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Research Article

Investigating the effective factors on e-marketing of rural products using fuzzy inference systems (ICT approach)

Hassan Nosrati Nahook[a], Shayesteh Tabatabaei[b]

[a] Department of Computer Engineering, Higher Education Complex of Saravan, Saravan, Iran.
hsn.nosrati@gmail.com.
[b]Department of Computer Engineering, Higher Education Complex of Saravan, Saravan, Iran.
shtabatabaey@yahoo.com

Abstract: The use of information and communication technology (ICT) as one of the technological advances of the new age and its tools, namely e-government, e-commerce, e-learning, etc. can, along with proper management, accelerate the development of e-market sales of rural products. Providing public welfare in these areas will provide significant assistance. Accordingly, in the present article, using fuzzy logic to examine the factors affecting the market for electronic sales of rural products in terms of four criteria, the rate of rural use of electronic services ICT offices, computer literacy, the use of experts, and knowledgeable e-marketing in offices Rural ICT, rural office facilities and e-marketing are covered in MATLAB software. The results of extracting the sales market model with fuzzy logic show that encouraging the villagers to use the electronic services of rural ICT offices, increasing the computer literacy of the villagers, and increasing the facilities of the offices will increase the electronic sales market of rural products.

Keywords: Fuzzy logic, rural ICT offices, e-marketing.

1. Introduction

Today, using the benefits of information and communication technology in the development and prosperity of countries' economies is very important. The agricultural and livestock sector is very important for all countries due to the employment of villagers in it, and countries are trying to develop this pole of their country's economy. To thrive in this sector, getting the target market and customers are the most important part. When a farmer sees that his product sells well and realizes that if he improves the quality of his product, he will get more profit, he will move towards more production and higher quality, and earning high profit will lead to more production. In the long run, when production goes up, it will be profitable for the farmer to continue his production and gain high profit with low profit in sales [1].This new environment has the conditions to be present in global markets and enjoy its benefits and has created heavy competition that cannot be successful without knowledge. Many developed countries of the world understand this phenomenon of the third millennium and the new century and have various plans to move from the traditional to the new conditions. They know that this dynamic process has a profound effect on all aspects of social and economic communication, business practices, politics, media, health, banking, education, recreation, business, and entertainment [2].

Today, the possibility of accessing the Internet and using its information resources is growing in all human societies, and different countries each benefit from the benefits of information and communication technology due to the various infrastructures created [2].In the market of agricultural products, we see that the products of foreign countries are sold with higher quality and the same price as the domestic product. This shows the correct marketing of foreign countries and shows that they pay attention to the consumer market and demand in producing their products. Have [3].Many countries market their products electronically and use the Internet as a channel to promote their products in their country and the world. Our country Iran, along with many leading countries in the world, has taken action to develop information and communication technology in the country and has tried to create, install, develop and expand the necessary hardware and software platforms to pave the way for the development of this branch in the country [3].

Most of the advances and facilities in the field of information and communication technology are in cities. Less than 26% [4] of the country's population is located in rural areas, which produce all of the country's agricultural and livestock products. All kinds of products produced in the villages enter the urban markets and are bought by the urban merchants or intermediaries at the lowest prices from the villagers and are traded at high prices in the market, making huge profits for traders and intermediaries.At present, information and communication technology has been developed worldwide, and in our country, ICT has been developed in all cities and villages, and people have used its services and are familiar with it. In the world, a high percentage of transactions and trade is based on ICT and is

expanding every day [4].Governments have taken several steps in this regard, the most important of which are the implementation of the project "Equipping ten thousand villages in the country with rural information and communication technology offices", expanding mobile phone lines, and launching television networks such as education [5].

In this regard, the role of rural ICT offices in providing services to rural areas and increasing the awareness of villagers can be considered. Paying attention to the role of information and communication technology in rural development, examining and recognizing the goals of establishing rural ICT offices, recognizing the strengths and weaknesses of ICT offices in rural areas, evaluating the economic, social, and cultural achievements of rural ICT offices and their performance in recent years has taken. Many conferences have been held in this field and most organizations and institutions in the field of rural ICT have a long-term plan and vision [5].Today, the issue of e-commerce is one of the new human innovations that has played a decisive role in all types of trade and transactions in the last decade and has become very widespread due to the development of information and communication technology. E-commerce has paved the way for direct communication between the producer and the consumer and has provided a potential market for customers to producers [6].

Due to the production of agricultural and livestock products, the villagers are considered as the most important element of the society's production, while the villagers, despite producing many products, unfortunately, do not make much profit from selling their products. This is observed in different villages of the country. Every year during the harvest season, we see that many of the farmers' crops are damaged or, often due to the hesitation of intermediaries and brokers in buying the crop, the farmers are forced to sell their products at a low price.In the meantime, if the farmers, with the cooperation of the responsible institutions or themselves, marketing with regard to the customers and the consumer market in the country or neighbouring countries, they would have gained more profit [6], [7].

In the country, several years ago, the expansion of rural ICT offices, which was carried out in cooperation with the United Nations, received a lot of attention, and these offices were established in many villages.After that, the process of expanding and creating these offices subsided, and the above project, like other IT-related programs in the country, became silent and disappeared in the twists and turns of the administrative system, and part of the revenue generation and job creation in the telecommunication system in Came.However, these offices provided a good basis for creating new applications of IT in the country's villages. In recent years, most parts of the country have suffered from drought and severe water shortages, which have created many problems for the villagers. Farmers have to access water resources for agriculture and crop production and incur higher costs for agricultural production, and on the other hand, drought has increased plant pests, and farmers use more chemical pesticides to solve this problem, and as a result, The quality of products has also decreased. With this difficulty in producing the product, the lack of a reliable sales market is another problem that worries farmers [7].

Intermediaries and brokers buy and store the product at a low price from the farmer in high season, or by marketing and presenting the same product in other parts of the country, they make a lot of profit and the farmers do not make much profit.Now the question is why farmers do not undertake marketing and selling their products? Is this possible or not? Is there a way for farmers to overcome this problem with ICT offices and the use of information technology? Is e-marketing possible in rural areas considering e-commerce?Today, the Internet has become a platform for e-commerce and marketing a variety of goods and products. In many countries, such as India, Africa, etc., products are marketed and sold with the help of the Internet and ICT-based methods, and through this, good profits are made to farmers and villagers [8].Our country Iran In its villages, a variety of agricultural products, livestock, and handicrafts are produced, all of which need marketing and presentation to customers. In many of these villages, there are ICT offices that are also connected to the Internet. Many young people in the villages go to these offices and order textbooks and textbooks and are familiar with the Internet and its benefits, so there is a good ground for e-commerce [8].

2.Related Works

2.1. Research Background

Information and communication technology has grown today with the help of the Internet in most parts of the world and has led to the development and creation of web-based businesses or e-commerce. Today, information and communication technology is the focus of the economic, social, and cultural development of different countries. E-commerce is one of the objective manifestations of the information and communication technology revolution in the economic field. The advent of the Internet and its commercialization in recent decades has transformed traditional ways of doing business [8].

E-commerce has important economic benefits and consequences such as market expansion, reducing the price of production resources, improving productivity, reducing transaction costs, creating employment, and reducing inflation and plays a key role in economic endogenous growth [9].E-commerce plays an important role in the trade and economy of the world. Of the total 8.4 $ trillion in global trade in 2002, $ 2.3 trillion electronically increased internationally to 12.8 $ trillion in 2006 and had an annual growth rate of 53.8 percent. Of the 2.3 $ trillion in e-commerce worldwide, 104 $ billion is in developing countries and the rest in developed countries [9].

In e-commerce, an organization consists of the following parts [10]:

1. Production: Where the organization's products are produced.

2. Financial part: is responsible for the company's account and financial book.

3. Human resources: Human resources are responsible for recruiting and training human resources.

4. Support: is responsible for support and after-sales service.

5. Marketing: This is at the forefront of the rest. All departments work so that the marketing department can sell products to customers. In other words, this section is the intersection of customers and the company. Marketing is one of the most important parts in launching e-commerce Marketing is one of the most important parts of launching e-commerce. According to "Figure 1".

Figure.1. Marketing relationship.

Research projects and books have been published on the marketing of rural products and the use of information and communication technology in projects. Among these, the projects carried out in poor countries are very significant. Strengthening agriculture and rural development as the main infrastructure of raw material production is essential. Today, in many poor countries and the Third World, which are struggling with food shortages and poverty, private organizations and institutions are working with the cooperation of governments and the United Nations, with the help of information and communication technology and mobile networks. And satellites have improved agricultural systems and by providing the necessary training have helped farmers and villagers to be able to sell their products at a daily price [11].

One of the problems of the agricultural production cycle is the issue of marketing and access to the buyer, which is due to the dispersion of rural areas and distance from sales centers. For a long time, the supply of rural products, both agricultural and livestock products and rural handicrafts was done through intermediaries. The flow of products in this way would minimize the profitability of the villagers from the production of rural products and the intermediaries would gain the most profit. Another problem with the production of rural products is the lack of sufficient knowledge of market demand. As a result, sometimes we see a shortage of some products in some years and another group of products, surplus market demand [11]. In the meantime, projects have been carried out in different countries of the world. In our own country, Iran, activities have been carried out, to which we refer to a number.

India is one of the leading countries in the field of information and communication technology. For the first time, rural ICT was carried out in rural India to cut off agricultural intermediaries and inform farmers about the price of products, and sell them at a reasonable price and closer to the current market price. To achieve this, a series of small computers such as mobile phones were used, and the farmer was informed of the current price of his product by pressing a special key. After this action and its success, it was decided to use rural ICT in other fields such as agricultural education, information, weather and weather conditions, type of crop that can be grown with environmental conditions, and in general for rural and agricultural affairs. to be used. To achieve this goal, it was decided to establish a center for these affairs and services, so this center was established under the title (ISAWA) in India [12].

In a region in central India where 60% lived below the poverty line, the project was implemented to establish communication through technological innovation, and on January 1, 2000, a rural Internet hub covering 20 rural information kiosks was set up in five districts. Start-up, which provides the following services by increasing the number of kiosks [13]:

- Estimates of Agricultural Auction Centers: On the common rates of important products in all known auction centers in India online.

- Information about farmers' lands such as area, document, general shape, etc.
- Providing general online services: such as income certificate, class, place of residence, municipal services, district, etc.
- Respond to complaints within a maximum of one week and online.
- Rural Auction Site: Launched in July 2000 to provide easy auctions for the farmer, easily providing him with land, machinery, and other equipment, and even selling his goods.
- Information about government programs.
- Copy, print, scan, etc.
- Use of internet and e-mail.

Milk production is important in India, as milk is a major source of protein and calcium for a largely vegetarian population. Dairy production and sales provide a livelihood for millions of Indian farmers and provide additional income for large numbers of rural families as well as a means for women to engage in economic activities in rural areas [13].For this purpose, GCMMF Company, with the help of information technology, has simplified the purchase of milk from farmers and has satisfied them by installing devices.The following measures have been taken by the government in the field of IT in Taiwan [13]:

- Educate farmers to use the Internet: At the beginning of the process, people interested in this work were selected and taught how to use the Internet and e-mail.
- Extensive training of staff to create a site for each region: Others were trained by hypertext to build sites for each region. They posted information and statistics about farmers, including products, prices, pests in the region, etc. on the site.
- Determining the prices and advertisements of products: After a while, computer systems provided ancillary services that analyzed all activities and product data, and another service was created to handle product production equipment to contribute to the optimal production of both products. The systems were placed on the site.

The Green Star Fund has established centers in various locations, such as the West Bank, India, Ghana, Mexico, Brazil, and Jamaica, whose electricity is supplied by solar energy. And are connected to the Internet wirelessly via satellite dishes. Each Internet service center, health facility, and training classroom includes distance learning tools and a business center through which traditional cultural products can be sold online. Traditional arts, music, photography, myths, and storytelling are recorded in small villages and sold in global markets via the Internet [14].The Grameen Phone project is a service for the commercial use of mobile phones in rural areas, which is mainly used by rural women to receive medical help and advice and to know the prices of products in urban areas. The result of this project has been very successful, and as an example after its implementation, the selling price of the products by the villagers in the covered villages has been higher than in the past, because the villagers had more information about the market and prices [15].

Examples of this work have been done in our country (Iran). Among these, we can mention the Qarnabad village project, which is the most successful example. The office currently works in education, government services, and tourist attraction.Another example of this is the program of the Management and Planning Organization of the country, which has established offices similar to the village of Qarnabad in several parts of the country to develop information and communication technology. One of these offices was opened in Sistan and Baluchestan province in the village of Tis Chabahar. This office is currently working, but they have not been able to proceed as they should in accordance with the set goals. Unfortunately, the creation of such offices is not done with the cooperation of experts, and always unrelated people are appointed to manage these offices just to get acquainted with Windows and some other software. So far, these offices in our country, like other countries, have not been able to succeed in their main goals.

2.2. Fuzzy inference system

Fuzzy inference systems provide a systematic process for transforming a knowledge base into a nonlinear mapping. For this reason, knowledge-based systems (fuzzy systems) are used in engineering and decision-making applications. Mamdani and Asilian used a fuzzy inference system in 1975 to control the combination of a steam engine and a boiler using a combination of language control rules in the experiences of human operators. In 1995, Holmblad and Ostergard introduced the first fuzzy controller to control a complete industrial process, the cement kiln. Since then, fuzzy controllers have been used in many industrial devices and processes, such as metro and robotics, and in many issues that required decision-making [16]. A fuzzy system has the following components:

1) A fuzzy generator at the input that converts the numeric value of variables into a fuzzy set.
2) A fuzzy rule database that is a set of if-then rules.
3) Fuzzy inference engine that converts inputs to output with a series of operations.
4) Defibrillator that converts the fuzzy output to a definite number.

"Figure 2" shows the steps of a fuzzy inference system.

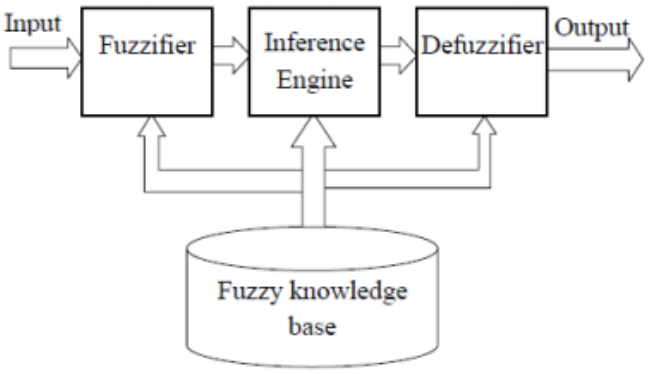

Figure.2. Steps of fuzzy inference system [17].

Fuzziness

In this step, for each input variable, we consider membership functions so that the definite inputs become fuzzy and are in the fuzzy inference system. There are different types of membership functions, such as triangular, trapezoidal, Gaussian, etc. In this research, two types of triangular and trapezoidal have been used. The triangular and trapezoidal functions are shown in "Figure 3", respectively [18].

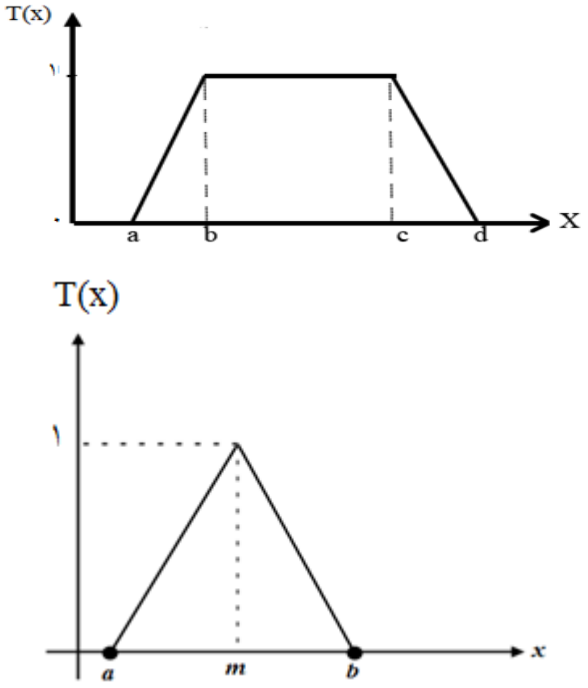

Figure.3. Triangular and trapezoidal membership functions.

To better understand fuzzy, suppose the variable x has three membership functions x1, x2, and x3. If the value of x is equal to 7, we can say that the variable x with a membership degree of 0 belongs to x1, with a membership degree of 0.3 belongs to x2, and with a membership degree of 0.7 belongs to x3, which is the same as fuzzy x = 7. "Figure 4" shows this example.

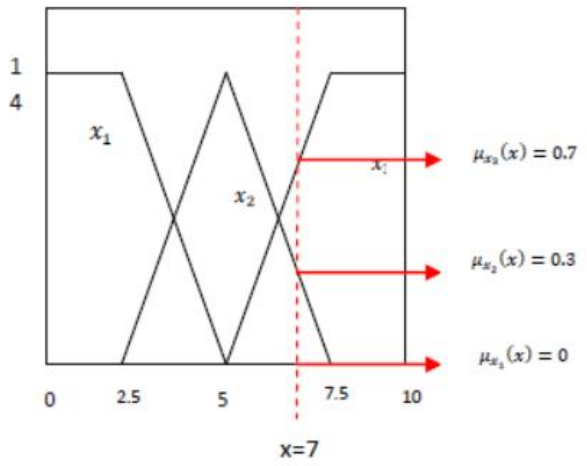

Figure.4. Fuzzy definite numbers.

Database[18]

The rule database is called the fuzzy if-then set that forms the heart of the fuzzy inference system. There are two main methods for determining fuzzy rules: one is the use of expert knowledge and the other is the use of self-organized training, such as new algorithms and neural networks. In this article, the first method is used to determine fuzzy rules. An if-then rule is defined as "if x equals A, then Y equals B." where x and Y are input and output variables and A and B are the language values (membership functions) written for these variables. It is important to note that in the Mamdani method, the output is defined in the fuzzy form. The "If x equals A" section, the "Introduction or Assumption" section, and the "Then Y equals B" section are called the "Result or Outcome" section. Figure 5 shows some rules. As shown in "Figure 5", Rules 1 and 2 have three preambles, but Rule 3 has two preambles. The number of preliminaries and conclusions (outcomes) is determined according to the expert's opinion. "Table 1" shows the written form of the rule database of Figure 5. How to use the operators will be discussed below

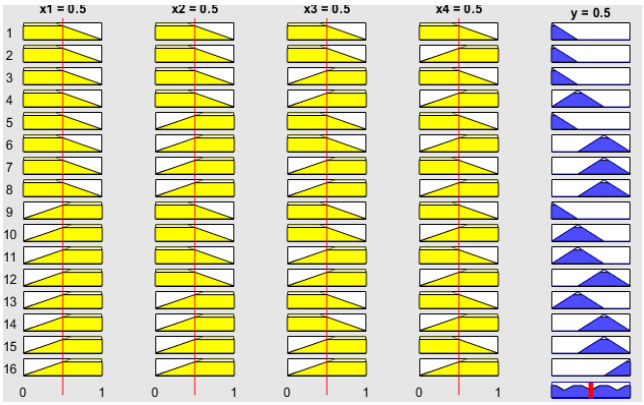

Figure.5.Four fuzzy rules.

Table.1. Written form Figure 5.

1. If (x1 is L) and (x2 is L) and (x3 is L) and (x4 is L) then (y is VL) (1)
2. If (x1 is L) and (x2 is L) and (x3 is L) and (x4 is H) then (y is VL) (1)
3. If (x1 is L) and (x2 is L) and (x3 is H) and (x4 is L) then (y is VL) (1)
4. If (x1 is L) and (x2 is L) and (x3 is H) and (x4 is H) then (y is L) (1)
5. If (x1 is L) and (x2 is H) and (x3 is L) and (x4 is L) then (y is VL) (1)
6. If (x1 is L) and (x2 is H) and (x3 is L) and (x4 is H) then (y is H) (1)
7. If (x1 is L) and (x2 is H) and (x3 is H) and (x4 is L) then (y is H) (1)
8. If (x1 is L) and (x2 is H) and (x3 is H) and (x4 is H) then (y is H) (1)
9. If (x1 is H) and (x2 is L) and (x3 is L) and (x4 is L) then (y is VL) (1)
10. If (x1 is H) and (x2 is L) and (x3 is L) and (x4 is H) then (y is L) (1)
11. If (x1 is H) and (x2 is L) and (x3 is H) and (x4 is L) then (y is L) (1)
12. If (x1 is H) and (x2 is L) and (x3 is H) and (x4 is H) then (y is H) (1)
13. If (x1 is H) and (x2 is H) and (x3 is L) and (x4 is L) then (y is L) (1)
14. If (x1 is H) and (x2 is H) and (x3 is L) and (x4 is H) then (y is H) (1)
15. If (x1 is H) and (x2 is H) and (x3 is H) and (x4 is L) then (y is H) (1)
16. If (x1 is H) and (x2 is H) and (x3 is H) and (x4 is H) then (y is VH) (1)

This article contains 16 rules, all of which have 4 prefixes and one result.

Defuzzification

Diffusion is the process of turning a fuzzy set into a definite number. Thus, the input of the diffuse process is a fuzzy set (the sum of the output fuzzy sets) and its output is a number. That fuzzy helps with mid-stage valuation is that the final desired output for each variable is only one number. There are different methods, such as the center of gravity [b], bisector, half-maximum (average value of fuzzy set maximum), maximum, and smallest maximum for diffusion, but the center of gravity method is the most common method [39]. In this paper, the center of gravity method is used for diffusion. Equation 1 is the diffusion relation based on the center of gravity.

$$\text{Stock - Liquality} = \frac{\sum_{l=1}^{m} y^{-l} \prod_{i=1}^{n} \mu A_i^l(X_i)}{\sum_{l=1}^{m} \prod_{i=1}^{n} \mu A_i^l(X_i)} \quad (1)$$

The parameters of this formula are i: path index, m: number of fuzzy rules (here it is 8), n: number of membership functions of input variables, $\mu A_i^l(X_i)$: fuzzy value of membership functions and y^{-l} output centers [19].

3.The proposed model to investigate the e-marketing analysis of rural products using FIS.

Using the variables x1: Rural people use electronic services of ICT offices, x2: Computer literacy, x3: Use of experts and knowledgeable e-marketing in rural ICT offices, x4: Features of rural ICT offices, in fuzzy inference systems We estimate the market for the sale of rural products (y). The proposed model in this paper consists of three steps and seven steps ("Figure 6").

- The first stage (fuzziness)

Step 1 (s11): Select the inputs (xi, i = 1,2,3,4) as a fuzzy number.

Step 2 (s12): Write the relevant rules extracted from the table of mathematical calculations using the opinion of experts.

The first step is input to the second step.

- The second stage (inference engine)

Step 3 (s21): Apply input and get the membership function.

Step 4 (s22): Apply fuzzy operators.

Step 5 (s23): Apply the signification method and obtain the output of each rule.

Step 6 (s24): Assemble the outputs and obtain the final fuzzy output.

- The third stage (defuzzication)

Step 7 (s31): Convert the final fuzzy output to a definite number.

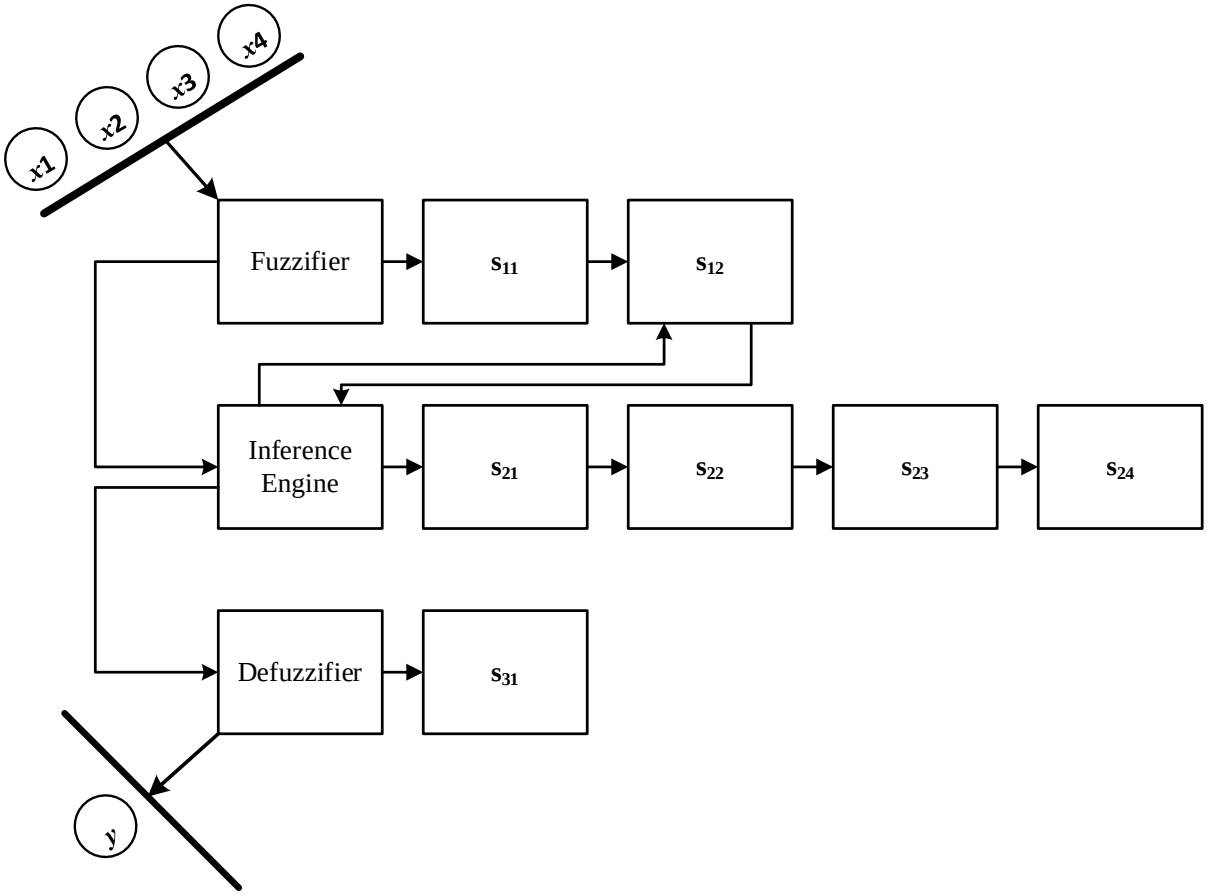

Figure.6. Proposed model.

For each of the input variables, we define two fuzzy sets with trapezoidal membership functions. (From H for the upper limit and L for the lower limit) shown in Figures 7, 8, 9, and 10. The reason for using trapezoidal attachment functions is its accuracy. For the output, five fuzzy sets with triangular attachment functions (H for the upper limit, VH for the very high, L for the lower limit, and VL for the very low limit) are used, as shown in "Figure 11".

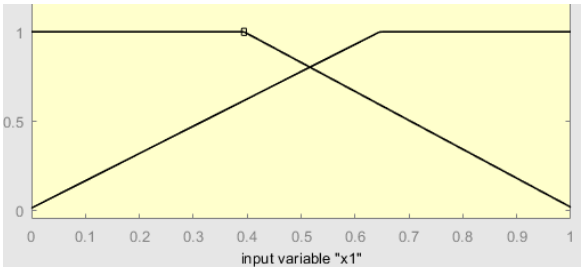

Figure.7. Membership functions for the first input variables.

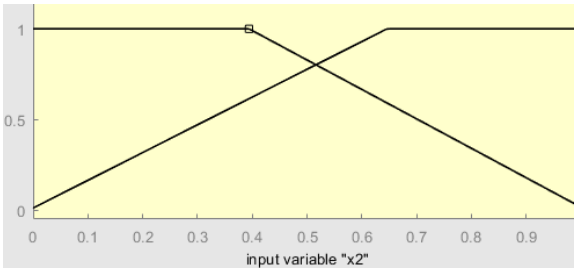

Figure.8. Membership functions for the second input variables.

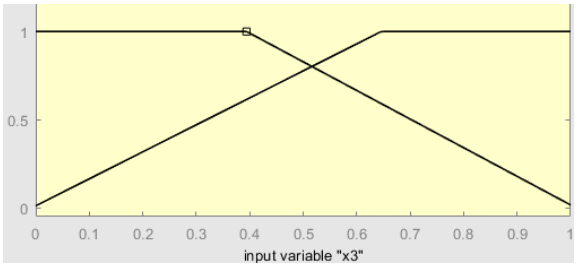

Figure.9. Membership functions for the third input variable.

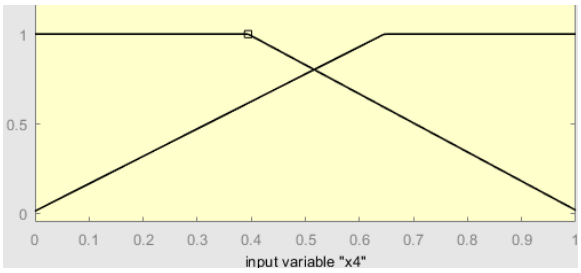

Figure.10. Membership functions for the fourth input variable.

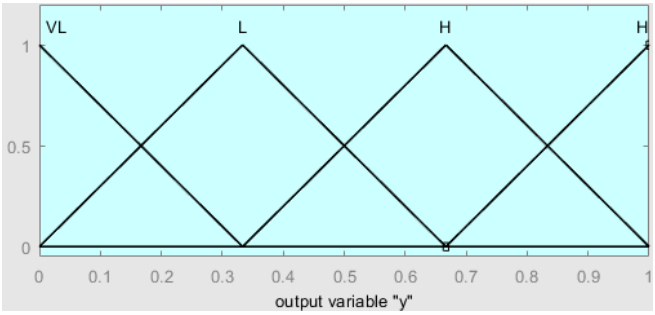

Figure.11. Membership functions for the output variable.

The four indicators are given to the fuzzy system as input to determine which factor has had the greatest impact on the electronic sales of rural products. "Table 2" shows the extracted rules for inputs for estimating output.

Table.2. Extracted rules.

	Inputs				**Output**
Rule number	x_1	x_2	x_3	x_4	y
1	L	L	L	L	VL
2	L	L	L	H	VL
3	L	L	H	L	VL
4	L	L	H	H	L
5	L	H	L	L	VL
6	L	H	L	H	H
7	L	H	H	L	H
8	L	H	H	H	H
9	H	L	L	L	VL

10	H	L	L	H	L
11	H	L	H	L	L
12	H	L	H	H	H
13	H	H	L	L	L
14	H	H	L	H	H
15	H	H	H	L	H
16	H	H	H	H	VH

Rule 1: If (the number of rural people uses the electronic services of ICT offices = low and the amount of computer literacy = low and the use of experts and knowledgeable e-marketing in rural ICT offices = low and the facilities of rural offices ICT = low) then the number of sales Electronic = very low.

Rule 2: If (the number of rural people uses the electronic services of ICT offices = low and the amount of computer literacy = low and the use of experts and knowledgeable e-marketing in rural ICT offices = low and the facilities of rural offices ICT = high) then the number of sales Electronic = very low.

Rule 3: If (the number of rural people using electronic services of ICT offices = low and the amount of computer literacy = low and the use of experts and knowledgeable e-marketing in rural ICT offices = high and the facilities of rural offices ICT = low) then the number of sales Electronic = very low.

Rule 4: If (the number of rural people uses the electronic services of ICT offices = low and the amount of computer literacy = low and the use of experts and knowledgeable e-marketing in rural ICT offices = high and the facilities of rural offices ICT = high) then the number of sales Electronic = low.

Rule 5: If (the rate of rural use of electronic services of ICT offices = low and the rate of computer literacy = high and the use of experts and knowledgeable e-marketing in rural ICT offices = low and the facilities of rural offices ICT = low) then the number of sales Electronic = very low.

Rule 6: If (the number of rural people using electronic services of ICT offices = low and the amount of computer literacy = high and the use of experts and knowledgeable e-marketing in rural ICT offices = low and the facilities of rural offices ICT = high) then the number of sales Electronic = high.

Rule 7: If (the rate of rural use of electronic services of ICT offices = low and the rate of computer literacy = high and the use of experts and knowledgeable e-marketing in rural ICT offices = high and the facilities of rural offices ICT = low) then the number of sales Electronic = high.

Rule 8: If (the number of rural people uses the electronic services of ICT offices = low and the amount of computer literacy = high and the use of experts and knowledgeable e-marketing in rural ICT offices = high and the facilities of rural offices ICT = high) then the number of sales Electronic = high.

Rule 9: If (the number of rural people using electronic services of ICT offices = high and the amount of computer literacy = low and the use of experts and knowledgeable e-marketing in rural ICT offices = low and the facilities of rural offices ICT = low) then the number of sales Electronic = very low.

Rule 10: If (the rate of rural people using electronic services of ICT offices = high and the rate of computer literacy = low and the use of experts and knowledgeable e-marketing in rural ICT offices = low and the facilities of rural offices ICT = high) then the number of sales Electronic = low.

Rule 11: If (the rate of use of electronic services by rural people in ICT offices = high and the rate of computer literacy = low and the use of experts and knowledgeable e-marketing in rural ICT offices = high and the facilities of rural offices ICT = low) then the number of sales Electronic = low.

Rule 12: If (the number of rural people using electronic services of ICT offices = high and the amount of computer literacy = low and the use of experts and knowledgeable e-marketing in rural ICT offices = high and the facilities of rural offices ICT = high) then the number of sales Electronic = high.

Rule 13: If (the number of rural people using electronic services of ICT offices = high and the amount of computer literacy = high and the use of experts and knowledgeable e-marketing in rural ICT offices = low and the facilities of rural offices ICT = low) then the number of sales Electronic = low.

Rule 14: If (the number of rural people using electronic services of ICT offices = high and the amount of computer literacy = low and the use of experts and knowledgeable e-marketing in rural ICT offices = high and the facilities of rural offices ICT = high) then the number of sales Electronic = high.

Rule 15: If (the rate of rural people using electronic services of ICT offices = high and the level of computer literacy = high and the use of experts and knowledgeable e-marketing in rural ICT offices = high and the facilities of rural offices ICT = low) then the number of sales Electronic = high.

Rule 16: If (the number of rural people uses the electronic services of ICT offices = high and the amount of computer literacy = high and the use of experts and knowledgeable e-marketing in rural ICT offices = high and the facilities of rural offices ICT = high) then the number of sales Electronic = very high.

4. Simulation of the proposed method

In this paper, Matlab software version 2017 has been used to simulate the proposed method. The output of the fuzzy logic system is shown in "Figures 12" and "13". Of course, the three-dimensional simulation of this fuzzy inference can be represented in 16 rules, the variables that show the greatest effect on the output in different formats are listed here.

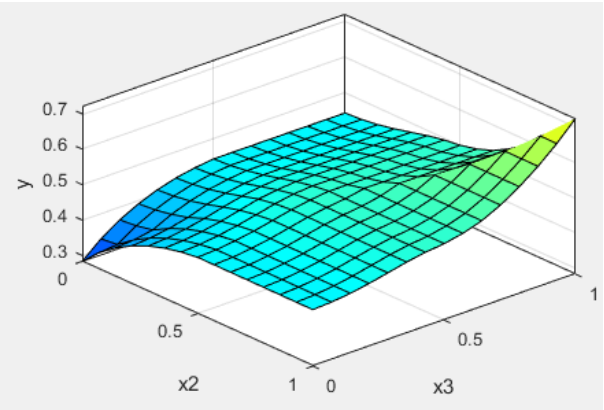

Figure.12. Fuzzy logic output with two and three variables.

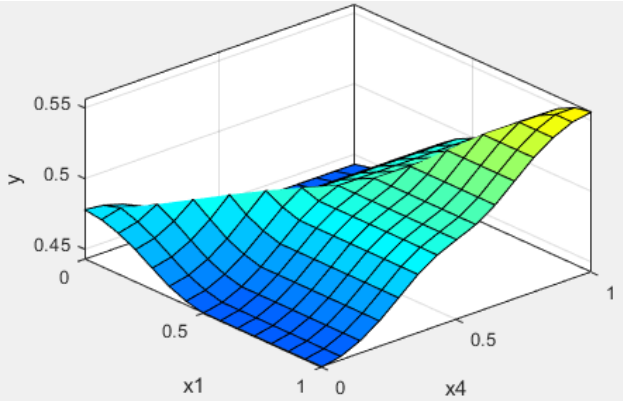

Figure.13. Fuzzy logic output with first and fourth variables.

The relationship between input variables and electronic sales of rural products These four variables in output can be seen with the fuzzy levels of Figures 12 and 13. Figure 12 shows a three-dimensional representation of the possible combinations of the two positively influential input and output variables, and Figure 13 shows the reduction of the first and fourth inputs in the output. This is a quick and intuitive way to show the positive and negative effects of inputs on output. It can be used to assess the impact of e-market sales on rural products derived from ICT variables, which can be shown which variables have the most impact and which one has the least impact on output. From this model, the optimal state can be extracted in case studies.

5.Conclusion

This article examines the impact of information and communication technology on the marketing and sales of rural products. In this paper, using fuzzy logic, the factors affecting the electronic sales market in terms of four input variables were investigated. The results of this analysis showed that there is a significant positive relationship between rural people using e-services of rural ICT offices and e-marketing, so to increase e-marketing in rural areas, the e-services use index should be increased. E-marketing is the main part of e-commerce, so the use of e-services by villagers will increase their awareness of product production, new methods, and familiarity with the Internet as the main platform of e-marketing. Villagers' use of electronic office services increases e-readiness. Electronic readiness is the ability to adopt, use and apply information technology and related applications in communities. In relation to the second variable; The overall level of computer literacy is low and the results showed that there is a strong positive relationship between the level of computer literacy of villagers and e-marketing. Measures should be taken to increase the computer literacy of villagers. The existence of electronic facilities is one of the main conditions for the development of information and communication technology in rural areas. The existence of facilities for rural men and women will expand information and communication technology and a basis for the expansion of e-commerce and e-marketing, and on the other hand, will increase the use of the Internet and its use will expand information about market demand, price Products and improvement of competitive conditions will be the market of rural products, which will provide more benefits to the villagers, which will lead to the prosperity of villages and rural jobs.

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