THEOREM ON BRAND LOYALTY IN CONSUMER DYNAMICS FOR MODERATE CONSUMPTION LEADING TO WELL-BEING OF SOCIETY

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Abstract- These are most advanced and new approaches in area of consumer marketing research that its results are proved numerically. Almost forty years ago the subject of Economics was purely theory based but now no one can think about it without involving advanced mathematics. Similarly at present consumer marketing research needs mathematical approaches to prove its results.

Using the knowledge of advanced applied mathematics, various explanations in marketing research are possible in an easy and understandable manner which otherwise become a matter of conflict of interests. Mathematically we can always converge our discussions to a numerical value or values and hence it becomes easier to have a logical conclusion(s) by doing its interpretation.

Transformative Consumer research(TCR)for personal well-being is an academic marketing research defined as a function of research focused at consumer of a particular segment of society with all of their problems, resources for their well-being.

On the other hand this research can be expanded in multiple directions depending upon parameters of consumers and society. The numerical approach in this research process is used to observe the *dynamics of consumer behavior* in the area of transformative consumer research of any region around the globe. The pattern of the specific region will help in contouring the large diversity of consumer behavior thus enabling the easy and understandable formation of mathematical models(here equations, polynomials, differential calculus, and integral calculus, etc).[7] The focus is on finding the subsets of large interacting forces relative to social values. The recognition of such subsets are the fundamental steps in designing the desired models in TCR

This article outlines in a very technical way a specific proof in research which is appropriate to understand the proposed solutions in TCR for a specific segment of society(it is also termed as Singled-valued TCR or STCR) and to obtain the new alternative solutions with available boundary values like brand loyalty, quality, or purchasing power of a consumer, social constraints in context with some specific brand of a product.

Key words- Consumer Dynamics Transformative Consumer Research Vector Analysis Vector Dot Product Riemann Integration Vector Valued Function

I. INTRODUCTION

Although the advancement in science and technology has affected social norms everywhere, yet there still exists a large portion of the consumers in society not influenced regarding some particular brands of different products. This envisaged them about declining social values relating overconsumption and underconsumption[1]. The binding forces between the consumer and their brands are so strong that any sort of media influence fails[6].

Consumers are mainly characterized as Traditional Consumer and Barter Consumer. Further we may classify them as Rural and Urban Consumers.[11]

The forces influencing the consumer's knowledge (Human Capital) can be stated as

a) Inherited Family Knowledge
b) Knowledge by Education
c) Knowledge by Media[8] etc

A potential consumer possessing inherited knowledge (knowledge transferred from ancestors) simply ignores the market research about a particular brand but remains brand loyal, alternatively the quality comparison of desired products are meaningless for him[2].It is a well known fact that overconsumption and underconsumption result in a lot of social issues but for a brand loyal consumer the consumption is always a moderateconsumption. This behavior is naturally well-being of himself and for other similar consumers. The consumption for a certain product (products) for that consumer (consumers) is always moderate.

In other words brand loyalty of a set of such consumers for a specific product leads to moderateconsumption. Moderateconsumption not only gives birth to lesser social issues but provides guide lines for others i.e a moderate consumer is always self contended with the objective of improving consumer well-being[1]. Hence STCR is a one-to-one function of brand loyalty.

II. LITERATURE REVIEW

It has already been stated that the area of Consumer Marketing Research at present is purely descriptive or theory based. A very few researcher around the globe are manipulating this area numerically. It is quite a new dimension of research. The numerical proofs of results of this area are almost *unavailable* where as traditional theoretical explanations are available in abundant. One of result of consumer

dynamics , that *moderateconsumption leads to personal and collective well-being is a function of brand loyalty has* been proven just like Pythagora's Theorem by involving advanced mathematics. By use of higher mathematics proof and working of any description become clear, understandable, faster and precise.

III. METHODOLOGY

Institutively with the help of Vector Analysis we can say that the track of vector of such consumer moving on a market sphere will always be directed towards the family origin. Thus this consumer vector has a constant magnitude and equals to the radius of market sphere. We notice the inclination of this consumer towards other brands in the market is the *First Order Partial Derivative* of family inherited human capital with respect to the amount of time spent in market and is always zero.

Let Inherited Human Capital Vector = $\overrightarrow{I_h}$ and t is equals the time

$\Rightarrow \frac{\partial \overrightarrow{I_h}}{\partial t} = 0$ i.e The behavior of such consumer is very rigid towards the purchase of other brands of a particular commodity.
There is no change in the behavior of the consumer.

Precisely speaking, in this singled-valued transformative consumer research, a targeted segment of society in which all consumers are brand loyal is being addressed with all of their existing issues, available choices of facilitation with objective of their well-being.
One of the pre-requisite of such consumers who are falling in the area of moderateconsumption of the product is to be a *potential consumer*. These consumers mostly make a group and hence their TCR community becomes an active innovative group. In the forth coming paragraphs an example from Saskatoon, Canada is quoted.
One of the major uplift in TCR for a brand loyal consumer is the ***time saving factor.*** Such consumers never waste time in searching the market. Using vector analysis, the market search for other commodities with respect to behavior vector function may or may not be orthogonal to the plane of behavior function. The inclination of this vector is ranging from zero to 180^0 except 90^0. At orthogonal position the behavior is not defined but other behaviors can be positive and negative towards certain brands.

If we say the $\overrightarrow{m_s}$ represents market search vector then $\overrightarrow{m_s} \cdot \frac{\partial \overrightarrow{I_h}}{\partial t} = 0$ These two vectors are placed on x-axis and y-axis on the plane of market sphere, respectively.If we denote brand loyalty by $\overrightarrow{b_l}$ and quality consciousness by $\overrightarrow{q_c}$ and we also know that these are two components of purchasing power $\overrightarrow{p_p}$ of the consumer then

$$\overrightarrow{p_p} = \overrightarrow{b_l} i - \overrightarrow{q_c} j \,, \quad \overrightarrow{q_c} = \begin{cases} positive\,(higher) \\ 0 \quad\quad (ignored) \\ negative\,(lower) \end{cases}$$

Interpreting the above three situations.
First, if a consumer goes for higher quality product than that of his own brand i.e some positive value of $\overrightarrow{q_c}$ will weaken the brand loyalty and hence purchasing power increases which results in overconsumption. Overconsumption of products always create problems such as obesity, materialism, debt, addiction and environmental degradation.[1]
Second, the negative sign between the two terms on the right hand side of this equation indicates that when quality $\overrightarrow{q_c}$ is ignored then purchasing power $\overrightarrow{q_c}$ is equal to brand loyalty $\overrightarrow{b_l}$ .This is the case of moderateconsumption. Opportunities of moderate consumption improve well-being in society which includes sharing, recycling, donations, preventive and affirmative health decision making, wise money management and investment and other consumer activities that enrich personal and social development (e.g exercises, art, hobbies).

Third, if a consumer goes for lower quality product than that of his own brand i.e some negative value of $\overrightarrow{q_c}$ will increase the brand loyalty and hence purchasing power decreases which results in underconsumption. Underconsumption of products is a source of or reflection of social troubles such as malnourishment, poverty, discrimination, and homelessness etc.
Here brand loyalty does never mean that the product is of highest quality in the market.
An other vector proof is possible if we place these three vector on 3-D coordinate axes i.e they are orthogonal to each other and their scalar product is zero.

$$\overrightarrow{I_h} \bullet \overrightarrow{m_s} \bullet \overrightarrow{p_p} = \left|\overrightarrow{I_h}\right| \left|\overrightarrow{m_s}\right| \left|\overrightarrow{p_p}\right| \cos\theta \qquad where\ \theta = \begin{cases} Acute Angle\ or\ \theta < 90^o \\ Right\ Angle\ or\ \theta = 90^o \\ Obtuse Angle\ or\ \theta > 90^o \end{cases}$$

For value of Θ less than 90^o , any

one of the vector on RHS will be negative and consumer will go for market search ignoring quality and may not be able to purchase it which eventually results in underconsumption. For a value of Θ equaling 0^o, means that Inherited Human Capital is independent of other two factor proving a brand loyalty hence resulting in moderateconsumption. For value of Θ more than 90, three quantities reinforces each other and purchasing power increases with a conclusion of overconsumption.

For example in Saskatoon, Canada, the rural consumer with traditional inherited knowledge of using finest home grown tobacco will never search for any other brand of tobacco in the market because of strong brand loyalty.

On the other hand a rural consumer migrated to Ottawa or other urban area will always be searching for the same brand which he has already been using because any other brand available in the city may not be having the same quality characteristics. Although most of the cigarette manufacturing companies produces high quality and expensive products yet unable to meet the classical taste of farm grown tobacco. The strong force which tends to avoid market search for this consumer is brand loyalty and life style of the consumer. [4]

The vector representation of such a behavior can be defined as a Consumer Curve i.e a vector-valued function is a rule that assigns a vector to each character in the consumer's domain.

$$\vec{r}(t) = \vec{I}_i + \vec{p}_j + \vec{m}_k$$

or $\vec{r}(t) = \vec{I}(t)\hat{i} + \vec{p}(t)\hat{j} + \vec{m}(t)\,k$ where $a \le t \le b$

The interval $[a,b]$ represents the life style of the consumer. The curve $\vec{r}(t)$ passes through the domain of multivariate function $f(I,p,m)$, the consumer behavior function in a family.

The vector-valued function $f = f[I(t), p(t), m(t)]$ is defined for Inherited Human Capital $I(t)$,Purchasing Power $p(t)$ and Market search function $m(t)$.

By taking the integral of this composite function over the interval [a,b] which represents the life style of the consumer we have $\int_a^b f\,dt = \int_a^b f[I(t), p(t), m(t)]\,dt$

The life style [a,b] is partitioned in to 'n' number of subintervals each showing the behavior over certain period of time with width Δ_k having sum equals S_n such that by Reimann Integration

$$S_n = \int_c f[I(t), p(t), m(t)]\,dt$$

$$= \sum_{k=1}^{n} f[I(t), p(t), m(t)] \cdot \Delta_k$$

If the consumer behavior function is positive, persistent or continuous towards the brand of a product and no changing behavior which has already been defined then the right hand side of above equation approaches to zero as n increases i.e

$$\lim_{n\to\infty} \sum_{k=1}^{n} f[I(t), p(t), m(t)] \cdot \Delta_k = 0 \qquad \text{or} \int_c f[I(t), p(t), m(t)]\,ds = 0$$

In case the consumer is using, for example, any three products namely $x, y, and\ z$ then they are related by a function $f(x,y,z) = x - 3y^2 + z$. Let $(1,1,1)$ indicates any time point for the use of the product.

Since the summation is already zero, the simplest parameterization of vector $\vec{r}(t)$ is represented as $\vec{r}(t) = 1\vec{t}_i + 1\vec{t}_j + 1\vec{t}_k$. This function is continuous with first order partial derivatives such that $\left|\vec{r}(t)\right| = \sqrt{3}$ is not zero, hence parameterization is smooth

$$f(x,y,z)dt = \int_0^1 f(t,t,t)(\sqrt{3})dt = \int_0^1 (t-3t^2+t)(\sqrt{3})dt = \sqrt{3}\int_0^1 (2t-3t^2)\,dt$$

$$= \sqrt{3}\left|t^2 - t^3\right|_0^1 = 0$$

This partial mathematical proof for single-valued transformative consumer research could be possible if a consumer with strong inherited knowledge will only go for that product which has already been placed in the domain of his mind (useful social values) due to strong Inherited Human Capital (existing social norms within a family). This very TCR is confined to a very limited segment of the society.

Huge amount of TCR can be supported for consumers who are not brand loyal and thus many social problems are emerged on the basis of overconsumption and underconsumption. These issues are in-numerable but one of the primary feature is " *The goal of improving consumer well-being.*"This goal is a function of health, happiness and prosperity[1].

Researchers are busy in finding solutions or giving recommendations to state about the health issues especially concerning childhood and productive youth. For example obesity among students. This is the result of oversonsumption of junk food. It is badly required to create awareness among parents and students about this use.

An other noticeable factor is the unsatisfactory academic performance of students because of heavy use of modern electronic gadgets. Researchers in United Kingdom, United States and in many other countries have taken up this issue at national level. In one of the Asian country a state has banned students to carry cellular phones in their educational institutions.

It is well said that academic marketing research have a long history of doing socially relevant research and still lot of work has to done more[1].

CONCLUSION

The objective of this study was to obtain a mathematical proof for one segment of consumers i.e to observe the dynamics of brand loyal consumer behavior. This numerical approach in transformative consumer research has also been focused on well-being of a small group of consumers and can be extended to all others remaining areas e.g when consumer is not brand loyal, poor and low literate consumer etc. Infect this approach provides a numerical foundation for one aspect of consumer research which can be extended in multiple directions.

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