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Consumers' Buying Behaviour Governed by Needs Using the Laws of Electric Current & Associated with Fuzzy Cognitive Map

PRATEEP UPADHYAY
DST-CIMS (DST-Centre for Interdisciplinary Mathematical Sciences) (Banaras Hindu University), Varanasi (Uttar Pradesh), India

Abstract*—Cultural Social personal and psychological factors play the cardinal role in establishing the buying behaviour of a consumer. Needs associated with means is the driving force behind every consumers' buying behaviour. A humble approach through this paper has been made to model the needs by using the principles of current flowing through a conductor. This paper encompasses almost all the major aspects about the out coming results when current flows through a wire & ventures to emulate the fulfilment of the needs based on these. My sincerest presentation is to clad the efforts made to fulfil the needs with a numeric value. The value may not be quantitative but it is a qualitative one. Fuzzy cognitive map (FCM) has been used to understand the fulfillment of needs mathematically.

***Keywords*-Consumers' Buying behaviour, Needs, Fuzzy cognitive map (FCM), Electric current.**

I. INTRODUCTION

From [1], a consumer's buying behaviour is influenced by cultural, social, personal and psychological factors. Cultural factors exert the broadest and deepest influence.

Electric current: From [2], when there is a transfer of charge from one side of an area to the other, we say that there is an electric current through an area. If the moving charges are positive, the current is in the direction of motion. If they are negative, the current is opposite to the direction of motion.

Electric field and magnetic field: From [2], a charge produces something called an electric field in the space around it and this electric field exerts a force on any charge (except the source charge itself) placed in it. Magnetic fields are produced by electric currents, which can be macroscopic currents in wires, or microscopic currents associated with electrons in atomic orbits. Magnetic fields arise from charges, similar to electric fields, but are different in that the charges must be moving.

Heating effects of current (Joule's laws of heating): From [2], when there is an electric current in a resistor, the thermal energy of the resistor increases. If the potential difference between the ends of a resistor is V and a current I passes through it, the work done by the electric field on the free electrons in time t is

W= (potential difference) x (charge)

W= V(it)

W=i2Rt

Where 'W' is work done, 'i' is current, 'R' is resistance & 't' is time.

The work done by the field is converted into thermal energy of the resistor through the collisions with the lattice. This thermal energy is generally referred to as the heat produced in the resistor and is denoted by H. Similar discussion holds for conductors also.

Five Levels of the Hierarchy of Needs: From [1], Abhram Maslow sought to explain why people are driven by particular needs at particular time. Why does one person spend considerable time and energy on personal safety and another on pursuing the high opinion of others? Maslow's answer is that human needs are arranged in a hierarchy, from the most pressing to the least pressing. In order of importance, they are physiological needs (food, water shelter), safety needs (security, protection) social needs (sense of belonging, love) esteem needs (self esteem, recognition, status), self actualization needs (self development and realization) figure given below (each need in associated with the level of priority). People will try to satisfy their most important needs first. When a person succeeds in satisfying an important need, he or she will then try to satisfy the next most important need. For example , a starving man (need 1) will not take interest in the latest happenings in the art world (need 5)., nor in how he is viewed by others (needs 3 and 4) nor even in whether he is breathing clean air (need 2); but when he has enough food and water, the next most important need will become salient.

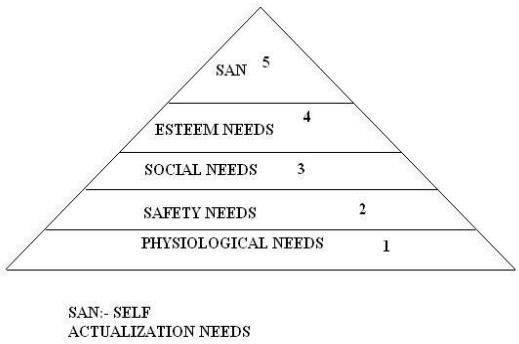

Fig 1. Five levels of Hierarchy of needs

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Sets & fuzzy sets From [4], to distinguish between fuzzy sets and classical (non fuzzy) sets, we refer to the latter as crisp sets. The letter X in this paper denotes the universe of discourse, or universal set. This set contains all the possible elements of concern in each particular context or application from which sets can be formed. The set that contains no members is called the empty set and is denoted by Φ. To indicate that an individual object x is a member or element of a set A, we write x Є A whenever x in not an element of a set A we write x does not belong to A. There are three basic methods by which sets can be defined within a given universal set X.

A set is defined by naming all its members (the list method). This method can be used {a1,a2,a3,…..,an}

A set is defined by a property satisfied by its members (the rule method. A common notation expressing this method is A = {x|p(x)} where the symbol | denotes the phrase "such that" and p(x) designates a proposition of the form "x has the property p". That is, A is defined by this notation as the set of all elements of x for which proposition p(x) is true. It is required that the property p be such that for any given x Є X, the proposition p(x) is either true or false.

A set is defined by a function usually called a characteristic function, that declares which elements of X are members of the set and which are not. Set A is defined by its characteristic function μA as follows

$$\mu A(x) = \begin{cases} 1; & \text{for } x \in A \\ 0; & \text{for } x \text{ does not belong to } A \end{cases}$$

The characteristic function maps elements of X to elements of the set {0,1}, which is formally expressed by μA: X→{0,1}. For each x ЄX where μA(x)=1, x is declared to be a member of A; when μA(x)=0, x is declared as a nonmember of A. As defined the characteristic function of a crisp set assigns a value of either 1 or 0 to each individual in the universal set, thereby discriminating between members and nonmembers of the crisp set under consideration. This function can be generalized such that the values assigned to the elements of the universal set fall within a specified range and indicate the membership grade of these elements in the set in question. Larger values denote higher degrees of set membership. Such a function is called membership function, and the set defined by it a fuzzy set. The most commonly used range of values of membership function is the unit interval [0,1] . In this case each membership function maps elements of a given universal set X, which is always a crisp set, into real numbers in [0,1]. This can be depicted as μA: X→[0,1].

Fuzzy cognitive map: From [3], an FCM is a directed graph with concepts like policies, events etc. as nodes and causalities as edges. It represents casual relationship between concepts. Fuzzy Cognitive Map was introduced by Bart Kosko in the year 1986. If increase (or decrease) in one concept leads to increase (or decrease) in another, and then we give the value 1 to the edge weights. If there exists no relation between two concepts the value 0 is given to the edge weights. If increase (or decrease) in one concept decreases (or increases) another, then we give the value –1 to the edge weights. Thus FCMs are described in this way. Consider the nodes / concepts C1, …, Cn of the FCM. Suppose the directed graph is drawn using edge weight eij ε{0, 1, –1}. The matrix E is defined by

E = (eij) where eij is the weight of the directed edge Ci Cj . E is called the adjacency matrix of the FCM, also known as the connection matrix of the FCM.

Methodology: We are now going to give the model of fulfillment of needs based on electric current flowing in a conductor. If we assume human life as a conductor (wire) and the current flowing in it as needs of his/ her life and the potential difference applied across the wire is the event of his/her birth and the event of end of his/her life . That is the potential difference as the total life span of a human being. We divide the human life in four stages named childhood, young age, middle age, and old age. These classifications of ages will serve the value of time in our paper. We assign them values as 1, 2, 3 and 4, where 1 denotes childhood, 2 denotes young age, 3 denotes middle age and 4 denotes old age. Obviously all the things needed in all these ages will be different. For example in childhood a child needs toys most, while in the old age an old man's needs are quite different from that of a child. The basis of classifications of priorities of ages made in this paper is based on taking into account of all such factors that is why we have assigned the priority value 1 to the childhood and 4 to the old age. It should be noted that in this paper 1<2<3<4. Now if we focus ourselves only on the fulfillment of needs, we can say that all the needs can be fulfilled only by making some effort. Which definitely resembles with the "heating effect of current" because making effort to fulfill any need is an undesirable factor for anyone because everyone wants their needs to be fulfilled without making any effort. Just above we described about the work done in the heating effects of the current section, we can think of the amount of work done as the amount of effort made to fulfill any need. It is to be noted that the amount of effort made derived in such a way may not be equal to the actual amount of effort made. It is just a feeling of how much effort is made in our case. As we know that the amount of work done is W=i2Rt. In this paper we take the value of 'i' as the type of need in the Maslow's classification e.g 1 for psychological needs, 2 for security needs, 3 for social needs, 4 for esteem needs and 5 for self-actualizing Needs. It is to be kept in mind that until a person is aware enough to decide the priority of the his/her own need the priorities will be assigned by observer himself/ herself. R is the number of unwanted factors to fulfill the need e.g if a man is in shortage of money he has to lend money from others which is clearly an unwanted factor for the man. So here we take the value of R as 1. Similarly if a man is having a money problem as stated above and he does have one more problem and that is he is unable to go to market to get the thing then in this case

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number of undesirable factors are 2. 't' in our paper is the age to which the person belongs e.g. 1 for childhood, 2 for young age etc. We set 'V' as the complete life span of man if he is not alive anymore and if he is alive then the age of the man is to be taken as the value of 'V' .Since this model gives just a mere feeling of the amount of effort made. Hence we set the same unit of work done (e.g. joule in SI system or other units of work done in other systems) for it .Now we move on to form our fuzzy cognitive map (FCM). It is to be noted that in this paper we are going to present the FCM (fuzzy cognitive map) for the needs and its fulfillment. Taking needs as nodes and its fulfillment as edges. According to the definition of FCM we consider nodes as needs and way of fulfillment as the edge weights. If we consider an n x n adjacency matrix where the n needs of n persons are being studied then such matrix can always say exactly which need of which person is satisfied and which need is not satisfied yet, if we place 1 for each need fulfillment and 0 for unfulfilment. Similar FCMs for other cases can also be thought of. A general FCM in the case of fulfillment of needs based on Maslow's classification can be seen as where 1,2,3,4 and 5 are the classification of needs based on Masolow's model. It is assumed that every higher priority need is satisfied only when lower priority needs are satisfied. Every edge weight joining nodes are equal to1. If higher priority needs are satisfied without satisfaction of lower priority needs then edge weights corresponding to such needs (nodes in our case) in our FCM will have value equal to 0.

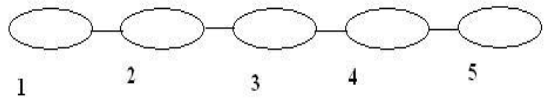

Fig 2. Required Fuzzy Cognitive Map

II. CONCLUSION

This paper tries to provide a model for the needs based on certain laws of electricity. It also provides a way to have a numeric feel of the net effort made in case of fulfillment of any need. It provides a FCM which can be used to understand which needs of a specific person or a number of persons are satisfied and which are not satisfied. On the other hand this paper provides a way to draw FCM of needs and its fulfillment.

III. FUTURE ENHANCEMENT

I am interested to model similar ideas with magnetic effects of current and to compare the results with the results given in this paper. Further, I wish to apply some more soft computing techniques to model consumers' buying behaviour in different stages of life to get better feel of the numeric values of effort made for the accomplishment of needs.

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AUTHOR'S PROFILE

Prateep Upadhyay Currently Pursuing Research from DST-CIMS, Banaras Hindu University-Varanasi,(Uttar Pradesh), India in computer science. He has a number of international and national Journal Publications. Apart from this he has a number of publications in different national and international conferences. He has a keen interest in the areas of soft computing and its applications (especially fuzzy sets fuzzy logic and its applications to consumers' buying behaviour). He has done his Undergraduate and Post Graduate courses from the same university.