Plant Archives Vol. 20 Supplement 1, 2020 pp. 1743-1751 **e-ISSN:2581-6063 (online), ISSN:0972-5210**

IMPACT OF INSTITUTIONAL PRESSURE ON INVESTMENT DECISION-MAKING PROCESS IN RENEWABLE ENERGY TECHNOLOGIES IN THE AGRICULTURAL SECTOR, IRAN

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Abstract

Iran is a country heavily dependent on fossil fuel resources. The Iranian agricultural sector is no exception. Investing in renewable energy technologies could be the most important way to get rid of this problem in this sector. According to studies institutional pressure is one of the most important factors affecting the decision to invest in renewable energy in agriculture sector. However, so far this issue has been less addressed and this article is going to investigate the effect of this factor. The statistical population of this study consists of 130 investors in renewable energy in the agricultural sector of Iran. Sampling method was simple random. The sample size was determined 97 according to Krejcie and Morgan table. The results indicate that 31% of the variance in Investment Decision-Making in Renewable Energy Technologies in the Agricultural Sector of Iran was explained through institutional pressure and among the items forming the institutional pressure "Consultants opinion" and "Investments by well-known/high-profile investors in the sector" had the highest effect. Therefore, for future policy making and planning, these should be considered.

Key words: investment, investment decision-making process, renewable energies, agriculture sector, institutional pressure, Iran.

Intorduction

The Middle East energy making sector is conquered by fossil fuels that can cause environmental issues. Currently, the use of renewable energy is attaining political attention and many countries are paying attention to this target. Iran is no exception and has an extremely high level of energy consumption per head of population it has been estimated to be 80% above average for the Middle East. Iran's total primary energy consumption share by fuel in 2017 is shown in fig. 1. As it is depicted from the graph renewables have about 2% share for Iran's total primary energy consumption.

According to statistics from the International Energy Agency, Iran is the fourth largest crude oil reserve and the second largest gas reserve in the world also is the ninth country in CO_2 emissions (IEA, 2018). Iran's dependence on fossil fuels has also led the government to allocate part of its annual funding on this.

Iran's energy consumption per capita is about 17 times that of Japan and 10 times that of the European Union. Given the high fossil fuel subsidies in the country, Iran's energy consumption is three times the global average and 2.5 times that of the Middle East. According to the latest statistics available in 2014, the country's per capita energy consumption in agriculture is about 3.1 times more than the global average (Power and Energy Planning Department, 2017).

Renewable energies can be a good alternative to conventional energy such as fossil fuels in remote areas where electricity is impossible or very expensive to supply, as well as in places where the use of gas and diesel equipment is dangerous. Part of the energy needs in agriculture can be met by the use of renewable energies for different geographical conditions (Sawin *et al*., 2017). 2018 saw a sustainable market for renewable energies. Total renewable energy capacity has seen significant growth compared to the previous year. However, the number of countries with a high share of renewable energy is still increasing. The approximate share of renewable energy for global electricity production was

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estimated about 26%, while renewable power plants are much more economical in 2018 than fossil fuels.

Fig. 3, shows the share of renewable energies in total final energy consumption, which is about 28%.

Today, the world's energy is mainly supplied by different types of fossil fuels such as coal, oil and natural gas. About 80% of the world's total energy consumption is generated by fossil fuels (REN21, 2019). Excessive and inappropriate use of fossil energy sources leads to negative consequences such as deforestation, soil erosion, declining soil productivity, increased greenhouse gas emissions and the spread of various diseases in humans (Afsharzhade *et al*., 2016). Also, due to the increased carbon dioxide accumulation in the lower layers of the atmosphere climate change had happened and the results are floods, heavy rainfall and drought so each country is responsible for reducing these damaging effects by improving the quality of energy sources if possible by replacing renewable energies with fossil fuels (Mostafaeipour *et al*., 2016).

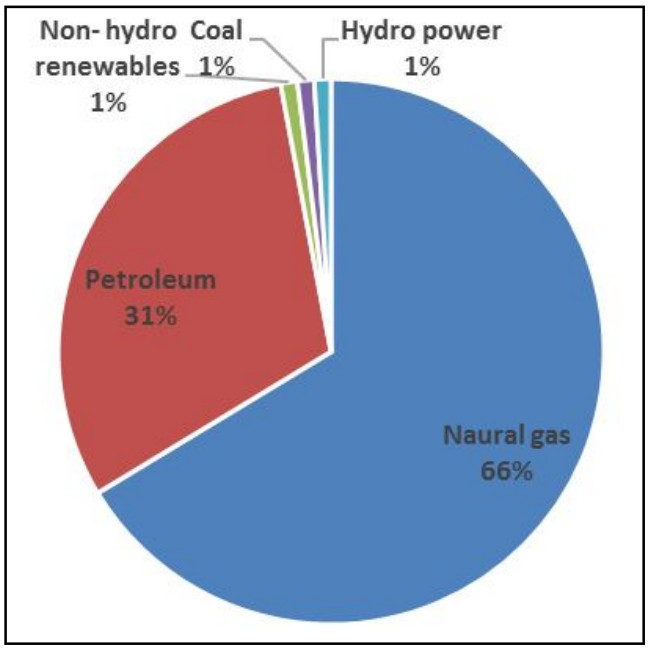

Fig. 1: Iran's total primary energy consumption share by fuel in 2017. (EIA, 2018).

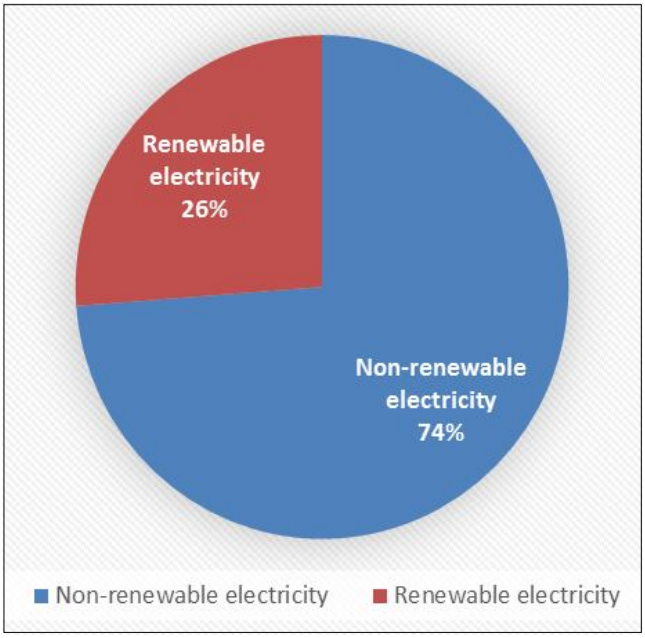

Fig. 2: Estimated Renewable Energy Share of Global Electricity Production, End-2018. (REN21, 2019).

Yet despite Iran's high potential for renewable energy, the share of these types of energy in the country's energy basket is only 2%. Iran has an area of about 1648195 square kilometers and a population of about 80 million people. The highest level of land is in arid and semi-arid climates with average annual precipitation of 250 mm and average temperature in summer and winter from 19-38°C and 10-25°C, respectively (SATBA, 2018). Due to specific geographical conditions and having 300 sunny days, it has the potential to use hydroelectric, wind, solar, geothermal and biomass energy and in this regard agriculture is one of the most important economic sectors of the country. There are many potentials and favorable areas for the development and utilization of renewable energies. In this sector, energy is consumed as a productive input. Therefore, timely, reliable and inexpensive supply of energy is of particular importance in increasing production, reducing production costs and thereby increasing non-oil exports (Najafi *et al.*, 2015). Today, the use of energy in agricultural activities is inevitable and renewable energies can be a good replacement for conventional fuels.

World Investment in Renewable Energy Technology

Total investment in renewable energy worldwide in 2017 was approximately $ 279.8 billion, which represents a 2.07 percent increase from $ 274 billion in 2016. As presented in fig. 2, according to the latest statistics in 2017, investment in China, Europe, USA, Asia and Oceania except for China and India, America continent except for USA and Brazil, India, Middle East and Africa and Brazil has increased by 45% (126.6 billion dollars), 15% (40.9 billion dollars), 14% (40.5 billion dollars), 11% (31.4 billion dollars), 5% (13.4 billion dollars), 4% (10.9 billion dollars), 4% (10.1 billion dollars) and 2% (6 billion dollars), respectively compared to 2016 (UNEP, 2018).

According to fig. 5, the maximum level of investment is related to solar energy with 161 billion dollars. The extent of investment in other resources including Wind energy, Biomass and waste, Small hydro, Biofuels, Geothermal and Marine has been 107, 5, 5, 2, 2 and 0.2 billion dollars, respectively (UNEP, 2018).

Table 1: Studies Related to Investigating the Factors Affecting Investment Decisions.

Tittle	Researchers	Variable
Effects of institutional pressures on information technology investments: An empirical investigation	Ravichandran *et al.*, (2009)	institutional ressures, information technology investments
The impact of behavioral factors in the renewable energy investment decision making process: Conceptual framework and empirical findings.	Masini and Menichetti (2012)	a priori beliefs, policy preferences and attitude toward technological risks
The Process of Decision Making and the Evaluation of Investment Projects in Information Technology	Ali and Younes (2012)	1. Analysis and planning, 2. Evaluation of costs and benefits, 3. Project selection and implementation and 4. Post-implementation evaluation.
Renewable energy investment in Malaysia: An integrated model in evaluating public decision making process	Mat Husin and Alrazi, 2017	prior belief (ensuring the effectiveness of existing policies and ensuring technological adequacy), organizational pressure (organizational pressure from colleagues and Consultants and reports from technical information), attitudes to new technological innovations and knowledge of using renewable energy technology
Investigating the role of promoting the localization of new energies	Mirdamadi *et al.*, 2015	Impacts of Channels and Mass Media on promoting the new energies
Barriers to investment in utility-scale variable renewable electricity(VRE) generation projects	Hu *et al.*, 2018	Integrated investment decision-making process
Country factors and the investment decision-making process of sovereignwealth funds	Amar *et al.*, 2019	SWF investment decision-making process

Process of renewable energy production in Iran

According to Iran's energy balance sheets, renewable energy production in the country includes Biofuels, Geothermal, hydro energy, solar and wind energy. However, the cost of producing one megawatt of energy from a solar power source has dropped from $ 1.5 million in 2016 to $ 600,000 in 2018. Given that the cost of energy production from renewable sources has dropped significantly in recent years, the private sector tends to invest more in this sector. Iran expects to generate 5,000 MW of renewable energy by 2020 and expects to generate 4,000 MW of this from wind power.

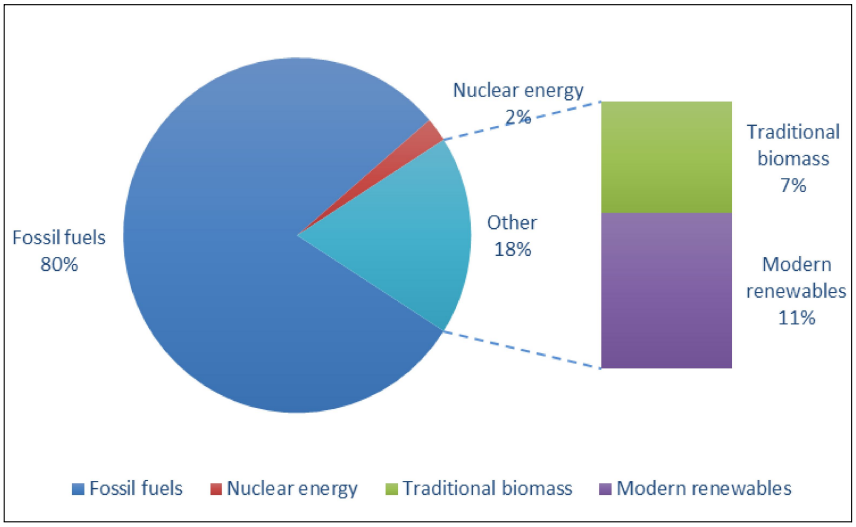

Fig. 3: Estimated Renewable Share of Total Final Energy Consumption, 2017. (REN21, 2019).

Investment decision making process

Investment decisions are made by investors. Investors usually invest with technical analysis and readiness. Investment decisions are often supported by important decision-making tools. Given that market information and factors systematically influence individuals' investment decisions as well as market outcomes (Jagongo and Mutswenje, 2014). Investment decision making is a challenging activity for investors in a multi-dimensional environment. Given the complexity of the investment decision-making process, these decisions cannot be implemented quickly. Investors need to be smart in order to achieve their goals (Farooq and Sajid, 2015). The investment decision making process is a complex process that involves selecting a particular alternative after properly evaluating all available options. Investors also need to be aware of new market events to gain knowledge and information related to investment decisions (Talha *et al.*, 2015).

Given the effective role of investment decision making in renewable energy technologies to protect the world,

Table 2: Survey items and Cronbach's alpha, AVE and CR coefficients.

Variables	Items	Source	Abbraviation
Investment decision making process (α=0.87, AVE=0.51, CR= 0.82)			
Investment decision making	1. I will achieve my goals by decision making to investment in renewable energy in agriculture sector	Amar *et al.,* 2019; Ali and Younes, 2012; Hu *et al.*, 2018	DM1
	2. I consider the assessment of the support and after-sales services in my investment decision making process.	Amar *et al.*, 2019; Ali and Younes, 2012; Hu *et al.*, 2018)	DM2
	3. I have access to enough capital to invest in renewable energy in the agricultural sector.	Amar *et al.*, 2019; Ali and Younes, 2012; Hu *et al.*, 2018	DM3
	4. I consider the initial risk of investment in renewable energy in the agricultural sector.	Amar *et al.,* 2019; Ali and Younes, 2012; Hu *et al.*, 2018)	DM4
	5. I consider the economic assessment of investment in renewable energy in the agricultural sector.	Amar *et al.*, 2019; Ali and Younes, 2012; Hu *et al.*, 2018, Mat Husin and Alrazi, 2017	DM5
Institutional pressure (α=0.92, AVE=0.57, CR= 0.88)			
Institutional pressure	1. NGOs roles	(Masini & Menichetti, 2013)	Pressure1
	2. Investments by well-known/high-profile investors in the sector.	(Masini & Menichetti, 2013)	Pressure2
	3. Consultants ' opinion	(Masini & Menichetti, 2013)	Pressure3
	4. Channels and Mass Media	(Mirdamadi *et al.*, 2015) (Fangjun et al., 2019)	Pressure4
	5. Technical reports	(Masini & Menichetti, 2013)	Pressure5
	6. Laws and regulations to strengthen the company's environmental adjustment	(Masini & Menichetti, 2013; Lu *et al.*, 2018)	Pressure6

the role of factors influencing this process is discussed.

Many studies have been conducted to investigate the factors affecting investment decisions. Some of them are mentioned in table 1.

A review of the literature shows that institutional pressure is a very important factor in the investment decision process. Institutional pressure is consist of "NGOs roles, Investments by well-known/high-profile investors in the sector, Consultants 'opinion, Channels and Mass Media, Technical reports and Laws and regulations to strengthen the company's environmental adjustment (Masini and Menichetti, 2013; Lu *et al.*, 2018).

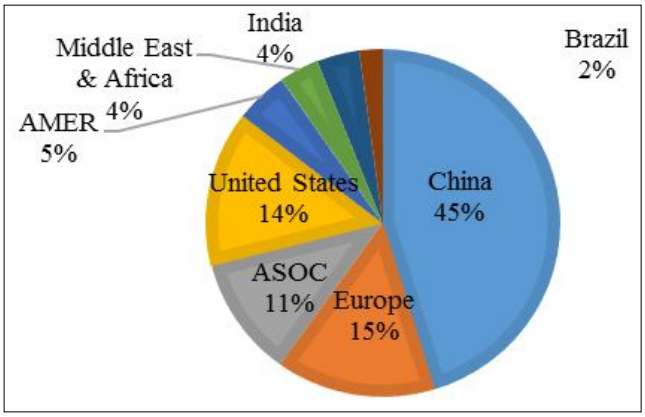

Fig. 4: Global new investment in renewable energy by region, 2017, $BN (UNEP, 2018).

Previous models have examined the set of variables that influence investment decision making in renewable energy technology and non of them studied the role of institutional pressure alone, moreover, none of the previous models specifically addressed investment decision making in renewable energy technology in agricutural sectors, which is one of the innovations of the present research.

The overall purpose of this study was investigating the role of institutional pressure on the decision process of investing in renewable energy in the agricultural sector of Iran. Understanding the status of investment decision making processes in renewable energy in the agricultural sector was among the specific objectives.

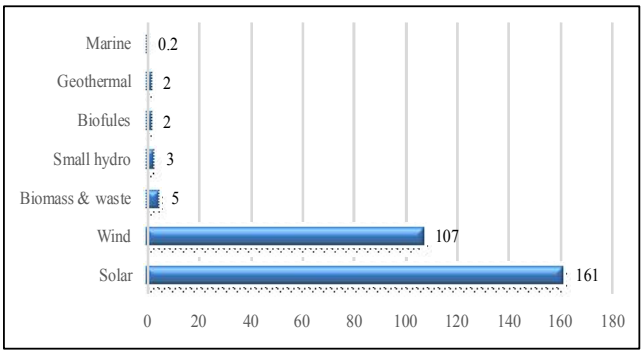

Fig. 5: Global new investment in renewable energy by sector, 2017, $BN (UNEP, 2018)

Table 3: Descriptive statistics of respondents.

Varialbe	Category	Fregnancy	Percentage	Mode
Gender	Male	6.2	6	Male
	Female	93.8	91	
Educational degree	Bachelor	27	27.8	Master
	Master	61	62.9	
	Ph.D.	9	9.3	
Investment in various renewable sources in the agricultural sector	Solar energy	75	77.3	Solar energy
	Wind power	5	5.2	
	Biomass	3	3.1	
	Hydropower	4	4.1	
	Geothermal energy	1	1	
	All Sources	9	9.3	

Table 4: Descriptive statistics of respondents.

Variable	Category	Frequency	Percentage	Mean
Age (years) Max=50 Min=23	$X \leq 32$	33	34	36
	$32 \leq X < 41$	43	43.3	
	$X > 63$	22	22.7	
Experience Max=25 Min=1	$X \leq 9$	65	86.6	7
	$9 < X < 17$	28	11.3	
	$X > 17$	4	2.1	
Initial Investment (dollar) Max=15000 Min=2000	$X \leq 5300$	28	28.9	8200
	$5300 < X \leq 86001$	30	30.9	
	$8600 < X \leq 11900$	28	28.9	
	$X > 11900$	11	11.3	
Monthly Profit (dollar) Max=2500 Min=100	$X \leq 900$	90	92.8	500
	$900 < X \leq 1700$	4	4.1	
	$X > 1700$	3	3.1	
Percentage of investment Renewable energy in the agricultural sector Max=5% Min=70%	$X \leq 21\%$	28	28.9	28%
	$21\% < X \leq 37\%$	52	53.6	
	$37\% < X \leq 53\%$	16	16.5	
	$X > 53\%$	1	1	

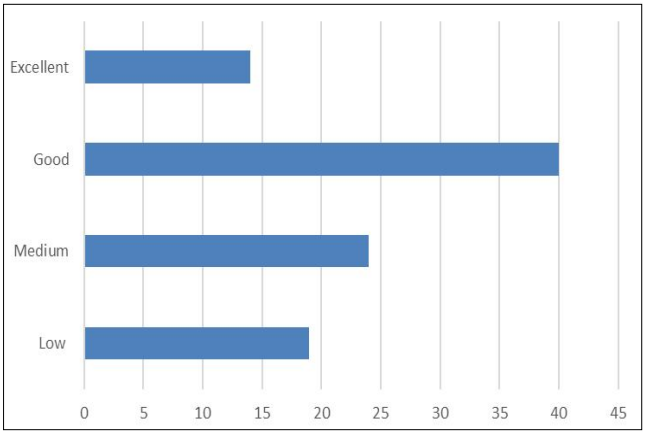

Fig. 6: The Status of Investment Decision Making Processes in Renewable Energy in the Agricultural Sector.

Materials and Methods

The statistical population of this study consists of 130 investors of companies active in renewable energy in the agricultural sector throughout Iran. Simple random sampling method was used. The sample size was 97 according to Krejcie and Morgan table (Krejcie and Morgan, 2003). In this research part of the information is obtained through library study and access to scientific documents and resources and other sections were collected using a questionnaire, after researching the theoretical understanding of the decision-making process of investment in renewable energies in the agricultural sector and institutional pressure and taking into account the specific goals, the questionnaire items were designed in different dimensions and after designing the questionnaire and correcting and validating it, the final questionnaire was provided to the respondents.

Results and Discussion

According to the results 91% and 6% of respondents were male and female, respectively. About 63% of them had Master degree and 77.3% of them invest in solar energy. Most of them had an age range of 32-41 years old (43.3%) and most of them, 86.6% of them had nine years and less of experience. The maximum frequency for the initial capital of the studied companies ranged between 5300 and 8600 dollar (30.9%). The maximum frequency of the monthly profit of investment of the studied companies was 900 dollar and less. Further, considering the percentage of share of investment in renewable energies in the agriculture sector, 53.6% of them lied within the range of 21 and 37% (Table 3 and Table 4).

Table 5: Status of Investment Decision Making Process in Renewable Energy in Iranian Agriculture Sector.

Variable	Level	Frequency	Mod
Investment decision making process in renewable energies	Low	19	Good
	Medium	24	
	Good	40	
	Excellent	14	
Total		97	

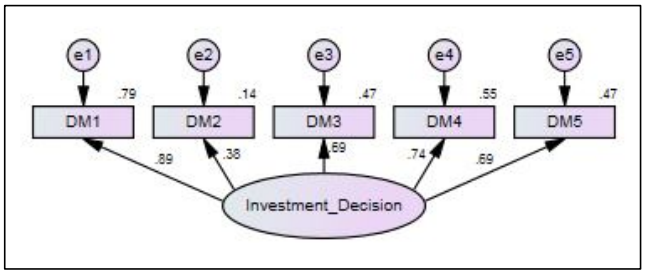

Fig. 7: Measurement model of investment decision making.

Description and Analysis of the Status of Investment Decision Making Process in Renewable Energy in Iranian Agriculture Sector

The ISDM index was used to qualitatively describe the status of the investment decision-making process in the field of renewable energies in the agricultural sector. Given the overall status of the average of investment decision-making process in the field of renewable energies, was 14.45 and standard deviation was 4.27. The status of the investment decision-making process using the Standard Deviation of Mean (ISDM) formula is categorized as follows into four sections. Most people (40 people) were good and 14 were excellent.

A = Low: A$\leq$ Mean - SD

B = Medium: Mean - SD $\leq$ B < Mean

C = Good: Mean $\leq$ C < Mean + SD

D = Excellent: Mean + SD $\leq$ D

The results of Pearson correlation test showed that there is a significant and positive relationship between Institutional pressure and investment decision making process in renewable energies at 99% level and this value is equal to 0.461. This implies a moderate correlation between the two factors of Institutional pressure and the investment decision-making process in renewable energies in the agricultural sector. In this way, the use of the ideas and opinions of consultants and individuals in investor's decision-making will be effective.

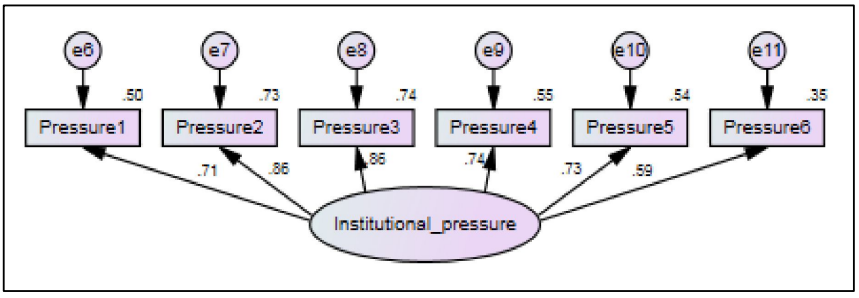

Fig. 8: Institutional pressure Measurement Model.

Table 5: The relationship between the investment decision and organizational pressure.

First variable	Second variable	Type of correlation	Correlation coefficient(r)	Significance level
Institutional pressure	Investment decision making	Person	0.461**	0.000

Measurement Models

Measurement Model of Investment decision making

According to the measurement model of the investment decision making process, the standardized factor loadings of all items were above 0.38 and the value of t was significant for all of them.

Prioritize items in order of highest factor loadings respectively are as fallow: "I will achieve my goals by decision making to investment in renewable energy in agriculture sector", "I consider the initial risk of investment in renewable energy in the agricultural sector.", "I consider the economic assessment of investment in renewable energy in the agricultural sector", "I have access to enough capital to invest in renewable energy in the agricultural sector", "I consider the assessment of the support and after-sales services in my investment decision making process". The results of this model were in agreement with all the proposed fit indices.

Measurement Model of Institutional pressure

According to the institutional pressure measurement model, standardized factor loadings of all items were above 0.59 and t values were significant for all of them. Prioritizing items based on the maximum amount of factor loadings shows: "Consultants "opinion", "Investments by well-known/high-profile investors in the sector", "Channels and Mass Media", "Technical reports", "NGOs roles", "Laws and regulations to strengthen the company's environmental adjustment", respectively. The results showed that the proposed model fit all the proposed fit indices.

Structural Model of Research

In examining the structural part of the model, relationships between internal and external latent variables are considered. The purpose here is to determine whether the theoretical relationships between the variables in the conceptual framework formulation have been confirmed by the data or not. In addition, the relative effects of independent variable on the latent variables can be examined.

In this section, after providing measurement models for each variable, the general model of research regarding the effect of independent variable (institutional pressure) on the dependent

Table 6: Goodness of fit statistics of measurement model of investment decision making.

Fit statistics	*Fit values	**Research results
Chi-square to degree of freedom ratio (CMIN/DF)	Less than 3	0.601
Comparative fit index (CFI)	Larger than or equal to 0.90	0.999
Goodness of fit index (GFI)	Larger than or equal to 0.90	0.992
Normalized fit index (NFI)	Larger than or equal to 0.90	0.989
Tucker-Lewis Index (TLI)	Larger than or equal to 0.90	0.998
Incremental fit index (IFI)	Larger than or equal to 0.90	0.999
Root Mean Square Error of Approximation (RMSEA)	Less than or equal to 0.90	0.004

Table 7: Goodness of fit statistics of measurement model of institutional pressure.

Fit statistics	*Fit values	**Research results
Chi-square to degree of freedom ratio (CMIN/DF)	Less than 3	1.919
Comparative fit index (CFI)	Larger than or equal to 0.90	0.981
Goodness of fit index (GFI)	Larger than or equal to 0.90	0.958
Normalized fit index (NFI)	Larger than or equal to 0.90	0.962
Tucker-Lewis Index (TLI)	Larger than or equal to 0.90	0.959
Incremental fit index (IFI)	Larger than or equal to 0.90	0.981
Root Mean Square Error of Approximation (RMSEA)	Less than or equal to 0.08	0.008

variable (Renewable Energy Investment Decision Making Process) were tested.

Given that the overall model of the study was of good diagnostic validity and reliability, (CMIN/DF), (CFI), (GFI), (NFI), (TLI), (IFI) and (RMSEA) were used to evaluate the model fit. Since the values of relative indices such as (CFI), (GFI), (NFI), (TLI) and (IFI) for the model were above 0.9, the general model of this study was accepted. Finally, with respect to the RMSEA index, the overall model of the research is well-suited.

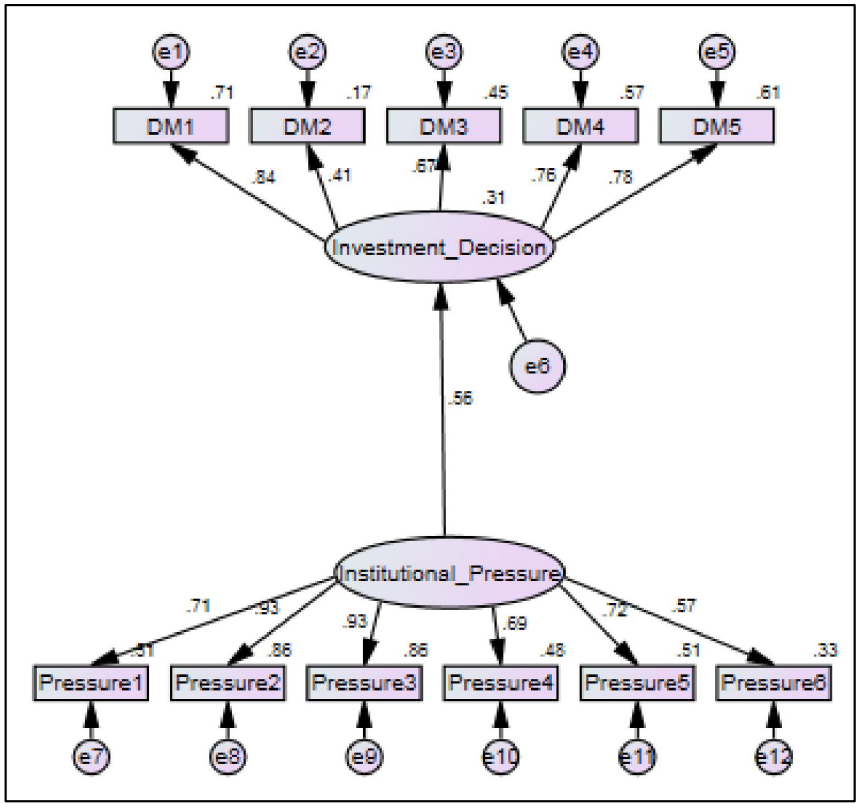

Fig. 9: Overall standardized fit of the model.

Structural model of the research

The results show that the Structural model is appropriate and acceptable. According to the indices of fitness and the amount of variance explained by the independent variable, it was found that the external variable explains 31% of the variance in decision making in investment in renewable energies across the country.

As can be seen in the figure above, in the extended model of the impact of institutional pressure on the investment decision-making process in renewable energies, the studied components of the research are shown in conceptual model along with their respective markers.

According to the proposed model, the selected indicators in the components of the decision-making process of the investment in renewable energies models confirm their respective components correctly.

The total effect of independent variable on dependent variable

According to the table 9, total effect of institutional pressure on investment decision making 0.56. And the regression equation is presented as follows.

Investment decision making = (0.86) × Institutional pressure

Table 8: Goodness of fit statistics of measurement model of institutional pressure.

Fit statistics	*Fit values	**Research results
Chi-square to degree of freedom ratio (CMIN/DF)	Less than 3	1.675
Comparative fit index (CFI)	Larger than or equal to 0.90	0.92
Goodness of fit index (GFI)	Larger than or equal to 0.90	0.93
Normalized fit index (NFI)	Larger than or equal to 0.90	0.83
Tucker-Lewis Index (TLI)	Larger than or equal to 0.90	0.90
Incremental fit index (IFI)	Larger than or equal to 0.90	0.92
Root Mean Square Error of Approximation (RMSEA)	Less than or equal to 0.08	0.04

Table 9: Total effect of institutional pressure on investment decision making.

Independent variable	Dependent variable	Total effect
Institutional pressure	Investment decision making	0/56

Reference: Research Findings

The results show that the factor of institutional pressure directly influences the investment decision making process. In fact, getting information from experienced and prominent people, consultants' ideas and technical reports on renewable energy investment can help investors make the right decision and accelerate it. The results are in line with Mat Husin and Alrazi's, (2017) research. The results showed that there is a positive and significant relationship between institutional pressure and investment decision making process in renewable energies in agriculture. Therefore, it is recommended that appropriate actions be taken by identifying and recruiting experts and specialists and collaborating between them and relevant organizations to make full use of the potential and capacity of the country's human resources to foster investment in renewable energies. Also supporting research centers and NGOs to develop research programs and financial support for renewable investment projects can be effective in enhancing it.

Acknowledgements

The authors acknowledge the financial support of Tarbiat Modares University during the project.

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