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Effects of Water Resource Reduction on Employment in Agricultural and Non-Agricultural Sectors Based on the Social Accounting Matrix

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Abstract

Water is one of the main basic resources for development and is the most significant factor in Iranian agriculture production. The agricultural sector has an important role in production, employment, and gaining exchange and drastically affects other sectors of the economy. The purpose of this study was to evaluate the effect of water resources` reduction on agricultural sub-sector and other sectors` employment. The employment data were collected from SAM, 2011 and the employment generated by the economic activities of the economic sectors and the contribution of each of these sectors to employment was examined. The service sector ranked first with 24.99% employment creation and agriculture ranked second with 19%. Construction, industry, commerce, and transportation sectors ranked third to sixth, with 82.4% of the total employed working in these six sectors. The results showed that with water resources reduction by 10, 20 and 30%, the total employment decreased to 416334, 769472 and 1044114 people, respectively. In agricultural sub-sectors, the highest decrease was in farming and horticulture subsectors with an average of 14.17%. According to the results, water saving technology was a solution to reach the major goals of agricultural development, especially for employment.

Keywords: Agricultural sector, Employment, Social Accounting Matrix
Classification JEL: E24, C67, Q16

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Introduction

Water is one of the most significant resources for development of the country and one of the greatest human challenges of the present century, which can be the origin of many positive and negative developments in the world. Water is the most important element in agriculture production, and agriculture has a significant role in the production, employment, acquisition of foreign exchange and has a drastic effect on the other sectors of the economy. With about 11% of GDP, 23% of employment and providing food to more than 80% of the population, agriculture has a critical role in the Iranian economy (Federation of International Trade Association (FITA), 2006). With less investment compared to the other sectors, this sector has a more critical role in modifying unemployment problems than the other sectors. To understand the importance of this sector in the national economy, the best practice is to calculate and estimate its sub-sectors through SAM.

Although Iran icludes one percent of the world's population, and more than 50 million hectares of agricultural land which accounts for about 18% of the total cultivation land area in the world. Even in the case of water, about 90 billion cubic meters of water are harvested in the country, which accounts for more than 3% of the total amount of harvested water in the world.. The problem is that the water is not used optimally, as only 5% of the stated lands (about 18.5 million hectares) are under aquaculture. In other words, millions of cubic meters of water, which is worth over billions of Rials, is wasted.

The problem our society has faced, especially in recent years, has been the decrease in rural incomes due to the decrease in production and the low price of agricultural products given the continuing droughts, which has led to an unmanageable migration of villagers to cities and, consequently, a decrease of population of producers and an increase in the population of consumers, as well as increased unemployment and social problems. The statistics on the potential and actual states of the country in the agricultural sector show that there are still many potential sources in the country that will resolve some of the concerns in employment and production, if properly planned. During the years of 1976 to 2006, job creation in cities was 5.25% more than in rural areas. During this period, although more than 36.6% of the added unemployed were allocated to rural areas, but only about 16% of employment belonged to these areas. Given the role of employment in reducing economic, social and political inequalities in urban and rural areas of the country and the adjustment of rural migration, a balanced expansion of job opportunities between these areas is essential (Panahi and Morseli, 2007).

The water sector is one of the basic infrastructures of the country that can act as a growth engine in the economy and increase the growth of other sectors, particularly the agricultural sector and its related activities. Moreover, water sector is one of the key sectors of the economy that should be paid special attention for the growth of other sectors of the economy. In this study, with the understanding of the importance of the issue, the effect of reducing water resources on the employment of agricultural sub-sectors and other sectors have been examined. By analyzing this, SAM has been used to improve this sector and examine the positive strategies and effects.

Literature Review

The studies on the effect of various economic sectors on employment and their ranking within the country and abroad have all emphasized the effect of these sectors on employment. However, Esfandiari and Tarhimi (2009) have studied the employment-generation potential of Iranian economic sectors with an emphasis on the agricultural sector. The results of the study indicated that the agricultural sector, oils and other food products and construction rank first to third among the economic sectors. Comparison of the production potential and total employment growth shows that out of 35 sectors of Iran, only 7 sectors have more potential to create employment than production, stating that despite the high growth of production in Iran, employment growth rate is negligible. Zand *et al*. (2019a) investigated the socio-economic impacts (direct and indirect effects) of the investment development policy on the agricultural sector and its sub-sectors in Iran in 2011 using a social accounting matrix (SAM). The results included three scenarios including a 15% increase in investment in the agricultural sector, a 10% increase in the investment in the farming and gardening sub-sector, a 15% increase in the investment in the farming and gardening sub-sector, and a 10% increase in the investment in the

other sub-sectors. They indicated that the total income of the economy was increased when these scenarios were implemented; however, the first scenario had a greater impact on the total income of the economy (13.12%) compared to the other scenarios. Furthermore, it can be said that the sectors of agriculture (2.98%) and industry (0.36%) were most influenced by the first scenario and the sub-sector of farming and gardening and the industrial sector were most influenced by the second and third scenarios. Scott *et al*. (2008) examined the energy technology programs in buildings and their effect on employment, income, and investment. The results showed that if these programs could be developed, employment would increase by more than 446,000 jobs. Amirnezhad et al. (2015), in a paper entitled "Examining the effect of value added and investing on agricultural employment in 1986-2012" using econometric method and autoregressive distributed lag (ARDL), concluded that investment in agriculture, both in long and short terms, has a positive and significant effect on agricultural employment. Peng *et al.* (2011) examined the effect of higher education on increasing incomes and employment in the form of a report. The increasing income and employment ratios showed an increase in income and employment due to an increase in sales to other sectors. In the study by Zand *et al*. (2019b), the analysis of the effects of the policy of investment growth in agriculture based on the method of Social Accounting Matrix (SAM) was considered. The effects of applying this policy (including net, open and closed effects) have been analyzed in three scenarios. The results of net effects showed that the incomes of production activities would be increased in each of these scenarios. The findings also showed that the closed effects of the aforementioned scenarios on the industries, services, and commerce were more than the agricultural sector itself and its sub-sectors, indicating a strong link between these sectors and the agricultural sector and its sub-sectors.

Poursafar and Mohammadi (2015) examined the effect of investment in Iran's agricultural sector on employment and value added of this sector using the Johansen Johansen's method. They eventually concluded that investment had the highest positive effect on employment and value added of the agricultural sector. Dehgan Shourkand and Misaghifar (2017) studied the significance of educational services in Iran's economy using SAM approach. The study has examined the importance of the role of educational subdivisions using SAM in Iran's economy. According to the studies conducted in the educational sub-sections, higher education has far more effect on production, the income of production factors, employment and consumption of inputs compared to other educational subdivisions. The results of this study showed strong links between the educational sector and the wholesale, retail and repairing sectors of vehicles and goods. Sorudi and Mirzaei (2013) have analyzed the effects of increasing the price of energy carriers on the employment of Iranian economic sectors, with an emphasis on the agricultural sector. The results of the study on the employment effects of final demand components after adjusting 100% of carriers' prices showed that the increase in the price of energy carriers has a very small effect on the employment of these components in the agricultural sector. Salami and Ansari (2009) have examined the role of agricultural sector in creating employment and income distribution. In doing so, they developed Iran's accounting matrix according to the last output table in 2001 and by calculating the increasing coefficients of labor and income within the framework of this matrix, they analyzed these factors by structural analysis of the route and studying the role of agricultural sector in creating employment and reducing inequality in income distribution. The results showed that the agricultural sub-sectors have a high short-term potential in generating employment, and the development of these sub-sectors will generate significant household income growth. Sharifi *et al*. (2012) sought to specify the status of activity of different production sectors in creating employment and adding value in the country and its causes. Input-output coefficient analysis was used for this purpose. The results showed that one of the most important factors in creating employment and value added is the increasing coefficient of total employment in the past. Accordingly, only agriculture, horticulture and forestry sectors ranked among the top five in terms of increasing rates, value added and employment creation given the provision of inputs for the economic sectors. In a study using input-output analysis in 2006, Kureski and Rolem (2012) estimated the employment rate and direct and indirect income to differentiate the level of employment at the educational level. According to the results, the highest growth factor was found in employment in other service sectors and in the manufacturing sector in metallurgy of non-ferrous

metals. Kohansal and Perme (2014) examined the effect of reduction of agricultural sector subsidies on production and employment using the method of social accounting matrix of 2006. His results showed that one of the important effects of reducing agricultural sector subsidies is its effect on reducing the production of this sector and thus reducing its job creation. Mehrali Tabar (2013) examined the structure of the formal and informal sectors of Iranian economy with an emphasis on employment using SAM. The study examined the structure and dimensions of the informal sector of the economy with a general equilibrium approach in SAM framework of 2006 using peripheral statistics to distinguish between formal and informal sectors. The results showed that the employment potential of the informal sector is higher than the formal sector, showing the importance of this sector in the economy of the country. Mirbagheri and Ethnaashari (2016) examined the effect of private sector investment on employment using the multivariate linear regression model and data panel in 2000-2014. The results showed that private sector investment with a coefficient of 0.019 has a positive effect on employment. Valizadeh *et al.* (2015) determined employment and its relationship with investment in transportation in the region's economic growth using the theory of a dynamic labor demand approach. The results showed that investment should be made at the proper time to have positive effects, affect regional employment, and bring about economic growth.

Other studies have been done in this regard by (Khaleghi *et al*., (2015); Perme and Karbasi, (2012); Faridzad *et al*., (2012); Hosseinzadeh and Yaghoubi, (2016) and Khani *et al*. (2012).

Methodology

This study sought to use the information obtained on employment from SAM in 2011 and the employment generated by the economic activities of the economic sectors to examine the effect of reducing water resources on each of these sectors in creating employment.

To differentiate between different economic sectors in terms of employment creation in society, they were examined separately.

Table 1 summarizes the social accounting matrix. According to this table, this matrix shows the relationships between production activities, the income distribution of these activities among the factors of production, and the distribution of income among socio-economic institutions (Parmeh *et al*., 2011).

To calculate the average propensity to consume matrix in the SAM model by dividing each of the elements of the T_{nn} matrix into the sum of the corresponding column, another matrix called the average propensity to consume matrix is used (Salami and Parmeh, 2001; Zand *et al*., 2019a).

$$T_{nn} = A_n \ddot{Y}_n \quad (1)$$

$$A_n = \begin{bmatrix} A_{11} & O & A_{13} \\ A_{21} & O & O \\ O & A_{32} & A_{33} \end{bmatrix} \quad (2)$$

In the equation 1, it is a matrix of diameter whose elements on its main diameter are Yi (i = 1, ... n). Similarly, the relation 3 can show the Txn matrix (Salami and Parmeh, 2001; Zand *et al*., 2019a):

$$T_{Xn} = A_l \ddot{Y}_n \quad (3)$$

In relation 3, A_l is called matrix of average propensity to leak. According to the definition of two matrices An and A_l, l and n can be represented as follows:

$$n = A_n . Y_n \quad (4)$$

$$l = A_l . Y_n \quad (5)$$

By combining the above relationships, a new relationship is obtained as follows:

$$Y_n = A_n Y_n + X = (I - A_n)^{-1} X = M_a X \quad (6)$$

$$M_a = (I - A_n)^{-1} \quad (7)$$

Relation 6 essentially illustrates the pattern of social accounting matrix in which the income level of endogenous accounts in the social accounting matrix is expressed as a function of the variable level of exogenous X. In this respect, M_a is the accounting multiplier matrix. This matrix is called the accounting multiplier matrix, which only represents the structure formed in the form of the social accounting matrix as it is, and somehow establishes the relationship between certain levels of Y_n and X.

According to the basic equations of SAM table:

$$X = AX + Y \quad (8)$$

X shows the diagonal matrix of the total output, A the matrix of technical coefficients, and Y shows the diagonal matrix of final demand for sectors` production. In this case, usually X is the endogenous, which is calculated in terms of A as the technical coefficients matrix and Y is the exogenous variable.

Table 1- Different types of endogenous and exogenous accounts

Inputs Outputs		Endogenous accouts			Exogenous accouts	
		Productio n	Factors of Production	Innstitutrs (families and companies without govermment	Other accouts govermment, accumulation extemal world	Sum of the Inputs demand and total income)
Endogenous accouts	Production	T_{11}	0	T_{13}	X_1	Y_1
	Factors of Production	T_{21}	0	0	X_2	Y_2
	Innstitutrs (families and companies without govermment)	0	T_{32}	0	X_3	Y_3
Exogenous accouts	Other accouts govermment, accumulation extemal world	l'_1	l'_2	l'_3	T	Y_X
Sum of the outputs		Y'_1	Y'_2	Y'_3	Y'_X	

Source: (Defourney & Thobcke 1984)

$$X = (I - A)^1 \times Y = C \times Y \quad (9)$$

C is a reversal of the Leontief matrix, which shows the effect of the final demand for sectors` production at the level of production of the sectors in question. In other words, the elements of the matrix C are the value of production needed from the manufacturing sectors studied to respond to a final demand unit of the economic sectors.

To calculate the employment rate or labor demand by each sector, the vector of employment coefficients should be multiplied in the inverse of the Leontief matrix so that the total employment generated by the activity of each sector could be calculated. Additionally, if the employment coefficients (employment rate per division for a unit of production) are multiplied by a diagonal matrix in the inverse of the Leontief matrix, employment matrices can be used to distinguish direct employment from indirect employment (Sameti, 2002).

If q_j and e_j are, respectively, production and employment in sector j, the employment coefficient in this sector is considered as such. Thus, the coefficient of employment is derived from the division of the employment of each sector into the total output of that sector. Employment coefficient is the value of work required per unit of production in the i-th unit.

$$a_j = \frac{e_j}{q_j} \qquad \text{i = 1 and 2.... and n} \quad (10)$$

If any of e_is in the original diameter is an n × n matrix and the other elements of this matrix are zero, then the coefficient of employment is created, therefore the following equation is obtained (Tarahomi, 2008).

$$e = \begin{bmatrix} e1 & 0 & 0 \\ 0 & e2 & 0 \\ 0 & 0 & en \end{bmatrix} \quad (11)$$

In this case, the employment matrix L is the product of the diagonal matrix of the employment coefficients e and the inverse of the Leontief matrix.

$$L = \hat{e}(I-A)^{-1} \quad (12)$$

In this case, the inverse matrix of employment coefficient is obtained. Using this employment matrix, which is calculated by multiplying the inverse of the Leontief matrix and the coefficient of employment matrix, one can calculate the employment effect of each sector according to the final demand and its components. For instance, if L matrix is multiplied by governmental expenditures, the employment effect of this component of the final demand can be measured for each sector, and if we multiply the final demand of the whole economy, the priority of the industry would be different from the employment perspective. In other words, to calculate the potential power of different sectors of the economy, the inverse employment matrix (L) is multiplied by the final demand:

$$P = L.Y \quad (13)$$

The total column of the reciprocal matrix

elements of employment shows an increasing employment rate. This index shows th volume of increased employment in the economy if one million riyals increase in the final demand of section j.

$$L=\begin{bmatrix} e_1 & \cdots & 0 \\ \vdots & & \vdots \\ 0 & \cdots & e_n \end{bmatrix} * \begin{bmatrix} 1-a_{11} & \cdots & -a_{1n} \\ \vdots & & \vdots \\ -a_{n1} & \cdots & 1-a_{nn} \end{bmatrix}^{-1} = \begin{bmatrix} l_{11} & \cdots & l_{1n} \\ \vdots & & \vdots \\ l_{n1} & \cdots & l_{nn} \end{bmatrix} \quad (14)$$

As is seen in Equation 7, matrix L is obtained from the product of the multiplication of the diagonal matrix of the direct coefficients of employment (e) and Leontief inverse matrix (c). Thus, the elements of this matrix showed the direct and indirect employment of different sectors of the economy when the final demand or its components changed. In other words, the main diameter of this matrix was the direct employment generated by each unit of the final product produced in the studied section. Other elements of the matrix row showed the indirect employment generated by each unit of final product produced in other sectors of the economy in the studied sector.

Employment multiplier E: It is the row vector (1 * n) obtained from the column sum of the elements of the employment matrix. This vector showed the amount of units that could be added to the total employment if the final demand was increased by one percent (one unit) (Javaheri and Hadi Zonuz, 2008).

$$E = i'.L \quad (15)$$

i': unit row vector

By replacing 10 in 9, a new relationship is obtained that shows the relationship between final demand, production structure, and employment creation capacity (people-job of created direct and indirect) by different economic sectors.

$$L = e(1-A)^{-1}Y = KF \quad (16)$$

And $K = e(1-A)^{-1} = K_{ij}$

MatrixK_{ij} represents the matrix of employment multiplier, and the sum of each of its columns reveals the direct and indirect jobs created by injecting a specific unit of exogenous accounts of economic sectors by those sectors throughout the economy. This matrix is called the incomplete closed-loop effects of employment. If we want to calculate the indirect jobs created by each department, it is enough to subtract the direct employment coefficients from the matrix of employment multipliers. The following relation expresses the indirect job created by the additional injection of a specific unit of exogenous accounts.

$$IL = (K-e)F = QF \quad (17)$$

Where in $Q = (K-e) = q_{ij}$

In relation 17, q_{ij} is the matrix of indirect employment multiplier. The sum of each of those columns reveals the indirect jobs created by the additional injection of a specific unit of exogenous accounts of productive activities by sectors throughout the economy (Banoui and Mahmoudi, 2001).

Statistical resources

The information used in this study was derived from the input-output table and SAM of the country in 2011. In doing so, 71-item table of 2011 IPRC was used. Employment statistics were derived from the statistics of the employed by the major groups based on the Population and Housing Census in 2011. By integrating sub-sections and reaching the main sections, the table was obtained as 13 activities. Finally, the employment statistics of 2011 were converted into 13 economic sectors with activities in the table.

Results and Discussion

The social accounting matrix was used to determine the share of manufacturing activities in direct and indirect employment in the whole economy and the share of each production for use in the creation of employment.

Table 2 showed the employment status of the country in 2011. Of the 20546874 people employed in various economic sectors, service sector (public, social, personal, household, real estate, professional and specialized services, and financial and monetary services) by generating 24.99% employment was in the first rank followed by agriculture and horticulture, animal husbandry, forestry and fishing with 19% of employment in the second place. Construction, industry, commerce, and transportation sectors ranked third to sixth, accounting for 82.4% of all employees in these six sectors. In contrast, oil and gas sectors, mines and water were between tenth and thirteenth, with the lowest number of employees in the stated year. The Table also showed the direct and indirect employment of the sectors separately.

Employment generated in different sectors of the economy depends on various factors. One of these factors is the coefficient of correlation of direct job creation of different economic sectors, as shown in Table 2. According to the calculations,

the coefficient of correlation of direct job creation rates of different sectors of the economy with the employment generated in them was 0.113. Although a part of the employment creation of the sectors was due to the difference in the coefficients of direct employment, the low coefficient showed the low importance of this factor. Thus, factors other than user or capital-based sectors were involved in their employment.

Also, according to results of Sharifi *et al.* (2012), the agriculture, horticulture and forestry sectors were ranked first to third in employment creation in 1385, respectively, and among these, only the agriculture, horticulture and forestry sector is the only sector that is also in terms of creation. Value added and in terms of employment was among the top 5 sectors of the Iranian economy in 1385.

Table 2- Total, direct and indirect employment in different sectors of the economy

Economic sectors	Total employment (people)	Direct employment (people)	Indirect employment (people)	Percent L	Rank L
Agriculture and horticulture	2629352	2208602	42755	12.8	5
Animal husbandry	1104897	977989	126908	5.38	7
Forestry	39481	-276369	315850	0.19	12
Fishing	128668	-107131	235799	0.63	10
Oil and Gas	150878	66015	84863	0.73	9
Mines	92401	-22034	113435	0.44	11
Industry	3062534	3017827	44707	14.91	3
Electricity	253814	131561	122253	1.24	8
Water	9696	-8634	18330	0.05	13
Construction	3112017	2971508	140509	15.15	2
Commerce	2994715	2776620	218095	14.58	4
Transportation	1833745	1586089	2465	8.92	6
Services	5135671	4888009	247662	24.99	1
Total	20547869	18210052	2337817	100	

Source: Research findings

The results of Table 3 showed the effects and consequences of reducing 10% of the water in reducing the employment of the economic sectors in terms of absolute effects and relative effects. In order to avoid increasing the volume of paper, the economic sectors have been covered and presented in the form of 13 parts of the case Trial and analysis.

Table 3- Absolute and relative effects of 10% water reduction on the employment of agricultural sub-sectors and other sectors

Economic sectors	Absolute effects of 10% (person)	Relative Effects (Percent)	Economic sectors	Absolute effects of 10% (person)	Relative Effects (Percent)
Agriculture and horticulture	58989	14.17	Electricity	9210	2.21
Animal husbandry	11626	2.79	Water	24821	5.96
Forestry	761	0.18	Construction	14797	3.55
Fishing	1481	0.36	Commerce	63812	15.33
Oil and Gas	6024	1.45	Transportation	32847	7.89
Mines	2282	0.55	Services	152861	36.72
Industry	58989	8.84	Total	416334	100

Source: Research findings

The results showed that the direct and indirect effects and the consequences of a 10% reduction in water resulted in a decrease of 41,634 people in all sectors with the highest drop in employment being in the service sector with 152,861 people and the lowest reduction in the forestry sector with 761 people. According to SAM, the reduction of water content in agricultural and industrial sectors can be interpreted directly, but the decline in the services` sector cannot be interpreted directly. This is because the mediator need of the water sector to these sectors is low, but the intensity of the dependence of the agricultural sector and services to the water sector is high. Thus, considering Table

3, one can state that agricultural and service sectors were directly affected by the reduction in water.

Relative effects` figures showed the effect of one percentage reduction in water levels on employment units before and after water reduction. For example, agriculture with 17.5% and services with 36.77% reduction in employment had the most effect on job losses. Commerce, industry, transportation, water and construction with 15.33%, 8.84%, 7.89%, 5.96% and 3.55%, respectively, had the next ranks in employment reduction. These results showed that agricultural sectors were among the most important sectors that should be considered by responsible institutions during the drought. Given that the share of employment in the agricultural sector is declining and at the same time labor productivity in this sector is improving. The decrease in the share of agricultural employment in Iran from 56% in 1335 to 23% in 1379 confirms this claim. The unemployment crisis in the last decade has cast doubt on the potential of Iran's agricultural sector to create jobs (Sadeghi and Homayonifar, 2001).

Thus, water reduction in the agricultural sector, besides reducing the product output of these sectors, dramatically reduced employment in this sector and other sectors of the economy. This model could provide a more realistic look at the vulnerability of other economic sectors caused by water reduction (drought) for policy makers and relevant institutions.

According to the results of research Mahmudi and Banouei (2003) and Salami and Ansari (2009), among the producer sectors, agriculture and food industries are important and have priority in terms of job creation, and other producer sectors and some services are in the next categories. Therefore, they can be considered in policies as investment priorities to increase employment. These findings confirm our results.

Table 4- Absolute effects of a 20% water reduction on employment in agricultural sector-sectors and other sectors

Economic sectors	Absolute effects of 20% (person)	Economic sectors	Absolute effects of 20% (person)
Agriculture and horticulture	108002	Electricity	13623
Animal husbandry	21512	Water	55299
Forestry	1417	Construction	28200
Fishing	2583	Commerce	113257
Oil and Gas	11692	Transportation	59862
Mines	4341	Services	282878
Industry	66806	Total	769472

Source: Research findings

In this scenario, it is assumed that if water reduction rate was 20%, according to Table 4, due to the effect of this shock, the reduction in employment of agriculture and horticulture would be 14.17% (equal to 108002 people), and therefore the agricultural sector would reduce by 17.5% (equal to 133514 people). Moreover, service sector with a decrease of 36.72% (equal to 282878 people), commerce 15.33% (equal to 113,257 people) and industries 8.84% (equal to 66,806 people) would be the mostly affected sectors. Therefore, due to the existence of earlier and later links, the effects of this shock can be seen in other sectors in addition to the sub-sector of agriculture and horticulture. One can also state that this shock had the greatest decrease in employment in the agriculture, horticulture and services sectors and forestry had the lowest decrease (0.18%, 1417 people).

Table 5- Absolute effects of 30% water reduction on employment of agricultural sub-sectors and other sectors

Economic sectors	Absolute effects of 30% (person)	Economic sectors	Absolute effects of 30% (person)
Agriculture and horticulture	144623	Electricity	12078
Animal husbandry	29239	Water	92800
Forestry	1942	Construction	39872
Fishing	3215	Commerce	144855
Oil and Gas	16920	Transportation	79634
Mines	6123	Services	384523
Industry	88291	Total	1044114

Source: Research findings

According to the analysis conducted as shown in Table 5 for various sectors separately, 30% reduction in the country's water led to 1044114 people decrease in total employment, with the highest reduction in employment in the service sector and agriculture, respectively, as 384523 and 179019 people. Moreover, water sector with 5.96% employment reduction added 92800 unemployed people directly and indirectly to the unemployed population of the community.

According to Table 6, agriculture and horticulture sector with 20.48 had the highest employment creation coefficient. Hence, for one billion riyals in this sector, 20.48 people-jobs were created. Forestry, services, shipping, fishing, commercial and construction sectors ranked next in terms of employment. On the other hand, water, industry, oil, gas and mining sectors had the lowest employment levels, respectively. Analysis of the data table showed that the agricultural sector had the least investment compared to other economic sectors and could create more employment directly and indirectly, so one of the best ways to increase employment in society could be investment in this sector.

Based on the above results, it seems that the policies for development and expansion of agricultural activities and activities related to agricultural industries can increase the employment creation in the whole economy. On the one hand, there is a great deal of interdependence between the agricultural sector and the agri-industries, and secondly, these activities are users.

Table 6- Correlation coefficients of direct employment creation of economic sectors

Economic sector	L	Rank L	Economic sector	L	Rank L
Agriculture and horticulture	24.48	1	Electricity	5.95	9
Animal husbandry	6.18	8	Water	0.98	13
Forestry	15.37	2	Construction	6.84	7
Fishing	11.48	5	Commerce	10.61	6
Oil and Gas	4.13	11	Transportation	12.05	4
Mines	5.52	10	Services	12.05	3
Industry	2.18	12			

* Correlation coefficient of direct job creation with employment level of the sectors (0.113)
Source: Research findings

The product of the employment matrix and each component of the final demand showed the employment creation effect of that component. Table 7 shows the effect of employment-generation on the components of the final demand, separately for different sectors. As is seen, the highest employment was for the agriculture and horticulture, industries and commerce. Moreover, the effect of government spending on occupations in different sectors was less than the other parts of the final demand.

The positive correlation between the job creation coefficients of the sectors indicates the relative similarity of these sectors in the employment creation. Most of these coefficients are due to the importance of these sectors in employment.

In confirmation of these results, Banoui and Mahmoudi (2001) showed that the total direct and indirect jobs created by the agricultural sector in the whole economy, due to the injection of one billion rials of consumption, investment or export in the model of social accounting matrix is ranked first.

Conclusions and Policy Implications

This study examined the effect of water reduction on the employment of agricultural sub-sectors and other economic sectors using SAM of 2011. The results showed that with 10, 20 and 30% reduction in water, the total employment would decrease by 416334, 769472 and 1044114 people, respectively. This employment reduction was observed in the agricultural sub-sectors separately, with the highest reduction in the agriculture and horticulture sub-sector with an average of 14.17%. Then, the sub-sectors of fishing, animal husbandry and forestry had the highest reduction, respectively. As the results showed, employment reduction in services and commercial sectors was significant, as well.

Table 7- Employment creation according to parts and components of final demand (employment: people)

Economic sector	Private consumption costs	Public consumption costs	Formation of capital	Export	Final demand
Agriculture and horticulture	5535709	90174	3020174	1751890	10391737
Animal husbandry	787866	23138	772069	308374	1891447
Forestry	47754	90109	-45432	39793	132224
Fishing	232123	15930	34924	36351	319329
Oil and Gas	131485	6245	-97537	4196044	4236236
Mines	80150	5033	145133	156215	386532
Industry	2542690	117975	2420333	1424801	6505799
Electricity	1312873	128789	368840	772324	2582826
Water	23004	822	-2857	2035	23004
Construction	289182	122780	4852680	36080	5300721
Commerce	6922376	177276	4770229	827490	12697371
Transportation	2829574	104443	2270452	1097396	6301865

Source: Research findings

In terms of employment creation, the services` sector and agricultural sub-sector ranked first and second, and were far from the other sectors. In other words, these two sectors could potentially account for 52.22% of all Iranian economy employees.

Water reduction in the economy has two consequences: the first is the decline in the employment in the economy and the second is the decline in production in the community. Due to water reduction in the agricultural sector, employment in the economy has decreased by about 17.5%. The results of the estimation of employment creation correlation coefficient showed that among the economic sectors, the agriculture and horticulture sub-sector were not only important in terms of high potential for employment in the agricultural sector, but also it was important in other sectors of the economy. These results clearly indicated the status of the agricultural sector among other sectors of the economy, especially the industrial sectors, in terms of high potential in reducing the unemployment problem and in a shorter period, and again accredited the theory of centrality of the agricultural sector among the production sectors.

Restriction of water resources, rapid population growth and the need for further production have caused a higher demand for this input in the agricultural sector compared to the other water consuming sectors. Thus, the most important challenge in the agricultural sector in status quo is how to produce more food with less water.

It is imperative to consider saving water to help the employment of the economic sectors, especially the agricultural sector. In Iran, given the relative low price of water input compared to other inputs, there is no incentive to invest in water saving technologies. Therefore, simultaneous increase of water prices and subsidies for modern irrigation systems, along with expert methods, observing the agricultural calendar, observing the cultivation pattern appropriate to the climate of each region and preventing over-extraction of groundwater and surface water, timely implementation of sub-networks, development Greenhouse cultivation and education and promotion of optimal water consumption, along with the creation of incentive tariffs for thrifty farmers and the establishment of a fair pricing system can have a significant impact on reducing water consumption and increasing the economic value of water and can reduce water in Eliminate the years of water shortage can have a significant effect on reducing water consumption and increasing the economic value of water and can eliminate the effect of reducing water in the years of water scarcity (Kalaei 2014).

As the results indicated, unemployment and economic downturn would rule the country as a result of water scarcity. Therefore, to help economic units such as the agricultural sector, it is necessary to pay attention to the final demand components and to reduce the effect of water reduction on the economic sectors. Hence, the following strategies can be proposed to alleviate this problem:

Since Iran is located in an arid and semi-arid region, one of the strategies for developing technology in the agricultural sector and reducing unemployment is using the methods that increase water productivity.

using pressure irrigation systems, the implementation of a policy of saving and

rationalizing water use in all sectors of the economy are suggested. Given the above, one can generally consider water-saving technology as a positive tool that can be used to reach the major goals of agricultural development, especially in employment.

Finally, it should be noted that given the drought in recent years and the vulnerability of the agricultural sector in terms of production and employment, one has to consider the infrastructure to reduce these problems of mechanization as soon as possible and also, to eliminate unemployment, the sectors that have a higher employment potential should be given priority in development.

References

1. Amirnezhad H., Mardanshahi M., and Asadpour Kordi M. 2015. Investigating the effect of value added and investment on agricultural employment. Journal of Entrepreneurial Strategies in Agriculture 2(3): 27-34.
2. Anonymous. 2012. Iran's input-output Table, Iran's Statistics Center.
3. Banoui A.A., and Mahmoudi M. 2001. Calculating the employment capacity of sections based on the geographical distribution of household consumption (Income) in the form of Social Accounting Social Matrix System, Journal of Economic Research 8: 13-42.
4. Defourney J., and Thorbecke E. 1984. Structural path analysis and multiplier decomposition within a social accounting matrix framework. The Economic Journal 94(373): 111-136. https://doi.org/10.2307/2232220.
5. Dehgan Shourkand H., and Misaqhifar E. 2017. Investigation of the educational service importance in the Iranian economy with using social accounting Matrix. Journal of Economic Research and Policies 25(82): 139-166.
6. Esfandiari A., and Tarahommi F. 2010. Ranking of manufacturing and employment potentials of Iranian Economy Sectors. Journal of Economic Research 10(3): 267-286.
7. Faridzad A., Banoui A.A., Momeni F., and Amadeh H. 2012. Investigating the economic and social effect of limiting the supply of petroleum products using the Mixed Model of Socio-Economic Matrix. Journal of Economic Modeling Research 10(38): 99-123.
8. Federation of international trade association (FITA). 2006. Iran. Available on: http://www.fita.org/countries/Iran.html.
9. Hosseinzadeh R., and Yaghoubi N.M. 2016. The effect of structural changes in higher education sector on regional output (Case study: Sistan and Baluchestan Province). Iranian Economic Review 20(1): 21-31.
10. Javaheri B., and Hadi Zonuz H. 2008. A quantitative study on the employment of economic sectors of Kurdistan province in the table of data and input-output (I-O). Journal of Economic Research (Capital Markets Special) 3: 163-189.
11. Kalaei A. 2014. A brief overview of agriculture management and pricing in Iran and some selected countries. Ministry of Jihad-e-Agriculture, Institute for Planning Research, Agricultural Economics and Rural Development, Tehran.
12. Khaleghi S., Bazazan F., and Madani Sh. 2012. The effects of climate change on agricultural production and Iranian economy (Social Accounting Matrix Approach). Journal of Agricultural Economics Research 7(1): 113-135.
13. Khani S., Bazazan F., and Madani Sh. 2012. The effects of climate change on agricultural production and on the economy of Iran (Social Accounting Matrix Approach). Journal of Agricultural Economics Research 7(1): 113-135.
14. Kohansal M., and Permeh Z.Z. 2014. Estimating the effect of reduction in agricultural subsidies on production and employment. The Economic Research (Sustainable Growth and Development) 17(1): 23-44. http://ecor.modares.ac.ir/article-18-591-fa.html.
15. Kureski R., and Rolem C. 2012. Employment and Incom In The State of Parana By Years of Studies: Input-Output Matrix Approach. Revista Economia e Desenvolvimento 24(2).
16. Mehrali Tabar H., Taee H., and Banoui A.A. 2013. Investigating the Formal and Informal Structure of the Iranian Economy, with Emphasis on Employment: Using the Social Accounting Matrix, Allameh Tabatabai University, Faculty of Economics,
17. Mirbagheri M., and Ethnaashari Kh. 2016. Investigating the effect of private investment on employment, Third Conference on Economics and Applied Management with the National Approach, Babolsar, Industrial Research Company of North Trod.
18. Panahi,R., and A. Morseli. 2006. Survey of rural-urban employment inequality in Iran (1956-2006). Agricultural Economics and Development 14(56): 143-166.
19. Parmeh Z., Maleki B., Banoui A.A., Andaish Y., and Karami M. 2011. Estimation of the impacts of the subsidy reform plan of the energy carriers on the price level of the commodity and services. Journal of Trade Studies 58: 1-32.
20. Peng O.O., Leng O.W., and Chiang C.H. 2011. Higher Education as a Source of Economic Growth: Input-Output

Analysis, National Higher Education Research Institute.
21. Perme Z., and Karbasi A. 2012. Estimation of Agricultural sector Support and its Effect on Iran's Economy, Eighth Biennial Conference on Agricultural Economics, Shiraz, Iran.
22. Poursafar Z., and Mohammadi M. 2015. Investigating the effect of investment in Iran's agricultural sector on employment and value added of this sector. Second International Conference on Management, Accounting and Economics. Shiraz, Kharazmi High School of Science and Technology.
23. Sadeghi H., and Homayonifar M. 2001. The role of agriculture in providing employment and reducing unemployment. The Economic Research (Sustainable Growth and Development) 1(1): 17-34.
24. Salami H., and Ansari V. 2009. The role of agriculture in job creation and income distribution: A path decomposition analysis. Iranian Journal of Agricultural Economics and Development Research 40(3): 1-20.
25. Salami H., and Parmeh Z. 2001. The impacts of the increased exports of the agriculture and industry sectors on the economy of Iran: an analysis in the framework of the social accounting matrix. Journal of Economic Research 59: 149-181.
26. Sameti,M., and Naraqi M.M. 2002. Application of the regional input-output table developed by the GRIT method for studying employment and the importance of housing sector in Isfahan province. Second Conference on the Application of Data-Output Techniques in Economic and Social Planning (Feb. 7 and 8).
27. Scott M., Roop J., and Anderson D. 2008. The impact of DoE building technology energy efficiency programs on u.s employment, income and investment. Energy Economics 30(5): 2283-2301.
28. Sharifi N., Pahlavani M., Esfandiari M., Dehghan H., Aliasgharpour H., and Saadaty F.. 2012. The status of Job Creation and Value Added of Production Sectors in Iran (Using an Input-Output Analysis). The Journal of Economic Research Policy 4(8):
29. Sorudi A., and Mirzaei H. 2013. Effects of increase in energy price on employment with emphasis on the agricultural sector. Journal of Agricultural Economics Research 5(17): 143-156.
30. Tarahomi F. 2008. Importance of financial sectors in invention occupation in Iran's economy, Paper accepted at 48th Congress of the European Regional Science Association, Department of Civic Design, University of Liverpool.
31. Valizadeh R., Aghamohammadi A., Zarghami S., and Shams B. 2015. Identification of the employment category and its relationship with investment in transport in the region's economic growth using the theory of dynamic labor demand, the National Conference on Architectural Development, Civil Engineering and Physical Development, Koohdasht Municipality.
32. Zand P., Mirzaei H.R., Mehrabi H., and Nabieian S. 2019a. Socio-economic of the investment development polici on agriculture sector. Internanal Journal of Agricultural Mamagement and Development 9(4): 347-362.
33. Zand P., Mirzaei H.R., Mehrabi H., and Nabieian S. 2019b. Analysis of economic and social impact of investment development policy in agricultural sector, Journal of Agricultural Science and Technology 21(7): 1737-1751.

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مقاله پژوهشی

جلد ۳۶، شماره ۲، تابستان ۱۴۰۱، ص ۱۴۱-۱۲۹

تاثیر کاهش آب بر اشتغال بخش کشاورزی و سایر بخش‌های اقتصادی بر اساس جدول ماتریس حسابداری- اجتماعی

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چکیده

آب یکی از منابع مهم پایه‌ای برای توسعه کشور و مهمترین عامل تولید در کشاورزی ایران است. بخش کشاورزی نقش مهمی در تولید، اشتغال، کسب و تحصیل ارز داشته و بر روی سایر بخش‌های اقتصادی تاثیر زیادی می‌گذارد. هدف از انجام این تحقیق، ارزیابی تاثیر کاهش منابع آب بر اشتغال زیر بخش‌های کشاورزی و دیگر بخش‌ها می‌باشد. سهم هر یک از این بخش ها در ایجاد اشتغال مورد بررسی قرار گرفت. بخش خدمات، با ایجاد ۲۴/۹۹ درصد اشتغال در رتبه اول و بخش کشاورزی با ۱۹ درصد اشتغال در رتبه دوم قرار دارند. نتایج نشان داد که در اثر کاهش آب به میزان ۱۰، ۲۰ و۳۰ درصد، اشتغال کل به ترتیب به میزان ۴۱۶۳۳۴، ۷۶۹۴۷۲ و ۱۰۴۴۱۱۴ نفر کاهش پیدا می‌کند. در زیربخش‌های کشاورزی، بیشترین کاهش در زیربخش زراعت و باغداری با میانگین ۱۴/۱۷ درصد دیده می‌شود. با توجه به نتایج حاصل، فناوری آب اندوز راهکاری مناسب برای دستیابی به هدف‌های کلان توسعهٔ کشاورزی به ویژه در زمینه اشتغال می‌باشد.

واژه‌های کلیدی: اشتغال، بخش کشاورزی، ماتریس حسابداری- اجتماعی

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