} D^i = D(I - D)^{-1} \quad (6)$$

$$T = \left[t_{c_{ij}}\right]_{n\times n} \quad . \; i.j = 1, 2, \dots, n \quad (7)$$

Step 5: draw causal diagram

Following the formation of the total-relation matrix, the sum of the whole matrix's rows and columns, which reflects the cause (R) and effect (C) of each index, is determined. The values R+C and R-C must be determined prior to actually drawing a cause-and-effect diagram (Zhang and Deng 2018). C is the total relation-matrix's column sum, and it indicates how much one index is affected by other indicators (Equation 8). R is the sum of the rows in the total-relation matrix, and it reflects how much one index influences another (Equation 9). (Lee, *et al*., 2013).

$$C = \left[c_{ij}\right]'_{n\times 1} = \left[\sum_{i=1}^{n} t_{c_{ij}}\right]_{1\times n} \quad (8)$$

$$C = \left[c_{ij}\right]'_{n\times 1} = \left[\sum_{i=1}^{n} t_{c_{ij}}\right]_{1\times n} \quad (9)$$

2.4. ANP Method

As quantitative approaches are derived from logical linkages regarding interaction-induced phenomena, they can provide a rational and precise assessment of qualities and interactions. As a result, in this study, the ANP method was used to prioritize the factors influencing productivity. The three main stages of ANP are summarized as follows (Salehi *et al*., 2021):

Step 1: Build the Model (Network Structure Formation)

The initial stage in this method is to determine the relations with respect to criteria, sub-criteria, and alternatives displayed in a graphical network structure. At this stage, correlations can be found both between and within clusters.

Figure 3 shows the structure of internal relation between indicators and research components in the software environment. The reverse arrow in the criteria cluster indicates that the horizontal relationships between the criteria have also been investigated according to the results of the DEMATEL model, causing the structure to depart from its hierarchical form and be evaluated as a network.

Step 2: Form a Pairwise Comparison Matrix and Set Priorities.

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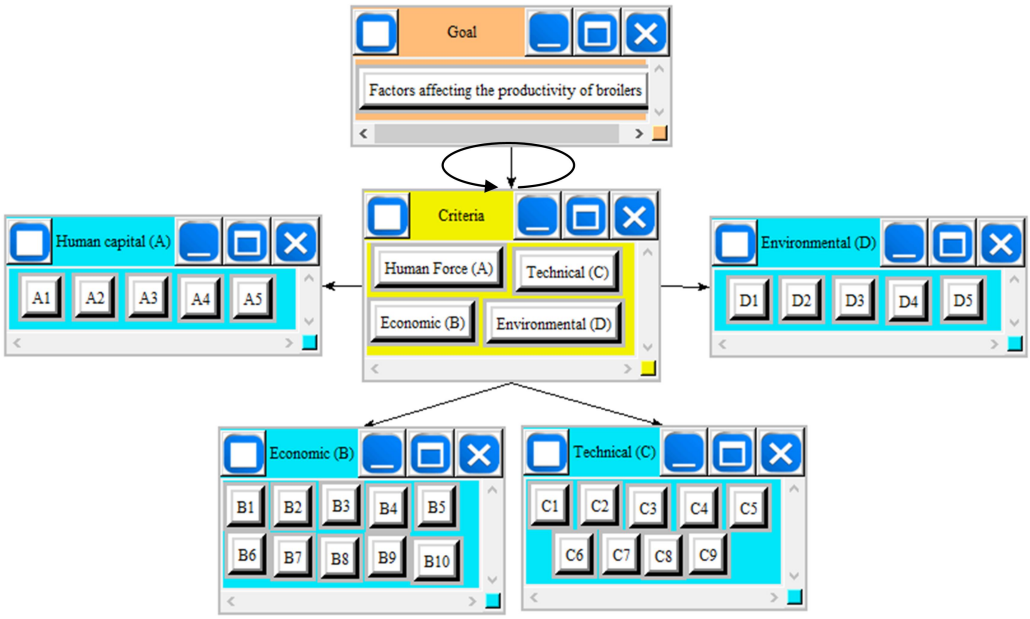

Figure 3. The ANP Model with Super Decision Software (Source: Research findings).

At this point, the broiler farmers' group opinion matrix is created by collecting their opinions via a geometric matrix (Equation 10).

$$x_{ij} = \sqrt[k]{\prod_{l=1}^{k} x_{ijl}},\ i, j = 1, 2, \ldots, n \text{ و } i \neq j, l = 1, 2, \ldots, k \quad (10)$$

The Consistency Index (CI), Random Index (RI), and Consistency Ratio (CR) are all derived using Equation (11). The random index is calculated according to the standard random index table. In addition, CR has to be less than 0.1.

$$CI = \frac{\lambda max - n}{n - 1} \quad (11)$$

$$W' = AW = \begin{bmatrix} w_1' \\ w_2' \\ \cdot \\ \cdot \\ \cdot \\ w_n' \end{bmatrix}, \text{ and } \lambda \text{ max } = \frac{1}{n}\left(\frac{w_1'}{w_1} + \frac{w_2'}{w_2} + \cdots + \frac{w_n'}{w_n}\right) \quad (12)$$

$$CR = \frac{CI}{RI} \quad (13)$$

Step 3: Form Super Matrix and Choose the Best Alternative

The super matrix is obtained by replacing the internal priorities vector (the importance coefficients or the relative weights) of the clusters and elements. The weighted super matrix is then formed by normalizing the un-weighted super matrix so that the sum of each column equals one. The weighted super matrix should be raised to powers in order to cause the matrix's elements to converge before computing the limit super matrix.

Computational Steps of DEMATEL and ANP Integrated Framework

An overview of the combination of the DEMATEL and ANP approaches is shown in Figure 4. According to the diagram, the research flowchart consists of four main stages. In the first step, recruiting questionnaire and reviewing the research literature, indicators and components related to the factors affecting the productivity of the chicken meat industry were identified. In the second step, respondents completed the DEMATEL method's initial questionnaire,

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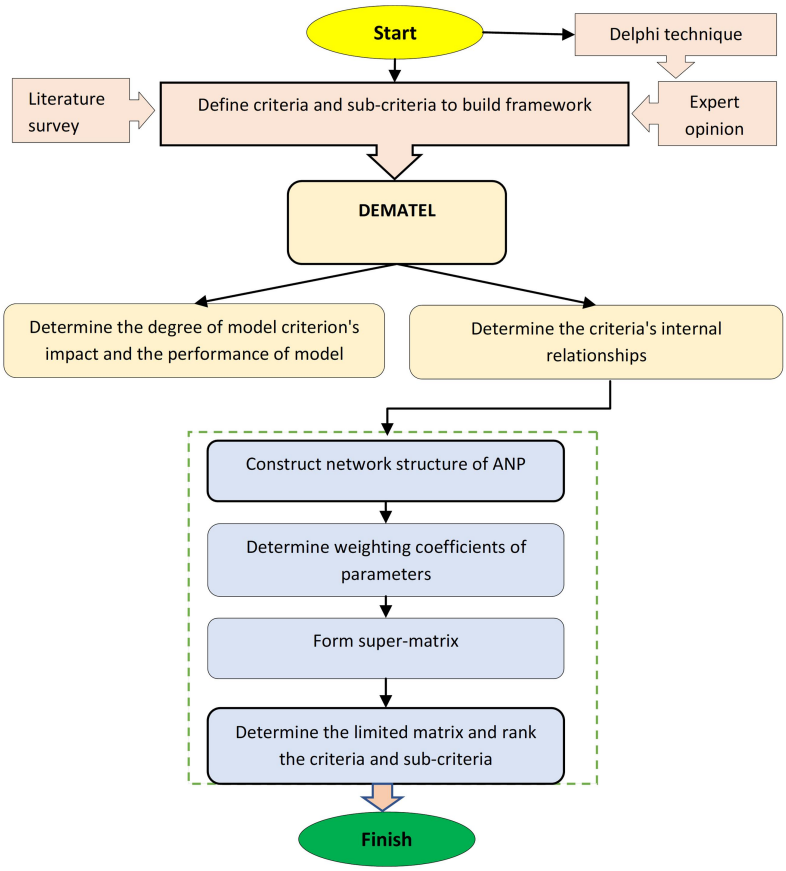

Figure 4. Phases of research process (Source: Research findings).

which was prepared based on research indicators and, therefore, the DEMATEL method's initial direct-relation matrix was created. The questionnaire findings were used to construct the pair-wise comparison matrix in the third phase, and each element's relative significance was estimated. The inconsistency rate index was also controlled at this stage, after which the initial super-matrix formed and the un-weighted matrix, weighted matrix, and limit of super-matrix were calculated. In the fourth stage, each of the sub-indicators of factors affecting productivity was prioritized based on the calculated weights.

RESULTS AND DISCUSSION

We attempted to hire DEMATEL and ANP integrated framework to evaluate four components and 29 sub-criteria with respect to broiler productivity. According to the results, the un-weighted supper matrix was formed and normalized into the weighted supper matrix. The summation of the numbers in each column in weighted supper matrix was 1, signaling that the initial super matrix was weighted. We boosted the weighted super matrix to powers to converge on the limited supper matrix. That is, all of the elements on each level are similar to one another (Figure 5).

According to the research findings in Table 1, the human capital index with the highest R had a significant influence on other indicators. Furthermore, the economic component with the biggest total C denoted the index that was being influenced. Table 2 additionally includes criteria prioritization based on R+C (importance) and R-C (relation) indicators. The R-C index

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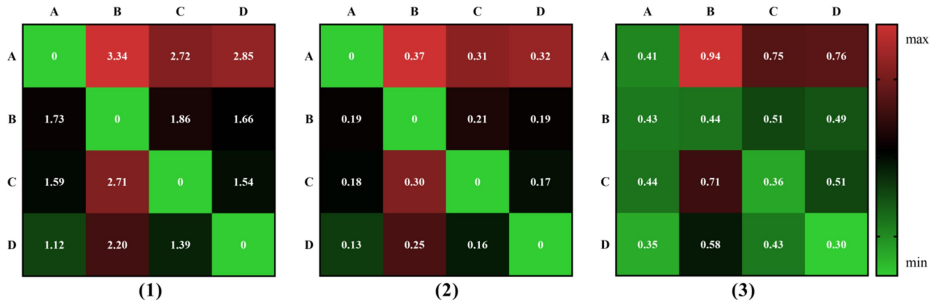

Figure 5. (1) The initial direct-relation matrix (X), (2) The Normalized direct-relation matrix (N), and (3) The Total-relation matrix (T) (Source: Research findings).

Table 2. Cause and effect matrix of the criteria. [a]

Criteria	Code	R	C	R+C	R-C
Human capital	A	2.44	0.00	2.44	2.44
Economic	B	0.51	2.23	2.74	-1.72
Technical	C	1.22	1.25	2.47	-0.04
Environmental	D	0.58	1.27	1.85	-0.68

[a] Source: Research findings.

categorizes the criteria into cause and effect groups. The criterion falls into the causal or influential class if R-C is positive. It is termed affected if it is negative. The R+C index also represents the system's effect size on the desired criterion. In other words, the higher the R+C value of a criterion, the more it interacts with other criteria. Accordingly, the human capital criterion with the highest R-C value will fit under the class of causal criteria, while the economic criterion, which is influenced by other factors, would be extremely affected. If the human capital criterion is upgraded, other productivity criteria will be improved as well.

Figure 6 shows the position of each criterion based on the importance and relation of indicators. According to the results of the total relation matrix, the vertical vector (R-C) represents the cause, and the horizontal vector (R+C) signifies the effect size with respect to each factor.

The internal relations between the indicators were found using the model depicted in Figure 3, which is known as the first stage in the ANP technique. The next section discusses the weighting and prioritizing of research indicators and components employing the ANP technique.

We raised the weighted super matrix to powers to converge in order to compute the limited supper matrix (that is, all the elements of each level resemble the other). The priority of criteria and sub-criteria is presented in Table 3 based on the limit matrix results.

According to Table 3, among the indicators affecting productivity, economic component (B) with a limit weight of 0.1666 has the most importance, and environmental index has the least. In this regard, the broiler farmer experience (A4) with a weight of 0.4168 is at the first place. Also, regarding the economic, technical, and environmental criteria, the components of feed cost (B1), breeding period (C4), and elevation above sea level (D1) ranked the top, respectively. In general, the “broiler farmer experience” (A4) component is regarded as the most important of the 29 sub-criteria. After that, feed cost (B1), cost of one-day-old chickens (B6), and the cost of health care (B4) ranked second to fourth, respectively. These have been recognized as the most important

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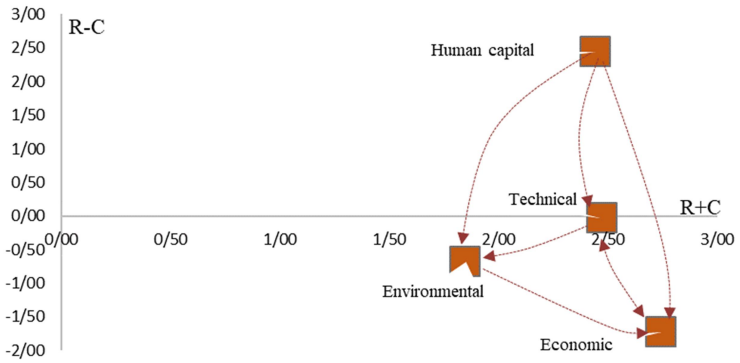

Figure 6. Internal relation pattern of the main criteria of the model. (Source: Research findings).

Table 3. Final output of ANP model for ranking criteria and sub-criteria. [a]

Criteria	Limited eeight	Sub-criteria	Limited weight	Local rank	Final rank
Human capital (A)	0.1063	A1	0.013461	4	18
		A2	0.005645	5	28
		A3	0.023448	2	8
		A4	0.041685	1	1
		A5	0.022145	3	9
Economic (B)	0.1666	B1	0.031812	1	2
		B2	0.006916	8	26
		B3	0.003804	10	29
		B4	0.025252	3	4
		B5	0.007607	7	25
		B6	0.029046	2	3
		B7	0.010028	6	24
		B8	0.006224	9	27
		B9	0.025242	4	5
		B10	0.020747	5	10
Technical (C)	0.1453	C1	0.01086	8	21
		C2	0.02067	2	11
		C3	0.018218	3	13
		C4	0.025224	1	6
		C5	0.017517	4	15
		C6	0.013313	7	19
		C7	0.015065	5	16
		C8	0.014014	6	17
		C9	0.01051	9	23
Environmental (D)	0.0815	D1	0.023788	1	7
		D2	0.018011	3	14
		D3	0.010535	5	22
		D4	0.010875	4	20
		D5	0.018351	2	12

[a] Source: Research findings.

factors affecting productivity of broilers in the province. Generally, these four sub-criteria, accounting for approximately 12.7% of the total factors, are effective with respect to the productivity of broiler in the province, which is essential in decision-making and planning for poultry farms, as well as boosting the performance of this business. Managers and officials must pay special attention to human capital factors, including

[DOI: 10.22034/JAST.26.2.259]

the manager's record as the unit's owner, in order to develop appropriate plans and improve productivity of the poultry units in the region.

Feed intake in broilers is substantially associated with body growth rate and is a key component in determining feeding efficiency. When deciding the type and volume of feed used by poultry owners, they should take into account factors such as target weight, different breeds, disease prevalence, feeding programs, etc. Furthermore, a high feed conversion ratio, significant breeding losses, price volatility of feeders and day-old chicks, and the high slaughter age of most herds raise production costs and make it difficult to compete with foreign products. Unang (2003) states that the productivity and profitability in this industry is strongly influenced by the price of feed and the day-old chicks.

As mentioned before, it is probably not the case that that the current method (ANP-DEMATEL approach) seeks to identify and prioritize indicators affecting broiler productivity, as it is difficult to compare the findings of the current study with other studies. Many studies have measured productivity of the factors of production in the agricultural sector, specifically in the broiler industry, using time series data and econometric models to determine the contribution of each factor of production to total productivity (Haji Rahimi and Karimi, 2008; Motemed and Pourkand, 2011; Asheri and Karimadeh, 2010) as well as the growth rate of these factors over time (Houedjofonon *et al*., 2020; Sadat Saei *et al*., 2021). Haji Rahimi and Karimi (2008) and Motemed and Pourkand (2011) stated in their reports that there was a significant relationship between feed cost and productivity, which indicates the optimality of feed consumption in broiler farms. This optimal consumption has increased the productivity of the farms. According to Ike and Ugwumba (2011), work experience and feed intake are factors influencing chicken meat output. Shaikh and Zala (2011), Adtetola and Simeon (2013), and Aboki *et al*. (2013) found that the Feed costs and its amount exert an impact on production.

CONCLUSIONS

Improving productivity is critical to the growth of Iran's broiler sector. The current study proposed a hierarchical model of the relationship between goals, criteria, and subcriteria in order to discover and expand quantitative evaluation of productivity indicators in the poultry industry. To evaluate empirically various factors and indicators, we developed an integrated framework that included the ANP and DEMATEL approaches. Accordingly, a total of 29 components affecting the productivity of this industry were categorized and organized into four major groups of human capital, economic, technical, and environmental factors. Both approaches used in this study are based on pairwise indicator comparisons. The ANP method is a weighting technique, whereas the DEMATEL method is used to determine the cause-and-effect relationship between variables. According to the DEMATEL results, the human capital criterion was identified as the most significant factor among the analyzed indicators, while the economic criterion was identified as the most influential factor. The ANP results also revealed that the economic criterion was the most important factor, with a weight of 0.167, while the environmental criterion had the least impact on the industry's output. Furthermore, with a final weight of 0.0416, the component "broiler farmer experience" is ranked first among all research components. Sub-criteria feed cost (B1) and breeding period (C4) ranked second and third, respectively, and had the greatest impact on chicken meat productivity in

[DOI: 10.22034/JAST.26.2.259]

Kurdistan Province. Based on the findings of this research, the following suggestions are made to improve the productivity of broiler industry in our case study. In order to make better decisions and increase efficiency, company owners should be able to keep a pretty thorough picture of the interactions between various components. Another critical issue is developing appropriate plans for hiring of technical managers so that their technical competencies can be fully utilized. Holding specialized intensive courses for broiler breeding unit management could be a step forward in this regard. Last but not least, production of feed and poultry vaccines within the province should be focused in order to achieve higher productivity in the Arian broiler sector.

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[DOI: 10.22034/JAST.26.2.259]

بهره‌وری صنعت مرغ گوشتی آرین در استان کردستان: ادغام روش‌های ANP و DAMATEL

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چکیده

صنعت طیور یکی از حیاتی‌ترین زیربخش‌هاي کشاورزي است که در زمینه تأمین پروتئین نقش اساسی داشته و جایگاه ویژه‌اي در تولید و اشتغال دارد. به منظور رشد و افزایش سوددهی در این صنعت لازم است، جنبه‌های اقتصادی تولید در نظر گرفته شود، به نحوی که عوامل موثر بر افزایش بهره‌وری واحدهای تولید مرغ گوشتی شناسایی گردد. با توجه به این مهم، در این پژوهش به بررسی و اولویت‌بندی شاخص‌های موثر بر بهره‌وری صنعت مرغ گوشتی آرین در استان کردستان ایران پرداخته شده است. به منظور ارزیابی بهره‌وری صنعت، چهار بعد اصلی شامل نیروی انسانی، اقتصادی، فنی و محیطی موردبررسی و ارزیابی قرار گرفت. سپس با بکارگیری روش ترکیبی DEMATEL-ANP، وزن‌های نسبی عوامل برای اولویت‌بندی آنها محاسبه گردید. نتایج نشان داد، فاکتور نیروی‌انسانی دارای بیشترین تاثیرگذاری و فاکتور اقتصادی به عنوان تاثیرپذیرترین عامل مشخص شدند. همچنین شاخص اقتصادی با وزن ۰/۱۷ دارای بالاترین اولویت است. از بین ۲۹ مولفه پژوهش (زیرمعیارها)، مولفه «سابقه مدیر مالک واحد» با وزن ۰/۰۴۲ در رتبه اول و بیشترین تاثیرگذاری را بر بهره‌وری صنعت مرغ گوشتی استان داشته است. بعد از آن «هزینه دان»، «هزینه جوجه یکروزه» و «هزینه بهداشت و درمان» به ترتیب در رتبه های دوم تا چهارم قرار دارند. بر اساس یافته‌ها، برای دستیابی و افزایش بهره وری در صنعت مرغ گوشتی استان ، باید زنجیره تولید مانند تولید نهاده‌ها و واکسن طیور بیش از پیش مورد توجه قرار بگیرد.

[DOI: 10.22034/JAST.26.2.259]