Ilkogretim Online - Elementary Education Online, 2020; Vol 19 (Issue 2): pp.1577-1587
http://ilkogretim-online.org
doi: 10.17051/ilkonline.2020.02.696742

Factors Influencing Adoption Of E-Payments In Intuitionistic Fuzzy Environment

Vinod Kumar[1] and Madhuchanda Rakshit[2]

[1, 2]Guru Kashi University, Talwandi Sabo, Bathinda, Punjab, India.

Abstract

From last one decade E-commerce become more and more popular and useful technique for all types of business transactions.E-commerce or the Internet and the web for business transactions and/or commercial transactions that covers a variety of business activitieswhereinternet is used as a platform for either information exchange or monetary transaction or both at times. Therearevarieties of ways of E-payments available in financial market nowadays. Every type of E-payment is used (more and less) by customers according to their interest and suitability. Here, in this paper a mechanism for the selection of type of E-payment by applying an uncertainty measure in intuitionistic fuzzy set theory is proposed. The whole process is based on the relation between various types of E-payments and factors affecting the convenience of customers. For this process, a case study with selected degree of membership function and degree of membership function and degree of non-membership function are used for checking and appropriate implementation of this modeling in practical fields.

Keywords: Intuitionistic fuzzy relations, Max-min-max approach,Tsallis entropy function, Types of E-payments

1. Introduction

We are living in the time when everything can be easily available through the internet. Many things can be done quickly by anyone, anytime and anywhere. Social networks are the main trend for the new generation in the form of communication. Business and Banking also start to move towards online with the introduction of E-Commerce. E-Commerce is basically a method of modern business, which addresses the requirements of Business organizations. Broadly we can say that it is a process of selling or buying goods or services by using an electric medium. E-Commerce sites use electronic payments. Electronic payment system has received different acceptance level across the world. The E-payment transaction has given security, efficiency and certainty of payment to the customer. It also saves time, contains no risk and has flexible transaction. There are a lot of advantages of E-payments for the whole society.

Electronic payments are one of the modern technologies that have been rapidly grown in the field of Business. E-payments have great revolution the manner in which the business conduct its transactions and operations. E-payments are mainly used by Electronic Commerce sites, where electronic payments refer to paperless transactions. E-payments have developed the business process by reducing the paperwork, transaction cost and also the labor cost. E-payments help the business organizations to expand their market reach.The very first thing that happens is that the customer goes through the web storefront and looks for a service or product according to his interest. When the customer searches the web storefront and identifies the service or product the next step is making the payment for the purchase of that product or service. Obviously,E-payment transaction is required. E-payment mainly refers to paperless transactions. E-payments also assist companies, banks and customers to make payments much more effectively and safely. The technology has been developed to improve and provide securee-payment transactions. In short, we can say that without a successful E-payment system, the picture of E-commerce is not complete.

Every business requires maintaining a high cash flow for operating smoothly. That is why, a lot of businesses have started including towards adopting their payments electronically. The growing use of Internet banking and shopping has seen the growth of different e-commerce payment system. The E-payment system has grown rapidly over the last few decades due to widely spread of internet facility. As the world advance more on the development of technology, a huge number of E-payments systems have been developed. Generally, Electronic payment is a way of paying money for goods and services through an electronic medium without use of cash or check.E-payment system helps the business to save their money and time. The process of payments can be done speedily by using E-payment system. It is also called an online payment system. There are many types of E-payments which make it easier and convenient to pay for their customers.In the Covid-19 pandemic a vast growth has been recorded in E-commerce market especially in E-payment sector.

There are mainly four types of E-Commerce. E-payments are included in business to customer (B2C) type of E-commerce. The customers mainly started the use of E-commerce system in early 1990's. Banerjee.et.al [2005] published an article related to the gender division in the use of internet applications. Black [2005] studied the predictions of consumer trust. Chau and Lai [2003] did an empirical investigation of the determinants of internet banking. Chen.et.al. [2009] presented the current status E-learning in China. Flavian and Guinaliv [2006] explained the three basic elements of loyalty to a web-site. Ha and Stoel [2009] gave a model for consumers of E-shopping acceptance. Johar and Awalluddin [2011] told the role of technology on E-Commerce application system. Jun and Cai [2001] have analyzed the key determinant of internet banking service quality. Kim.et.al. [2010] did an empirical study of customers' perceptions of security and trust in E-payment systems.Legris.et.al.[2003] did critical review of the technology acceptance model. Liao andCheung [2002] studied consumer attitudes on Internet-based E-banking. Monsuwe etal. [2004] reviewed the literature related to the interest of consumers towards online shopping. Tan and Teo [2000] told the main factors influencing the adoption of internet banking.Princeetal.[2016] applied a probabilistic information measure in IFS theory for the selection of laptops according to their brands and features.

2. Research methodology

From the derived rationale and introduction above, we carried out observational and explanatory research to find the solution. Descriptive survey has also carried out to analyze the factors influencing the adoption of E-payments by different modes. Different approaches have applied (Sanchez's approach, Max-min-max composition) on membership and non-membership functions. The main aim of this study is to find out which type of E-payment is more flexible, convenient and beneficial for a consumer. After studying the various factors namely reliability, less cost, technology, customer's information security, role of government and infrastructure which influence the interest of consumers and the use of E-payments system. Also, this research would like to study the relationship between consumers, their influencing factors and different types of E-payments namely crypto currency, E-money, credit card/debit card, E-wallet, cash payments, online transfer and net banking in the intension to use E-payment system. The whole empirical study has been shown in form of tables.Thestudy has done in the form of tables. Firstly, we take the IFR between customers and influencing factors for selecting type of E-payments with assigned degree of membership and non-membershipas given in table (3.1). Secondly, we take The IFR between the influencing factors and types of E-payments having assigned degree of membership and non-membershipvalues as given in table (3.2). In the next step, we apply max-min approach and min-max approach IFRs as given in table (3.3). Further intuitionistic index is calculated in table (3.4). Finally, we applyTsallis entropy in intuitionistic fuzzy environment(for different values of α) as given in (3.5)table. The minimum value from the whole values has been selected. If there is a tie in values, then weconsider that the customer is interested in both types of E-payments.

2.1. Intuitionistic Fuzzy Sets and Measures

Fuzzy sets show the extension of the concept of classical set theory. This theory is basically used for making mathematical models veiled and indefinite concepts, such as those of poverty, medical, youth, customer satisfaction and so on. Fuzzy set theory introduces a membership function similar as set belongs to set theory, expressing the degree of membership. The concept of fuzzy sets or fuzzy information theory was given by Zadeh [1965]. Recently Fuzzy set theory becomes more popular due to its vast application in almost all fields. Suchet & Madhuchanda used these fuzzy theory concepts in transportation problems, fractional programming problems, quadratic fractional programming problems [2017, 2017, 2017, 2017, 2018]. But sometimes the utilization of fuzzy members is insufficient in many situations which are proposed to solve by intuitionistic fuzzy set theory. The discovery of intuitionistic fuzzy sets was a happenstance done by Atanassov [1994]. Intuitionistic fuzzy set theory contains three parts: membership function, non-membership function, hesitation index function. With these three parts, intuitionistic fuzzy sets can explain the nature of fuzzy world better than traditional fuzzy sets. The use of considering intuitionistic hesitant fuzzy sets gives a valuable theoretical framework. Here we apply a model for the selection of type of E-payments done by customers.

As discussed in the above paragraph intuitionistic fuzzy measures are the generalizations of fuzzy measures. The value of these measures lies in the interval [0, 1]. The addition of all three parts (membership function, non-membership function, intuitionistic index function) must be equal to one. If the value of intuitionistic index is zero then intuitionistic fuzzy set becomes fuzzy set.

A lot of applications of intuitionistic fuzzy measures have been done in medical, applied science and social science. Szmidt and Kacprzyk [2003] developed many new entropy measures of IFS theory. Husain, Ahmad and Alam [2012] applied some intuitionistic fuzzy measures in various decision-making problems.Princeet.al. [2014] studied about various types of TB and patients suffering from this disease in IF environment.

Let $X = \{x_1, x_2, x_3, \ldots\ldots, x_n\}$ be a universal set. Then an intuitionistic fuzzy set A is given as:$A = [< x, \mu_A(x), v_A(x) > ; x \in X]$ Where $\mu_A(x) : X \rightarrow [0,1]$ and $v_A(x) : X \rightarrow [0,1]$ are membership functions and non-membership functions,under the condition$0 \leq \mu_A(x) + v_A(x) \leq 1$ and the value $\pi_A(x) = 1 - \mu_A(x) - v_A(x)$ is called the intuitionistic index function. The value $\pi_A(x)$ indicates more vagueness on x. If $\pi_A(x) = 0$ for all $x \in X$, then intuitionistic fuzzy set becomes asimple fuzzy set.In this article, we will applyTsallis's entropy measure as intuitionistic fuzzymeasure.

2.2. Max-Min-Max Criteria of Fuzzy Relations

Intuitionistic fuzzy relation can be combined with each other by the operation called "composition". There are many composition methods which can be used like max-min-max method, max-product method, max-average method etc. But max-min-max method is considered best in intuitionistic fuzzy logic applications.

Suppose A be anintuitionistic fuzzy set of set X andR be an intuitionistic fuzzyrelation from X to Y,then this approach of intuitionistic fuzzy set X with intuitionistic fuzzy relation R(X to Y) is given as B = R o A with membership degree function and non-membership degree functionis given below:

$$u_B(y) = \max_{x \in X}\{\min[u_A(x), u_R(x,y)]\} \quad \text{and}$$

$$v_B(y) = \min_{x \in X}\{\max[v_A(x), v_R(x,y)]\}$$

Some properties which are satisfied by the above composition are (i) Associativity (ii) Reflexivity (iii) Transitivity (iv) Symmetry

Further suppose C = $\{c_1, c_2,\ldots\ldots,c_m\}$; F = $\{f_1, f_2,\ldots\ldots,f_n\}$ and E = $\{e_1, e_2,\ldots\ldots,c_p\}$ be the countable set of customers, factors that influence the interest of customers and the types of E-payments respectively.

Then, the two fuzzy relationsQ and R are given as:

$$Q = \{<(c, f), u_Q(c, f), v_Q(c, f) > | (c, f) \in C \times F\}$$

$$R = \{<(f, e), u_R(f, e), v_R(f, e) > | (f, e) \in F \times E\},$$

Where $u_Q(c, f)$ define the degree in which thefactor f affect the interest of customer c. The value $v_Q(c, f)$ define the degree in which the factor f does not affect the interest of customer c. Similarly $u_R(f, e)$ indicate the degree in which the influencing factor (f) tends towards the E-payment type e. Also, the value $v_R(f, e)$ indicate the degree in which the influencing factor (f) does not tends towards the type of E-payment e.

The composition T of intuitionistic fuzzy relations R and Q(T = R o Q) represents the position of customer c_i in terms ofaffecting factors from C to E are given by membership degree and non-membership degree functions as given below:

$$\mu_T(s_i, c) = \max_{f\in F}\{\min[\mu_Q(s_i, f), \mu_R(f, c)]\}$$

$$v_T(s_i, c) = \min_{f\in F}\{\max[v_Q(s_i, f), v_R(f, c)]\},$$ for all $s_i \in S$ and $c \in C$

Thus, we can find the customers liking by using the information taken from the case study. These particulars play a meaningful role analysis when various options are available while doing E-payments.

We know thatthe Tsallis entropy measure is given as:

$$H_\alpha^T(P) = \frac{1}{1-\alpha}\left[\sum_{i=1}^{n} p_i^\alpha \ - 1\right] \ , \ \alpha \neq 1, \alpha > 0$$

In this article we use Tsallismeasure as an intuitionistic fuzzy measure in the form

$$H_\alpha^T(P) = \frac{1}{1-\alpha}\left[\sum_{i=1}^{n}\{(\mu_i)^\alpha + (v_i)^\alpha + (\pi_i)^\alpha\} \ - 1\right] \ , \ \alpha > 0$$

Where $\mu_i$represents membership degree function, $v_i$represents non-membership degree function and $\pi_i$shows the hesitation index. In addition, α is the parameter whose values may change or we can say α represents the interest of customers that may vary at some levels.

Now from Q and R we can find new measure of IFR T for which the interest level of student s for some course c so that the following is to be verified:

(i) $H_\alpha^T(P)$islowest in case of Tsallis's entropy measure.

(ii) The equality $T = R \circ Q$ is retained.

The obtained new measure of T will translate the maximum degree of association and lowdegree ofnon-association ofvarious customers' interestas well asless degreeof intuitionistic index. If there are almost equal values in T are obtained, weselect the value in which intuitionistic index is least.

3. Results and Discussion

Let us consider the name of five (hypothetical) customers areA, B, C, D and E. We know that thereare a lot of factors which affects the interest of customers towards selection of type of E-payments. But here we will discuss the major six factors namely reliability, less cost, technology, customer's information security, role of government, infrastructure. Again, we know that their various types of e-payments, but we will discuss the main six types of E- payment methods such as crypto currency, E-money, credit card/debit card,E-wallet, cash payments, online transfer and net banking.

Consider C = {C_1, C_2, C_3, C_4, C_5} be the no. of customers (normally having same age) and F = {F_1, F_2, F_3, F_4, F_5, F_6} be the set of affecting factors.

Now,suppose the intuitionistic fuzzy relation $Q(C\rightarrow F)$ is given by:

Table – 3.1 Relation between customers and influencing factors

Q	F_1		F_2		F_3		F_4		F_5		F_6	
Customers	μ_Q	ν_Q	μ_Q	ν_Q	μ_Q	ν_Q	μ_Q	ν_Q	μ_Q	ν_Q	μ_Q	ν_Q
C_1	0.8	0.1	0.7	0.3	0.6	0.1	0.0	0.4	0.5	0.5	0.2	0.6
C_2	0.0	0.5	0.5	0.5	0.3	0.2	0.5	0.1	0.4	0.6	0.8	0.2
C_3	0.7	0.2	0.1	0.6	0.0	0.9	0.2	0.5	0.8	0.1	0.6	0.3
C_4	0.4	0.4	0.5	0.5	0.8	0.2	0.9	0.0	0.7	0.1	0.3	0.3
C_5	0.6	0.3	0.4	0.3	0.9	0.1	0.3	0.2	0.1	0.5	0.0	0.8

Now F = [F_1,F_2, F_3, F_4, F_5, F_6] are some main factors which we have taken in this paper. The customer can select one factor or more than one factor at a time.

Then the intuitionistic fuzzy relation in this case is given as $R(F\rightarrow E)$

Table - 3.2 Relation between factors and E-payments types

R	E_1		E_2		E_3		E_4		E_5		E_6	
Factors	μ_Q	ν_Q	μ_Q	ν_Q	μ_Q	ν_Q	μ_Q	ν_Q	μ_Q	ν_Q	μ_Q	ν_Q
F_1	0.3	0.0	0.5	0.1	0.4	0.4	0.1	0.7	0.1	0.1	0.3	0.5
F_2	0.2	0.5	0.3	0.4	0.6	0.1	0.8	0.0	0.4	0.0	0.2	0.4
F_3	0.1	0.8	0.4	0.4	0.2	0.7	0.8	0.2	0.3	0.7	0.7	0.0
F_4	0.4	0.3	0.2	0.5	0.2	0.6	0.8	0.1	0.1	0.7	0.0	0.6
F_5	0.1	0.9	0.1	0.8	0.0	0.3	0.3	0.6	0.2	0.4	0.2	0.3
F_6	0.4	0.6	0.3	0.3	0.9	0.0	0.2	0.5	0.0	0.5	0.6	0.2

Now, we apply the max-min-max approach on both the tables (3.1) and (3.2). In case ofmembership function μ_Q maximum of the minimum value and for non- membership function $\nu_Q$minimum of the maximum value are considered.

Then T = R o Q is obtained as follows:

Table - 3.3 Max-Min-Max Composition

T	E1		E2		E3		E4		E5		E6	
Customers	μ_Q	v_Q	μ_Q	v_Q	μ_Q	v_Q	μ_Q	v_Q	μ_Q	v_Q	μ_Q	v_Q
C_1	0.3	0.1	0.5	0.1	0.6	0.3	0.7	0.2	0.4	0.1	0.6	0.1
C_2	0.4	0.3	0.3	0.3	0.8	0.2	0.5	0.1	0.4	0.5	0.6	0.2
C_3	0.4	0.2	0.5	0.2	0.6	0.3	0.3	0.5	0.2	0.2	0.6	0.3
C_4	0.4	0.3	0.4	0.3	0.5	0.3	0.8	0.1	0.4	0.4	0.7	0.2
C_5	0.3	0.3	0.5	0.3	0.4	0.3	0.8	0.2	0.4	0.3	0.7	0.1

From the above table (3.3) the following table (3.4) is obtained which contains the values of intuitionistic index.

Table – 3.4 Intuitionistic Index

Π_1	Π_2	Π_3	Π_4	Π_5	Π_6
0.6	0.4	0.1	0.1	0.5	0.3
0.3	0.4	0.0	0.4	0.1	0.2
0.4	0.3	0.1	0.2	0.6	0.1
0.3	0.3	0.2	0.1	0.2	0.1
0.4	0.2	0.3	0.0	0.3	0.2

Next, Tsallisintuitionistic fuzzy measureis applied on the tables (3.3) and (3.4) and the following tables are obtained.

Table - 3.5.1: Tsallis intuitionistic fuzzy measure for α = 0.1

H_α^T (	E1	E2	E3	E4	E5	E6
C_1	1.8	1.8	1.8	**1.7**	1.8	1.8
C_2	1.8	1.8	**0.9**	1.8	1.8	1.8
C_3	1.8	1.8	**1.8**	1.8	1.8	**1.8**
C_4	1.8	1.8	1.8	**1.7**	1.8	1.7
C_5	1.8	1.8	1.8	**0.9**	1.8	1.7

Table - 3.5.2: Tsallis intuitionistic fuzzy measure for α = 0.2

H_α^T (	E1	E2	E3	E4	E5	E6
C_1	1.6	1.6	1.6	**1.6**	1.6	1.6
C_2	1.7	1.7	**0.8**	1.6	1.6	1.6
C_3	1.7	1.7	**1.6**	1.7	1.6	**1.6**

C4	1.7	1.7	1.7	**1.5**	1.7	1.6
C5	1.7	1.7	1.7	**0.8**	1.7	1.6

Table - 3.5.3: (Tsallis intuitionistic fuzzy measure for α = 0.3)

H_{α}^{T} (	E1	E2	E3	E4	E5	E6
C1	1.5	1.5	1.5	**1.4**	1.5	1.5
C2	1.6	1.6	**0.7**	1.5	1.5	1.5
C3	1.6	1.6	**1.5**	1.6	1.5	**1.5**
C4	1.6	1.6	1.6	**1.3**	1.6	1.4
C5	1.6	1.6	1.6	**0.7**	1.6	1.4

Table - 3.5.4: Tsallis intuitionistic fuzzy measure for α = 0.4

H_{α}^{T} (	E1	E2	E3	E4	E5	E6
C1	1.3	1.4	1.3	**1.3**	1.4	1.3
C2	1.5	1.5	**0.7**	1.4	1.4	1.4
C3	1.5	1.4	**1.3**	1.4	1.4	**1.3**
C4	1.5	1.5	1.4	**1.1**	1.5	1.3
C5	1.5	1.4	1.5	**0.7**	1.5	1.3

Table - 3.5.5: Tsallis intuitionistic fuzzy measure for α = 0.5

H_{α}^{T} (	E1	E2	E3	E4	E5	E6
C1	1.2	1.3	1.	**1.0**	1.3	1.2
C2	1.4	1.4	**0.**	1.3	1.3	1.3
C3	1.4	1.4	**1.**	1.4	1.3	**1.2**
C4	1.4	1.4	1.	**1.0**	1.4	1.0
C5	1.4	1.4	1.	**0.6**	1.4	1.0

Table - 3.5.6:Tsallis intuitionistic fuzzy measure for α = 0.6

H_{α}^{T} (	E1	E2	E3	E4	E5	E6
C1	1.1	1.2	1.	**1.0**	1.2	1.1
C2	1.3	1.3	**0.**	1.2	1.2	1.2
C3	1.3	1.3	**1.**	1.3	1.2	**1.1**
C4	1.3	1.3	1.	**0.9**	1.3	1.0
C5	1.3	1.3	1.	**0.6**	1.3	1.0

Table - 3.5.7: Tsallis intuitionistic fuzzy measure for α = 0.7

H_α^T	E_1	E_2	E_3	E_4	E_5	E_6
C_1	1.0	1.1	1.	**1.0**	1.1	1.0
C_2	1.2	1.2	**0.**	1.1	1.1	1.1
C_3	1.2	1.2	**1.**	1.2	1.1	**1.0**
C_4	1.2	1.2	1.	**0.8**	1.2	1.0
C_5	1.2	1.2	1.	**0.5**	1.2	1.0

Table - 3.5.8: Tsallis intuitionistic fuzzy measure for α = 0.8

H_α^T	E_1	E_2	E_3	E_4	E_5	E_6
C_1	1.0	1.0	1.	**0.9**	1.0	1.0
C_2	1.2	1.2	**0.**	1.0	1.0	1.0
C_3	1.1	1.1	**1.**	1.1	1.0	**1.0**
C_4	1.2	1.2	1.	**0.7**	1.1	0.9
C_5	1.2	1.1	1.	**0.5**	1.2	0.9

Table - 3.5.9: Tsallis intuitionistic fuzzy measure for α = 0.9

H_α^T	E_1	E_2	E_3	E_4	E_5	E_6
C_1	0.	0.9	0.	**0.8**	0.9	0.9
C_2	1.	1.1	**0.**	0.	0.9	0.9
C_3	1.	1.0	**0.**	1.	0.9	**0.9**
C_4	1.	1.1	1.	**0.**	1.1	0.8
C_5	1.	1.0	1.	**0.**	1.1	0.8

From the above tables (3.5.1 to 3.5.9) our expected final results are obtained. The above tables (3.5.1 to 3.5.9) shows that the customers C_1, C_4, and C_5 are interested to adopt the E_4 type of E-payment. It means that customer namely A, D andE are interested in adopting E-wallet type of E-payments. CustomerB is interested in credit card/debit card payment and customer C chooses E_3 and E_6 type of E-payments.

4. Conclusion

Due to the growth of e-commerce, electronic payment has become a popular means for paying online purchases in the whole world. Every customer has his/her desires and conditions. The interest of customers affected by so many factors while selection for online dealing. In the present article, the concept of intuitionistic fuzzy information has been applied for getting more consistentresults. On the basis of above hypotheticalvalues,it is seen thatthe entropy gives the same result in intuitionistic fuzzy environment for different values of α. Some other entropies (contains one or two parameters) can be applied in various decision-making problems. These types of studies are beneficial in different commercial field. Further a case study on our obtained theory in this paper can be extended for future research.

References

[1] Atanassov K. T. (1994), "New Operations Defined over Intuitionistic Fuzzy Sets"; Fuzzy Sets and Systems, Vol. 61, pp. 137-142.

[2] Banerjee S., KangH., Bagchi-SenS. and Rao H.R. (2005), "Gender division in the use of the Internet applications"; International Journal of E-Business Research, Vol. 1 (2), pp. 24-39.

[3] Black G. (2005), "Predictors of consumer trust: likelihood to pay online"; Marketing Intelligence and Planning, Vol.23 (7), pp.648-658.

[4] Chau P. and Lai V. (2003), "An Empirical Investigation of the Determinants of User Acceptance of Internet Banking"; Journal of Organizational Computing and Electronic Commerce, Vol.13 (2), pp.123-145.

[5] Chen L., Chen H. and Wang N. (2009), "Distance education in China: the current state of e-learning"; Campus-Wide Info Systems, Vol. 26 (2), pp.82-89.

[6] Flavian C. and Guinaliu M. (2006), "Consumer trust, perceived security and privacy policy: three basic elements of loyalty to a web site"; Industrial Management and Data Systems, Vol. 106 (5), pp. 601-620.

[7] Ha S. and StoelL. (2009), "Consumer e-shopping acceptance: Antecedents in a technology acceptance model"; Journal of Business Research, Vol. 62 (5), pp.565-571.

[8] Husain S., Ahmad Y. and Alam A. (2012), "A Study on the Role of Intuitionistic Fuzzy Set-in Decision-Making Problems"; International Journal of Computer Applications, Vol. 48, No. 19, pp. 35-41.

[9] JoharM. and Awalluddin J. (2011), "The Role of Technology Acceptance Model in Explaining Effect on E-Commerce Application System"; International Journal of Managing Information Technology (IJMIT), Vol. 3 (3), pp.1-14.

[9] JunM. and CaiS. (2001), "The key determinants of Internet banking service quality: a content analysis"; International Journal of Bank Marketing, Vol.19 (7), pp.276-291.

[10] Kim C., Tao W., Shin N. and Kim K. (2010), "An empirical study of customers' perceptions of security and trust in e-payment systems"; Electronic Commerce Research and Applications, Vol.9 (1), pp.84-95.

[11] Legris P., Ingham J. and ColleretteP. (2003), "Why do people use information technology? A critical review of the technology acceptance model"; Information and Management, Vol.40 (3), pp.191-204.

[12] Liao Z. and Cheung M. (2002), "Internet-based e-banking and consumer

attitudes: an empirical study"; Information & Management, Vol.39 (4), pp.283-295.

[13] Monsuwe T.P., DellaertB. and RuyterK. (2004), "What drives consumers to shop online? A literature review"; International Journal of Service Industry Management, Vol.15 (1), pp.102-121.

[14] Prince, Gupta P. (2016)"Applying a Probabilistic Information Measure in Intuitionistic Fuzzy Theory to Select Laptop computer", Proceedings of National Seminar on Techno Tryst 2016 "Digital India Technological Leaps for Developing Smart Cities", held at Delhi Institude of Advanced Studies, Rohini, Delhi, pp. 31-42.

[15] Prince, GuptaP. and Kumar V. (2014), "Comparative Analysis between Intuitionistic Fuzzy Set Theory and Fuzzy Information Theory in Medical Diagnosis of Tuberculosis", Mathematical Sciences International Research Journal, Vol. 3, Issue 1, pp. 436-440.

[16] Kumar, S and Rakshit, M (2017), "A Solution of Fuzzy Multilevel Quadratic Fractional Programming Problem through Interactive Fuzzy Goal Programming Approach", International Journal of Fuzzy Mathematical Archive (IJFMA) , Vol No-13, Issue-1, pp. 83-97.

[17] Kumar, S and Rakshit, M (2017), "A Solution of Fuzzy Trilevel Quadratic Fractional Programming Problem through Interactive Fuzzy Goal Programming Approach", International Journal of Research, Vol. No-4, Issue-14, pp. 779-791.

[18] Kumar, S and Rakshit, M (2017), "Interactive Fuzzy Programming Procedure for Trilevel Quardartic Fractional Programming", IEEE International Journal Conference on Computing and Cummunication Technologies for Smart Nation (IC3TSN 2017).

[19] Kumar, S and Rakshit, M (2017), "A Modiefied FGP solution procedure for Bi-level Quardartic Fractional Programming Problem", International Conference on Electrical , Electronics, Computer Sciences, Management and Mechnical Engineering (ICE2CSM2E-2017), International Institute of Technology & Research (IITR).

[20] Kumar, S and Rakshit, M (2017), A Modified FGP solution procedure for Bi- level Quardartic fractional Programming Problem", International Journal of Advances in Electronics and Computer Sciences, Vol No-5, Issue-2, pp. 1-5.

[21] Szmidt E. Kacprzyk J. (2003), "A Measure for Intuitionistic Fuzzy Sets"; Fuzzy Sets and Systems, Vol. 121.

[22] Tan M., and Teo, T. S. (2000), "Factors influencing the adoption of Internet banking"; Journal of the AIS, Vol. 1(5).

[23] Zadeh L.A. (1965),"Fuzzy Sets"; Information and Control, Vol. 8,pp. 338-353.