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Optimization of Agricultural Activity in Iran to Limit Carbon Emissions Using Leontief Input-Output Model

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ABSTRACT

Identifying and prioritizing the key economic activities has a significant role in economic planning and policy-making, therefore, diverse methods have been developed and presented for this purpose. Besides, nowadays, pollution is also one of the globally critical issues. The aim of this study was to determine the key activities of the agricultural sector by considering carbon emission limitations, using numerical taxonomy methods, demand-driven (Leontief) and supply-driven (Ghosh) models, row and column multiplier, backward and forward dispersion index, carbon emission rate, profitability index and the ratio of water consumption value to value-added. Using numerical taxonomy methods, demand-driven, and supply-driven models, increasing row and column coefficients show that beekeeping and its sericulture activities are at the highest rank. The results obtained by using these models and backward and forward dispersion indexes show that forestry is also a key activity. These results and analysis of carbon emissions data indicate that the sub-sector forestry and beekeeping activities, which are located in the sub-sector of animal breeding, emit less carbon and create high value-added products.

Keywords: Backward and forward linkages, Energy, Numerical taxonomy method, Value-Added.

INTRODUCTION

Determining the primary economic sectors responsible for CO_2 emissions seems to be a fundamental issue for various countries pursuing a reliable, low-carbon economy. While considering the economy-wide implications of any emission reduction, identification of the primary sectors contributing to CO_2 emissions and the interdependencies across economic sectors is also important (Othman and Jafari, 2016). As 90% of this country's carbon dioxide emissions are associated with the energy sector (UNDP, 2010), release of agricultural carbon dioxide is from direct consumption of various fossil energy sources (Yu *et al*., 2020), and requires a necessary policy to deal with pollutants through carbon pricing (Metcal, 2009). Moon *et al*. (2020) believed that a significant worldwide issue is avoiding global warming, which is the result of increase in CO_2 emissions. Coordinated efforts will reduce the emissions of fossil fuels at the global level, and the successful implementation of the carbon emission reduction program needs a better understanding of the emission sources (Reyes, 2009). Green economy can be defined as an economy for creating less carbon, and as an efficient source for protecting the functional capacity of ecosystems and promoting welfare and social justice (Koskela *et al*., 2013). Morilas and Diaz (2008) believed that input-output model could identify the most important key industries in a specific economic area. This strategy not only depends on input-output

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framework and classical links but also depends on economic or technological indicators. Therefore, production and consumption data in all sectors allow the full allocation of all activities to all products, which is a top-down approach (Chatllier-Lorentzen and Sheinbaum Pardo, 2017). One of its advantages is the wider economic impact model for policy analysis. It examines the impact of one sector on other sectors of the economy and studies the interdependence of producer and consumer units in an economy based on their mutual transactions. One of the limitations of the method is its linear behavior, but it is not able to model the optimization behavior of consumers and producers based on price-quantity relationships in markets (Leung, 2006). Furthermore, the technical coefficient is fixed and ignores the possibility of substitution between production factors. In this model, there is no joint production means, i.e. an industry produces only one product. On the other hand, using a rigid model means that it cannot reflect the increase in costs (Kim *et al*., 2020). In this method, Leontif's demand-oriented model establishes a relationship between output X and final demand F, with a certain ratio of data. According to the changes in the gross production of the sector caused by the changes in the final demand of the sector, the economic effects can be measured and indicate industries affect the entire economy through supply and demand relations with other industries. This dependence of demand and supply is called backward and forward linkage, respectively (Chen and Kagatsume, 2018). The posterior links are made from the inverse of Leontief, while the forward links use the inverse matrix of the Ghosh price model (Amores and Rueda-Cantuche 2009). In the Ghosh price model, the linear relationship of distribution between sectors does not change with time (Sun *et al*., 2022), and this model is used to measure resource consumption and pollutant production, including air pollutants, mercury emissions, and carbon emissions. (Nie *et al*., 2022). It is a production model in which production depends on the income as an exogenous variable. This model will be useful for analyzing problems in planned economies with scarce material resources and abundant labor supply (Aroche Reyes and Marquez Mendoza, 2021). The main goal of present study is to optimize agricultural operations according to the limitation of carbon emissions using data input-output analysis.

Also, other studies investigate the prioritization of agricultural and economic operations. Czyżewski and Michałowska (2022) studied the correlation between the amount of greenhouse gas emissions, the value-added of the agricultural sector and economic growth in the countries of the Visegrad group in Europe, including Hungary, Poland, the Czech Republic, and Slovakia during the period of 2008-2019 using the panel model. Their results showed a positive correlation between greenhouse gas emissions and the added value of the agricultural sector and economic growth. Increase in these variables causes the emission of greenhouse gases in the countries of the Visegrad group. The analysis of the environmental efficiency of greenhouse gas emissions in agriculture in relation to the added-value of gross production shows that countries with the least pollution were Hungary, Slovakia, the Czech Republic, and Poland, respectively. Brosh Pagan's test showed that panel models with fixed effects were more accurate than panel models with variable effects for the countries studied by the Visegrad group. Also, based on Iran's input-output Table of 2010, Faridzad *et al*. (2020) analyzed the key energy-intensive sectors of Iran using the analyzed input-output coefficients approach. The results showed that six sectors including electricity production and distribution, crude oil and natural gas extraction, transportation, manufacturing of chemicals and chemical products, services and production of other non-metallic mineral products are among the key energy sectors of Iran, which have the highest values of the posterior and anterior coefficients compared to other economic sectors.

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Marconi *et al*. (2016) examined the Brazilian economy capacities and productive structure utilizing the input-output analysis approach relying on input matrices from 2000 to 2009 and found that agriculture, minerals, and non-tradable industries demonstrated the lowest potential to stimulate the economy. Besides having fewer multipliers, the Backward Linkages (BL) indexes for such industries are low since their supply networks seem small. In contrast, Forward Linkage (FL) indicators are fundamental for the most contemporary and dynamic service industries. Miscellaneous, mineral, and agricultural commodities have the least multipliers among the trading sectors. Employing input-output analysis, Tounsi *et al*. (2013) investigated important economic sectors in Morocco and reported that the data demonstrated the ordering changed from 1998 until 2007. In last two years, both the food and tobacco industries ranked key sectors among the major ones. Petroleum and many other energy products, real estate, renting and services to organizations, different non-financial activities, fishing, and aquaculture sectors seem to be the less connected throughout the economy. Employing the input-output chart for 2004, Botrić (2013) highlighted the main key sectors in Croatia and reported that all utilized techniques point to 40 (electricity) and 45 (construction), with significant BL. FL is associated with food production (01 and 05) as well as tobacco manufacturing (16); nevertheless, food processing (15) has considerable amount of BL. According to the findings, industries with more incredible connections to the remainder of the Croatian economy do not have much success with exports. Danielis and Gregori (2013) examined the port system's significant economic and industrial features in Italy's Friuli Venezia Giulia Region, employing the input-output technique. The input-output model estimates how production, employment, and income fluctuate in response to alterations in final demand (consumption by the private or public sector, investment, exporting, or inventory change). A unit variation in the average FVG port system's final demand seems to have a 3.15 production multiplier impact on the national economy. Nevertheless, the moderate impact on the economy of the FVG is the 1.34-output effect. Whenever final demand grows by one-unit, national income rises by 1.18 units on average. In addition, Czyżewski and Grzelak (2007) investigated the situation of agricultural households in Poland, after 1990, using the input-output model. Their results showed that the effective communication between the agricultural sector and other sectors was decreasing. On the other hand, the effects on agricultural sector are mainly transmitted by the price system and lead to limitation of income generation in this sector. In Poland after 1990, the structural factors in the input-output mechanism have influenced agricultural development to some degree. Leontief (1936) by examining quantitative input-output relationships in the United States economic system concluded that most of the 44 main table accounts include 4 production accounts: (1) Agricultural sector, (2) Industry sector, (3) Mining sector, and (4) Transportation department (railway) and electrical installations. According to Leontief's theory, all manufacturing companies should be divided into a number of homogeneous industrial groups, in which homogeneity is defined in terms of (a) the identity of the products and (b) the qualitative and quantitative similarity of the cost structure of the companies within each group. This is a description of the flow of goods and services as they enter the economic enterprise (or household) from one side and exits from the other side. Therefore, to understand the economic structure of an economic enterprise and evaluate its future development prospects, an approximate knowledge of the account of expenses and partial income is more important than the most accurate information related to net income or deficit.

Studies on the prioritization of different activities and sectors have been performed

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by limited methods and require more research on the prioritization of agricultural activities. Furthermore, previous studies have not been prioritized according to the carbon emission limitation. This study aimed to use different input-output methods with taxonomic and economic approach based on the limitation of carbon emission, using the data table of the Iranian Statistics Center and the statistics and information of the Ministry of Energy.

MATERIALS AND METHODS

A complete statistical analysis of an economy may be found in an input-output Table by using direct input coefficients and accounting for the interconnectedness of various economic activities as indicated by the Leontief inverse coefficients (Kamaruddin *et al.*, 2008). Different methods of prioritizing agricultural activities in the input-output model are available. One of these is Taxonomy approach, which is one of the most common methods of prioritizing markets based on several indicators (Brewer, 2001). The calculation of F_i (rating or ranking of the degree of development) in the taxonomic method is calculated using the following formula:

$$F_i = \frac{C_{io}}{C_o} \quad [1]$$

Where, C_{io} is pattern of development and C_O (upper limit of the pattern of development) is obtained from the following relation:

$$C_o = \overline{C_{io}} + 2Sd_{C_{io}} \quad [2]$$

Where, $\overline{C_{io}}$ and $Sd_{C_{io}}$ are the mean and standard deviation of C_{io}, F_i indicates that every activity fluctuates between zero and one, closer to zero, the more developed that activity is, and the closer to one, indicates the more undeveloped (Ziari, 2008).

Profitability Indicators

In this section, eight profitability indicators are introduced and presented.

The first indicator is the ratio of revenue to service compensation.

$$X_1 = \frac{B_i - c_i}{W_i} \quad [3]$$

Where, B_i is the *i*-th activity output value, C_i is the *i*-th activity production cost, and W_i is the *i*-th activity service compensation. This index directly indicates profitability and shows the amount of profit earned per unit of service compensation.

The second indicator: is the ratio of value-added to compensation for services.

$$X_2 = \frac{B_i - C_0^i}{W_i} = \frac{VA_i}{W_i} \quad [4]$$

Where, VA_i is the *i*-th Activity Value-added, and C_0^i is the *i*-th activity input value. This indicator indicates the profitability of activities.

The third indicator is the output to input ratio.

$$X_3 = \frac{B_i}{C_0^i} \quad [5]$$

This index indicates the profitability of each production activity; with the increase of this quantity, the amount of profitability also increases (Bidabad, 1983).

The fourth indicator is per capita production of employees

$$X_4 = \frac{VQ_i}{L_i} \quad [6]$$

This index is defined as the ratio of outputs to employees. VQ_i is the Value of the output of each activity, and L_i is the total number of employees in each activity.

The fifth indicator is competitive power:

$$X_5 = \frac{VA_i/L_i}{W_i} \quad [7]$$

The more competitive a production activity is, the more profitable it will be. This index shows how much productivity and value-added per capita has been created for *i*-th factor for each service compensation unit (Bidabad, 1983).

Indicator 6 is labor productivity:

$$X_6 = \frac{VA_i}{L_i} \quad [8]$$

Productivity is one of the criteria for evaluating the performance of activities in various economic and social sectors. VA_i is Value-added activity (Million Rials= 4 dollors) and L_i is total number of employees.

Index 7 is serviceability:

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$X_7 = \frac{VA_i}{VP_i}$ [9]

This Indicator is obtained from the value-added ratio to the output value of that activity.

The eighth indicator is the ratio of income to expenses:

$X_8 = \frac{B_i}{C_i}$ [10]

This Indicator is directly related to the profitability of economic activities. For this index, due to statistical limitations, instead of income (Y), the total output value of each activity is used (Bidabad, 1983).

Demand-Driven (Leontief) and Supply-Driven (Ghosh) Models

Total backward linkages are determined by summing the columns of the Leontief inverse matrix, BLt, notably: $BL_t = \sum_{i=1}^{n} L_{ij}$. and total forward linkages are calculated by summing the rows of the Leontief inverse matrix. Symmetrically, FL_t as $FL_t = \sum_{j=1}^{n} L_{ij}$. L= $[L_{ij}]$ is the Leontief inverse matrix (Hazari, 1970).

Row and Column Multiplier Method

Input-output information is displayed for zero and the first year, then, the coefficient matrix for the year zero can be calculated. If it is assumed that there is no technical change, the first-row coefficients can be calculated by applying these coefficients to first-year outputs. In the next steps, the total number of rows and columns must be adjusted many times, and this will continue until there is no need to adjust (Anonymous. 1997).

Later and Former Dispersion Indexes

The average backward multiplier of sector j is given by $B_{0j} = \sum_i \frac{b_{ij}}{n}$, where bij denotes the Leontief inverse matrix components, and n signifies the range of companies. Likewise, the average forward multipliers as $B_{i0} = \sum_j \frac{b_{ij}}{n}$ was calculated. The backward and forward coefficients of variation can be calculated and defined as follows:

$V_{0j} = \sqrt{\frac{1}{n-1}\sum_i (b_{ij} - B_{0j})^2} / B_{0j}$ And $V_{i0} = \sqrt{\frac{1}{n-1}\sum_j (b_{ij} - B_{i0})^2} / B_{i0}$

The coefficients of variation were normalized:

$V_{0j}^N = n\, V_{0j} / \sum_k V_{0k}$ and $V_{i0}^N = n\, V_{i0} / \sum_k V_k$ (Humavindu and Stage, 2013).

The power of dispersion index measures the intensity of direct and indirect dispersion by assessing the influence of one industry's unit final demand increase on output of various economic sectors. The dispersion index's complements the dispersion index's sensitivity. The more input a section generates for other sections, the higher its sensitivity index. If a part has a high sensitivity index, it means that part was a necessity (Rasmussen, 1956). Table 1 shows the categorization of the economy's productive system.

RESULTS AND DISCUSSION

In this study, to accomplish the goals, an

Table 1. Classification of the production system of the economy (Miller and Blair, 2009).

Output Input	≥ 1 previous link of intermediate goods	1< Previous link of final goods
≥ 1 Poster link of industrial goods	First group: Intermediate production	Second group: Final production
< 1 Posterior link of primary goods	Third group: Production of primary intermediaries	Group 4: Initial final production

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attempt was made to use the studied agricultural activities to be determined in Iran, based on methods such as taxonomy, Leontief demand-driven, and Ghosh supply-driven, row and columnar multipliers, later and former dispersion indices, carbon emissions and the ratio of water consumption value to value-added and output. First, the results of the numerical taxonomy method based on the eight selected indicators for 2018 are expressed. The mean (μ) and standard deviation (δ) of the indicators used to prioritize Iran agricultural activities have been calculated by forming the input matrix. Then, the standard (normalized) matrix was determined as the largest observable positive number (positive ideal) for each of the positive indices and the largest negative number (negative ideal) for the negative indices was displayed by DOj (Table 2).

In the homogenization of options, the results of the shortest distance vectors are shown in Table 3. Since the amount of upper and lower bounds are calculated equal to d (+)= 4.751 and d (-)= -0.131, the homogeneity distance is -0.131< d< 4.751. It should be mentioned that all activities were located between the upper and lower limits. According to calculation results, the shortest distance is related to sugar beet, sugarcane, and forestry.

The highest C_{io} was obtained with a coefficient of 7.597 and the lowest one with a coefficient of 4.494 (Table 4). The results of the final stage of the research showed that the activity of other industrial plants, with a F_i coefficient of 0.527, was ranked first, and the activity of beekeeping and sericulture in the second rank.

Leontief's demand-driven method and Ghosh's supply-oriented method calculated their posterior, anterior, and normalized linkages. The results indicate that key activities are beekeeping, sericulture farming, and forestry in the first group. They have strong later and former linkages (Table 5).

According to the input-output table, the multipliers for all sections (Table 6) as the second group is rice, sugar beet, sugarcane, other industrial crops, livestock, beekeeping, and sericulture.

The results of Table 7 reveal that, in terms of the previous dispersion index, activities of wheat, sugar beet and sugarcane, forestry, horticulture and agricultural services, other industrial crops, and rice have the lowest value. The lowest values in terms of the posterior dispersion index belong to forestry, animal husbandry, sugar beet and sugarcane activities, agriculture and horticulture services, wheat and other industrial crops show, which and indicates that the later linkage of the activities in question was balanced and evenly distributed to other sections.

Table 8 shows that the first group is wheat, sugar beet, sugarcane, other industrial crops, horticulture and agricultural services, and forestry.

According to Table 9, sugar beet, sugarcane, and forestry activities in terms of previous linkage and wheat, horticulture and agricultural services, livestock, and forestry in post linkage are desirable and key sectors.

According to Table 10, the lowest carbon emissions and the highest amount of benefit and output are in the animal husbandry and forestry sub-sectors.

Water consumption value, input-output value, and value-added were calculated and, according to Table 11, the lowest value-added water consumption is related to beekeeping, poultry farming, and forestry activities. It should be noted (zero means a very, very small amount) that the lower the value-added ratio of water consumption, the higher the value-added activity of that activity with less water. The reverse is true of the ratio of consumption to the output value.

The current study uses the input-output model of numerical taxonomy methods, Leontief demand-oriented and Ghosh supply-axis, row and column multipliers,

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Table 2. Input matrix formation and standard matrix. [a]

		Profitability indicators							
		Profit to service compensation	Value-added to service compensation	Output to input	Per capita production	Competitive power	Labor productivity	Productivity of products	Revenue to cost ratio
2018	μ	24.303	23.988	2.512	-2516201	0.345	-1795965	0.634	6.855
	δ	27.445	23.189	1.635	6288357	0.76	4152062.1	0.22	8.992
	DOj	2.111	1.738	2.498	1.106	2.781	0.825	1.267	2.693

[a] Source: Research Findings.

Table 3. Vector of the shortest distances (d) between agricultural activities.

Activity	Wheat	Rice	Sugar beets and sugarcane	Other industrial plants	Horticulture and agricultural services	Livestock	Aviculture	Beekeeping and sericulture	Fishing	Forestry
The shortest distance (d)	4.32	2.979	1.061	2.979	1.153	1.081	1.757	3.252	3.457	1.061

Source: Research Findings.

Table 4. Values C_{io}, F_i using numerical taxonomy.

Coefficient	Wheat	Rice	Sugar beets and sugarcane	Other industrial plants	Horticulture and agricultural services	Livestock	Aviculture	Beekeeping and sericulture	Fishing	Forestry
C_{io}	7.597	4.69	7.012	4.494	6.365	6.888	7.068	4.641	5.954	7.081
F_i	0.891	0.55	0.823	0.527	0.747	0.808	0.829	0.544	0.698	0.831
Rank	10	3	7	1	5	6	8	2	4	9

Source: Research Findings.

Table 5. Normal and normalized posterior and anterior links based on Leontief demand-driven and Ghosh supply-oriented methods.

Crop/Activity	FL	BL	NFL	Rank	NBL	Rank
Wheat	3.96	1.483	0.86	3	0.845	9
Rice	3.231	1.215	0.702	7	0.692	10
Sugar beets and sugarcane	3.766	1.906	0.818	4	1.086	3
Other industrial plants	3.243	1.511	0.705	6	0.861	8
Horticulture and agricultural services	2.911	1.598	0.632	8	0.911	7
Livestock	3.706	2.147	0.805	5	1.224	2
Aviculture	2.028	2.558	0.441	9	1.458	1
Beekeeping and Sericulture	4.852	1.898	1.054	2	1.082	4
Fishing	1.047	1.691	0.227	10	0.963	6
Forestry	23.499	1.775	5.108	1	1.012	5

Source: Research Findings.

Table 6. Calculation of multipliers of agricultural activities based on the input-output table.

Crop/Activity	Column multipliers	Normalized column incremental coefficients	Rank	Row multipliers	Normalized row multipliers	Rank
Wheat	0.225	0.545	8	7.172	0.713	6
Rice	0.175	0.426	10	15.472	1.538	3
Sugar beets and sugarcane	0.238	0.576	7	13.677	1.359	5
Other industrial plants	0.212	0.513	9	17.172	1.707	1
Horticulture and agricultural services	0.356	0.864	5	5.765	0.573	8
Livestock	0.291	0.705	6	13.972	1.389	4
Aviculture	0.48	1.164	3	6.263	0.622	7
Beekeeping and Sericulture	0.365	0.884	4	16.597	1.65	2
Fishing	1.079	2.615	1	2.514	0.249	9
Forestry	0.703	1.703	2	1.97	0.195	10

Source: Research Findings.

posterior and anterior dispersion index, water consumption value to value-added, and output and amount of carbon emissions were used to prioritize agricultural activities in Iran. According to the numerical taxonomy method, beekeeping and sericulture activities have the highest rank in terms of development. Based on Leontief's demand-oriented and Ghosh supply-oriented methods, beekeeping, sericulture activities, and forestry activities are in the first group and are considered as the key activities. However, beekeeping and sericulture activities ranked second based on the row and column multipliers method, which again shows that these activities have a strong backward linkage with other activities. Other methods, such as backward and forward dispersion indexes, and demand-driven (Leontief) and supply-driven (Ghosh) models, introduce forestry as a key activity. The lowest amount of carbon emissions to value-added is related to the animal husbandry and forestry, which is very important to pay attention to these activities in the discussions of preventing environmental pollution. The carbon tax policy will pay special attention to these activities to prevent the emission of greenhouse gases and pollution. The lowest

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Table 7. Calculation of the dispersion index of agricultural activities based on the input-output table.

Crop/Activity	Former dispersion Index	Rank	Normalized later dispersion index	Later dispersion index	Rank	The normalized former dispersion	Diffusion power index	Rank	Dispersion sensitivity index	Rank
Wheat	0.79	1	0.791	0.881	5	0.943	1.247	3	0.902	7
Rice	0.992	6	0.992	1.034	8	1.106	0.686	9	0.748	9
Sugar beets and sugarcane	0.893	2	0.893	0.838	3	0.896	0.999	6	1.15	3
Other industrial plants	0.982	5	0.983	0.892	6	0.954	0.694	8	0.917	6
Horticulture and agricultural services	0.917	4	0.917	0.844	4	0.903	1.009	5	0.946	5
Livestock	1.046	8	1.047	0.836	2	0.894	1.059	4	1.27	2
Aviculture	1.345	10	1.346	0.976	7	1.044	1.489	1	1.547	1
Beekeeping	1.1	9	1.1	1.157	10	1.237	0.743	7	0.801	8
Fishing	1.025	7	1.026	1.057	9	1.131	0.609	10	0.706	10
Forestry	0.899	3	0.9	0.829	1	0.886	1.46	2	1.009	4
Average of the whole country	0.999	-	1	0.934	-	1	1	-	1	-

Source: Research Findings.

Table 8. Classification of the production system in terms of the effect of balanced and unbalanced growth.

Final goods $FS_i < 1$	Intermediate goods $FS_i \geq 1$	Input-output
Rice	Fishing, beekeeping, and poultry farming	Industrial Goods $BS_j \geq 1$
Wheat, sugar beet, and sugarcane, other industrial crops, agriculture and horticulture services, forestry	Livestock	Basic goods $BS_j < 1$

Source: Research findings.

Table 9. Production system classification in terms of diffusion power index and sensitivity and the effect of balanced and unbalanced growth.

Sugar beet and sugarcane, forestry	$\boldsymbol{FS_i}$< 1 and sensitivity index ≤ 1
Wheat, horticulture and agricultural services, livestock, forestry	BS_j< 1 and diffusion power index ≤ 1

Source: Research findings.

Table 10. Carbon emission rates in agricultural sub-sectors.

Source	Agriculture and horticulture	Animal breeding	Fishing	Forestry
Coal mining	0	0.4579625	0	0
Petrol	425240.375	840133.736	1246500.119	70882.04252
Kerosene	84157.539	69089.55423	16236.25417	1623.170901
Gasoline	14903626.59	7552192.435	1288304.282	99106.436
Furnace and black oil	2942.892	0	0	48857.904
Generation, transmission, and distribution of electricity	6475528.72	2007001.38	354778.7528	109815.199
Natural gas and liquefied gas	540129.728	1039425.176	293269.5213	89718.393
Total carbon emissions	3831230816	11507842.74	172994199.8	420003.147
Carbon emissions to the output value	1.711	0.049343	6.611	0.00026
Carbon emissions to value-added	2.439	0.024	1.204	0.0294

Source: Research findings.

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Table 11. Value of water consumption, value-added and input value, and the output value of each activity in Iran's economy.

Crop/Activity	Water value	Input value	Output value	Added value	Water consumption to added value	Water consumption to output value
Wheat	1626460.39	127682081.8	442066538.3	314384456.6	0.00517	0.00367
Rice	848706.47	54684615.18	377191961.2	322507346	0.00263	0.00225
Sugar beets and sugarcane	721082.078	29388913.72	56426289.98	27037376.26	0.02667	0.0127
Other industrial plants	376889.183	26386698.56	86762199.29	60375500.73	0.00624	0.00434
Horticulture and agricultural services	7066910.13	355045497.1	1201072397	846026900.3	0.008353	0.00588
Livestock	767642.212	625272020.9	1005545078	380273056.9	0.00201	0.00076
Aviculture	164129.601	303219408.3	381368198	78148789.67	0.0021	0.00043
Beekeeping	0	2729337.146	12461634.15	9732297.002	0	0
Fishing	166164	13627100.99	157255103.1	143628002.2	0.00115	0.00105
Forestry	7832.807	8811236.337	23080349.97	14269113.63	0.000548	0.000339

Source: Research findings.

amount of water consumption to value-added is related to beekeeping, sericulture, and forestry activities. Considering all the indicators, and even though Iran is globally ranked the fourth for the bee colonies, it is suggested that the government encourage investment in this activity to provide production and employment. By increasing investment in this activity, significant economic and social benefits can be achieved. Officials should also implement policies to expand this activity as an important industry. Considering that forestry is one of the key activities of the agricultural sector, it is also suggested that appropriate planning should be done in forestry management and administration of forests in order to preserve environmental, economic, and social values within the framework of methods called multifunctional forestry and sustainable forest management.

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بهینه‌سازی فعالیت کشاورزی در ایران با توجه به محدودیت انتشار کربن با استفاده از مدل داده-ستانده لئونتیف

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چکیده

شناسایی و اولویت‌بندی فعالیت‌های کلیدی اقتصاد، موضوع مهمی در برنامه‌ریزی و سیاست‌گذاری اقتصادی است به طوری که، مدلهای متفاوتی برای این منظور ارائه شده است. از طرف دیگر مسأله آلودگی از مهم‌ترین و حادترین مسائل جهان امروز به شمار می‌رود. در مطالعه حاضر، تعیین فعالیت‌های کلیدی بخش کشاورزی با توجه به الزام محدود نمودن انتشار کربن، با استفاده از مدلهای تاکسونومی عددی، تقاضامحور لئونتیف و عرضه‌محورگش، ضریب فزاینده ردیفی و ستونی، شاخص پراکندگی پیسین و پیشین، میزان انتشار کربن، شاخص سودآوری و نسبت ارزش آب مصرفی به ارزش‌افزوده، با بهره‌گیری از جدول داده-ستانده به‌روز شده، انجام شده است. نتایج حاصل از بکارگیری مدلهای تاکسونومی عددی، تقاضامحور لئونتیف و عرضه محورگش، ضریب فزاینده ردیفی و ستونی نشان می‌دهد که فعالیت زنبورداری و نوغانداری در بالاترین رتبه قرار دارد. البته نتایج با بهره‌گیری از مدل تقاضا محور لئونتیف و عرضه-محورگش و شاخص پراکندگی پسین و پیشین نشان می‌دهد که فعالیت جنگلداری نیز جزء فعالیت کلیدی محسوب می‌شود، همچنین نتایج بررسی و تحلیل انتشارکربن، حاکی از آن است که زیربخش جنگلداری و فعالیت‌های زنبورداری و نوغانداری که در زیربخش پرورش حیوانات قرار دارند میزان کربن کمتری منتشر و ارزش افزوده بالایی ایجاد می‌کنند.

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