



New statistical analysis in marketing research with fuzzy data[☆]



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ABSTRACT

This research proposes new statistical methods for marketing research and decision making. The study employs a soft computing technique and a new statistical tool to evaluate people's thinking. Because the classical measurement system has difficulties in dealing with the non-real valued information, the study aims to find an appropriate measurement system to overcome this problem. The main idea is to decompose the data into a two-dimensional type, centroid and its length (area). The two-dimensional questionnaires this study proposes help reaching market information.

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1. Introduction

Talking about promoting the quality of market research is not possible without tackling the problem of implementing an efficiency evaluation tool, to systematically gauge work performance. The application of this measurable system requires setting up a metric system for sampling survey or field studies with fuzzy data.

Given the nature of the topic, studies of market research and decision management could have analyzed how people plan and execute their activities within a given time interval; researchers could have investigated plan-action discrepancies as a function of dynamic events, time budgets, etc. However, most research studies use cross-sectional designs and measurement instruments that emphasize stability rather than dynamic aspects of time-management behavior. Future research could profit much from dynamic approaches to theory building and research (Nguyen & Wu, 2006a, 2006b; Nguyen, Kreinovich, Wu, & Gang, 2011).

In many fields, such as human language, thought, and decision making—where categorization (or ranking) is vague and non-quantitative, often simply non-specific preferences—significant data may get lost easily. Consequently, statistical phenomena can easily and quickly describe the basic structure of the information for data analysis, employed in many academic areas.

Many researches focus on the applications of fuzzy statistical analysis in the social sciences, who identify the model construction through qualitative simulation. Wu and Tseng (2002) use a fuzzy regression method of coefficient estimation to analyze Taiwan monitoring index of economics. Nguyen et al., (2011) provide an extensive treatment of the theory of fuzzy statistics.

2. Literature review

Marketing research involves the process of determining needs, setting goals to achieve these needs, prioritizing and planning tasks required to achieve these goals, although several other definitions exist. Macan (1996) proposes a technique for effective time use, specifically, having enough time to accomplish the many tasks required, planning and allocating time. Strongman and Burt (2000) intend to maximize intellectual productivity, to assess the relative importance of activities through the development of a prioritization plan. In their book, Kahraman and Yavuz (2010) represent all areas of production management that reflect the natural order of production management tasks. The authors focus on applicability and wherever possible, numerical examples appear.

Marketing management behaviors comprise (1) marketing assessment behaviors, which aim at the awareness of here and now or past, present, and future and self-awareness of marketing use (attitudes and cognitions, which help to accept tasks and responsibilities that fit within the limit of marketing capabilities); (2) planning marketing behaviors, such as setting goals, planning tasks, prioritizing, making to-do lists, and grouping tasks (Lee, Chang, & Wu, 2012; Macan, 1996), which aim at an effective use of marketing; and (3) monitoring behaviors, which aim at observing people's use of marketing while

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performing activities, generating a feedback loop that allows limiting the influence of others' interruptions (Wu, Mei, & Zhong, 2012).

Building on the above discussion, this study proposes an idea of marketing management as “behaviors that aim at achieving an effective use of time while performing certain goal-directed activities.” This definition emphasizes that the efficient evaluation of marketing management depends mainly on the difference between expectation and market observation (realization).

Marketing management questionnaires include factor items on (1) attitudes' tendency towards marketing management (e.g., “do you feel you are in charge of your own market, by and large?”), and on (2) planning the allocation of market. The scale consists of three factors, namely short-range planning, long-range planning, and time attitudes.

Setting organizations' goals and priorities relates positively to perceived control, whereas mechanics of time management relate negatively to perceived control of time. Claessens, van Eerde, Rutte, and Roe

(2004) use a different marketing management scale to test the mediation model over time. Instead, this research uses a planning scale. This study also reveals partial mediation of control of time. In conclusion, these studies find some support for a process model that hypothesizes perceived control of time to fully mediate between time management behaviors and job- and person-related outcomes.

Many studies relate marketing management activity to several other outcome variables. Some studies look into the effects on proximal variables, such as accurately estimated time duration, and spent time on high-priority tasks. Other studies examine the effects on performance in work and academic settings, such as job performance, academic performance, and total study habits score. As for emotional exhaustion, Peeters and Rutte (2005) find that time management moderates the relation between high demands and low autonomy on the one hand, and emotional exhaustion on the other hand.

3. Statistical analysis with soft computing

3.1. Questionnaire with fuzzy set theory

Regarding the choice of statistical tools in the evaluation, and because the evaluation must align with the same logic base, significant differences should exist on the metrics. Finding the well-established evaluation system that goes along with this study goals and objectives is the key.

After the study of fuzzy graphic rating scale (FGRS) by Hesketh, Pryor, Gleitzman, and Hesketh (1988); Costas, Maranon, and Cabrera (1994) chose 100 university students as a sample of the research. They found that FGRS fits in the feature of human psychology. Herrera and Herrera-Viedma (2000) present the steps of linguistic decision analysis under linguistic information. Building on fuzzy number, their statements show different degrees of possibilities to express linguistics; however, studies must consider whether the response will produce the same fuzzy number. Building on the similarity of the linguistic concept, they present a formula of fuzzy association degree. Carlsson and Fuller (2000a); Carlsson and Fuller (2000b); Chiang, Chow, and Wang (2000), and Herrera and Herrera-Viedma (2000) discussed many concepts regarding the computation of fuzzy linguistic worthy broadcasting.

Drawing from previous statements: (1) the methods of traditional statistical analysis and measurement used in public consensus are incomplete. Building on the fuzzy feature of human thought, research should deeply consider and discuss quantifying the measurement of public consensus using the fuzzy number. (2) The measurement of attitudes and feelings building on the fuzzy set theory is a very common method in recent years. Many associated scholar areas in this type of research exist. Meanwhile, educational and psychological researches are still not as many. In conclusion, the theory research of fuzzy mode and experimental discussion this study presents is a possible solution of importance.

In the research of social sciences, the sampling survey always evaluates and understands public opinion on certain issues. The traditional survey forces people to choose fixed answers from the survey, but the survey ignores the uncertainty of human thinking. For instance, when people need to answer a survey that lists five choices such as “Very satisfactory,” “Satisfactory,” “Normal,” “Unsatisfactory,” “Very unsatisfactory,” despite that the answer is continual, respondents must choose an answer. This election limits the flexibility of the answer. When the survey proposes to have the answer for sleeping hours of a person, describing the feeling or reasonably understanding such feeling is difficult unless the study uses fuzzy statistics.

Traditional statistics deal with a single answer or with a certain range of the answer through sample survey, and are unable to sufficiently reflect the thought of an individual. If people use the membership function to express the degree of their feelings building on their own choices, the answer will be closer to real human thinking. Therefore, collecting the information based on the fuzzy mode is more reasonable.

3.2. The nature of fuzzy answering

Because many replies from sampling survey seem vague, uncertain, and incomplete, the information itself is divisible into continuous and discrete. This section includes brief definitions with fuzzy data.

Continuous fuzzy data are classifiable into several types, such as interval, triangular, trapezoid numbers, and exponential. The logic of the following interval analysis is one of certain containment. For example, the sum of two intervals certainly contains the sums of all pairs of real numbers, one from each of the intervals. This logic follows the definitions of interval arithmetic, drawing from simple properties of the order relation \leq .

The definition for the trapezoid data is basically the generalized form for the interval and triangle form.

A fuzzy number $A = [a, b, c, d]$, defined on the universe set U of real number R with its vertex $a \leq b \leq c \leq d$, is presumably a trapezoidal fuzzy number if its membership function is given by $u_F(x) = \frac{x-a}{b-a}$ if $a \leq x \leq b$; $u_F(x) = 1$, if $b \leq x \leq c$; $u_F(x) = \frac{d-x}{d-c}$ if $c \leq x \leq d$ and equals to 0. Otherwise, if $b \leq x \leq c$; when $b = c$, A is a triangular data; when $a = b$, $c = d$, A is an interval-valued data.

Respondents choose one single answer or a certain range of the answer in the traditional sampling survey. However, the traditional method is not able to truly reflect the complex thoughts of each respondent. If people can express the degree of their feelings by using membership functions, the answer will be closer to real human thoughts. Nevertheless, scholars unfortunately disagree about the construction of continuous fuzzy data. Many studies use continuous fuzzy without describing the construction method. The core of all the questions is fuzzy data that its membership function determines, but the construction of membership function is quite subjective. To reflect this, the respondents must determine the membership function building on GSP software.

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