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Constructing a Scientific Mixed Media Model for Boosting Automobile Dealer Visits: Evolution of Market Creation Employing TMS

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ABSTRACT

In this paper, the authors discuss the evolution of automobile market creation employing a "Total Marketing System" (TMS)as a core technology of New JIT, which contributes to constructing a Scientific Mixed Media Model (SMMM)for boosting automobile dealer visits. More concretely, the authors develop and validate the effectiveness of putting together four core elements (Video that Unites Customer behavior and Manufacturer Design Intentions (VUCMIN), Customer Motion Picture–Flyer Design Method (CMP-FDM), Attention-Grabbing Train Car Advertisements (AGTCA), and Practical Method using Optimization and Statistics for Direct Mail (PMOS-DM)) into a new strategic advertisement method designed to enhance marketing and the desire in the automotive industry. This model is applied to a dealership representing a well-known automaker, where its effectiveness is verified.

Keywords: Automobile Market Creation, Scientific Mixed Media Model (SMMM), Total Marketing System (TMS)

I. INTRODUCTION

Recently, the authors (Amasaka, 2002) have touched on the development of New JIT, a new management technology principle, and its validity as a new management technology for 21st-century manufacturing. New JIT innovates business processes in each division, encompassing sales, development, and production by utilizing a Customer Science that employs the Science SQC approach (Amasaka, 2002, 2003, 2005).

In light of recent changes in the marketing environment, the authors believe it is now necessary to develop innovative business and sales activities that adequately take into account the changing characteristics of customers who are seeking to break free from convention. If they are to be successful in the future, those involved in global marketing must develop a marketing system of the highest quality.

A marketing management system needs to be established particularly so that business, sales, and service divisions, which are developing and designing appealing products and are also closest to customers, can organically learn customer tastes and desires by means of the continued application of objective data and scientific methodology. At present, however, a system for applying scientific analytical methods to customer data has not been satisfactorily established. In some cases, its importance has not even been recognized.

In this paper, therefore, the authors discuss the validity of a Total Marketing System(TMS) as a core technology of New JIT, which contributes to the construction of a Scientific Mixed Media Model (SMMM)for boosting automobile dealer visits. A model that enables the sales, marketing and service divisions nearest the customer to systematically identify their tastes and desires is critical. The aim is for an evolution of market creation through innovative advertisements promoting dealer sales activities by utilizing the scientific approach of TMS (Amasaka, 2009, 2011).

To achieve this goal, the authors present SMMM, which takes the form of strategic marketing and has four core elements: Video that Unites Customer behavior and Manufacturer Design Intentions (VUCMIN),Customer Motion Picture–Flyer Design Method (CMP-FDM), Attention-Grabbing Train Car Advertisements (AGTCA) and Practical Method using Optimization and Statistics for Direct Mail (PMOS-DM) (Yamaji, et al., 2010: Koyama, et al., 2010: Ogura, et al., 2013: Kojima, et al., 2010: Ishiguro, et al., 2012a, 2012b). The effectiveness of SMMM using four core elements has been applied to a dealership representing a well-known automaker, where its effectiveness was verified.

II. NEED FOR A MARKETING STRATEGY THAT CONSIDERS MARKET TRENDS

Today's marketing activities require more than just short-term strategies by the business and sales divisions. In a mass-consumption society, when the market was growing in an unchanging way, sales increases were achieved by means of simple mass marketing through huge corporate investments in advertising (Nikkei Business, 1999: Amasaka, 2005). However, after the collapse of the bubble economy, the competitive market environment changed drastically. Since then, companies that have implemented strategic marketing quickly and aggressively have been the only ones enjoying continued growth (Okada, et al., 2001).

Upon close examination, it was determined that strategic marketing activities must be conducted as company-wide, core corporate management activities that involve interactions between each division inside and outside of the company (Jeffrey and Bernard, 2005). Therefore, a marketing management model needs to be established so that business, sales, and service divisions, which are developing and designing appealing products and are also closest to customers, can organizationally learn customer tastes and desires (Shimakawa, et al., 2006). Specifically, pursuing improvements in product quality by means of the continued application of objective data and scientific methodology is increasingly important (James and Mona, 2004: Amasaka, 2005).

At present the organizational system and rational methodology that allows them to analyze data on each customer using a scientific analysis approach has not yet been fully established in these divisions; in some cases, the importance of this system has not even been widely recognized (Niiya and Matsuoka, 2001: Gray and Arvind, 2003: Ikeo, 2006: Amasaka, 2007).

III. EVOLUTION OF MARKET CREATION EMPLOYING TMS

Significance of TMS, the key to application of New JIT

To create attractive, customer-oriented products that satisfy customers, the various divisions of a manufacturer must share a common language, ensuring unity and proper direction. This is necessary for all divisions, including business, sales, service, planning, development, design, production engineering, manufacturing, logistics, administration and management.

Thus, the authors (Amasaka, 2002, 2009) proposed New JIT with three core principles (Total Marketing System (TMS), Total Development System (TDS) and Total Production System (TPS)) asa new management technology principle for manufacturer activities in the next generation. The aim of *TMS* is to promote market creation as shown in Figure 1 and to realize quality management through scientific marketing and sales, not by sticking to conventional concepts.

As shown in the figure, in order to realize market creation with an emphasis on the customer, *TMS* is composed of these technological elements: (a) market creation activities through collection and utilization of customer information; (b) strengthening of merchandise power based on the understanding that products are supposed to retain their value; (c) establishment of marketing systems from the viewpoint of building bonds with customers; and (d) realization of the "Customer information network" for CS (Customer Satisfaction), CD (Customer Delight) and CR (Customer Retention) elements needed for the corporate attitude (behavior norm) to enhance customer values.

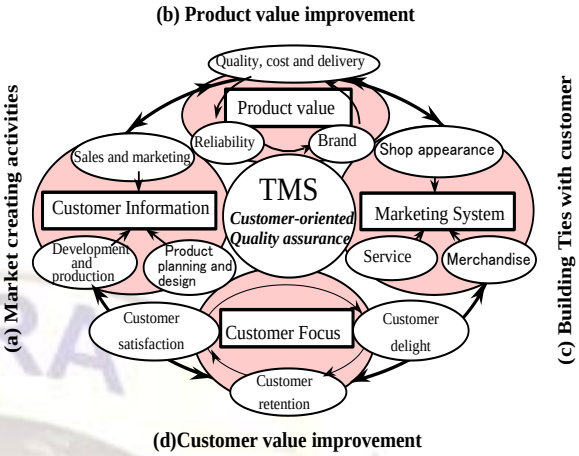

Figure 1 - Total Marketing System (TMS)

Developing Customer Science using Science SQC

Supplying products that satisfy consumers (customers) is the ultimate goal of companies that desire continuous growth. Customers generally evaluate existing products as good or poor, but they do not generally have concrete images of products they will desire in the future. For new product development, it is important to precisely understand the vague desires of customers. To achieve this goal, the authors (Amasaka, 2005) proposed Customer Science to help systematize TMS as shown in Figure 2.

To plan and provide customers with attractive products is the mission of companies and the basis of their existence. It is particularly important to convert customer opinion (implicit knowledge) to images (linguistic knowledge) through market creation activities, and to accurately reflect this knowledge in creating products (drawings, for example) using engineering language (explicit knowledge).

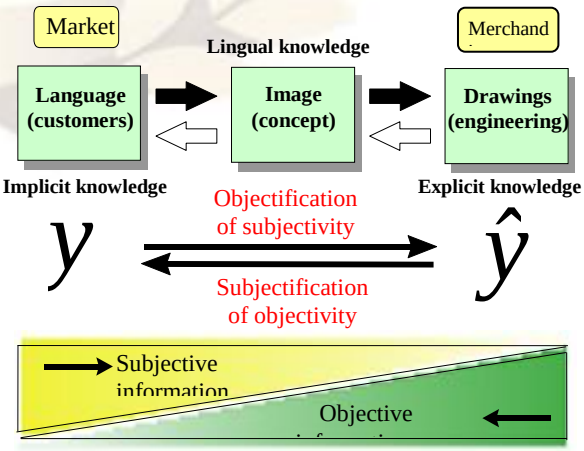

Figure 2 - Conceptual diagram of Customer Science

This refers to the conceptual diagram that rationally objectifies subjective information (y) and subjectifies objective information ($\hat{y}$) through the application of correlation technology.

The authors (Amasaka, 2003) apply the statistical science methodology to Science SQC, which has four core principles (Scientific SQC, SQC Technical Methods, Integrated SQC Network (TTIS), and Management SQC)and which is designed to develop Customer Science in business and sales divisions to make changes to marketing process management.

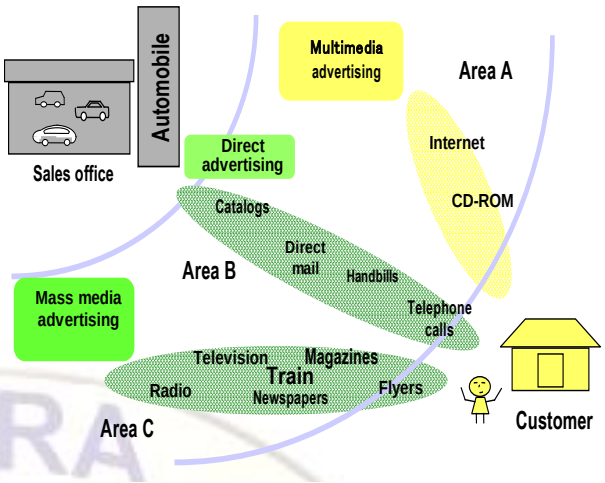

Figure 3 - Graphical representation of customer motives for visiting automobile dealers

IV. CONSTRUCTING A SCIENTIFIC MIXED MEDIA MODELFOR BOOSTING AUTOMOBILE DEALER VISITS

Publicity and advertising as automobile sales promotion activities

For many years, automobile dealers have been employing various publicity and advertising strategies in cooperation with automobile manufacturers in order to encourage customers to visit their shops.

Figure 3 shows a graphical representation of the relationship between publicity and advertising media—a relationship that helps draw customer traffic to dealers (Amasaka, 2009). Area A represents Area B represents direct advertising (catalogs, direct mail, handbills (directly handed to customers), telephone calls, etc.), and Area C represents mass media advertising (TV and radio broadcasting, flyers, public transportation (train cars), newspapers, magazines, etc.).

There appear to be few cases where scientific research method shave been applied to the effect of mixed media (areas A to C) and used to study the ways in which such sales activities actually draw customers to automobile dealers (Kubomura and Murata, 1969). However, the rational effects of the media-mix are insufficient as advertisement methods, and the authors therefore consider the need to scientifically promote a new advertisement media mixed model (Melewar and Smith, 2003: Amasaka, 2007: Smith, 2009: Ogura, et al., 2013).

Proposal of a Scientific Mixed Media Model for Boosting Automobile Dealer Visits

As part of an organization's market creation activities, it is important to gain a quantitative understanding of the effect of publicity and advertising, which are the principal methods involved

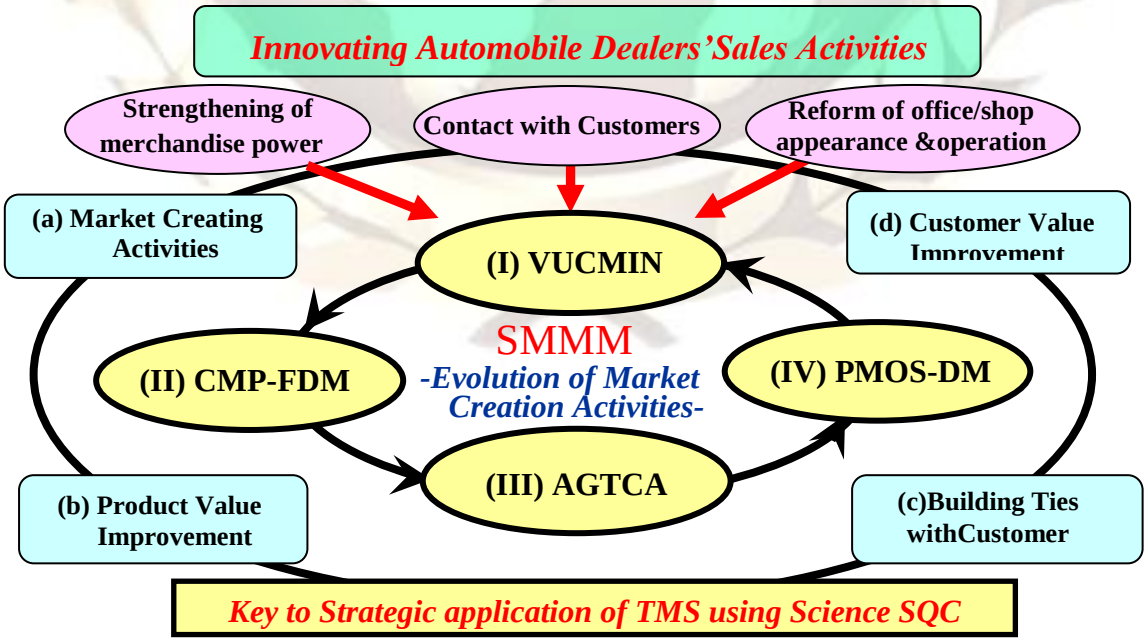

Figure 4 - A scientific mixed media model for boosting automobile dealer visits

in sales promotion and order taking, in order to aid development of future business and sales strategies (Kobayashi and Shimamura, 1997: Kishi, et al., 2000: Shimizu, 2004: Ferrell and Hartline, 2005: Amasaka, 2007, 2009, 2011).

Recent changes in the marketing environment, what is needed now is to develop "innovative business and sales activities" that are unconventional and correctly identify the characteristics of and changes in customer tastes. There has never been a greater need for careful attention and practice in customer contact, and in order to continuously offer an appealing and customer-oriented marketing strategy, it is important to evolve current market creation activities to strengthen commercial viability and reform office/shop appearance and operations using the Customer Science approach. Therefore, the authors want to construct a Scientific Mixed Media Model (SMMM) for boosting automobile dealer visits employing TMS as shown in Figure 4.

SMMM aims to achieve "a high cycle rate for market creation activities" and is composed of four core elements (I)-(IV). Core elements (I) and (III), Video that Unites Customer core elements (I)-(IV). Core elements (I) and (III), Video that Unites Customer behavior and Manufacturer Design Intentions (VUCMIN) and Attention-Grabbing Train Car Advertisements (AGTCA), are for improving mass media and multimedia advertising (TV, train cars, radio, internet, CD-ROM, etc.) through (b) Product Value Improvement and (d)Customer Value Improvement—and these are particularly important. These elements constitute the basis for the innovation of (a) Market Creation Activities, and (c) Building Ties with Customers.

At a certain stage in(a) Market Creation Activities and (c) Building Ties with Customers, it becomes particularly important to develop (II) Customer Motion Picture–Flyer Design Method (CMP-FDM), and (IV) Practical Method using Optimization and Statistics for Direct Mail (PMOS-DM) to achieve a high cycle rate for improving mass media and direct advertising (flyers, magazines, catalogs, direct mail, handbills, etc.). These four core elements aim to provide an up-to-date inquiry as to deep-seated customer wants in terms of customer behavior analysis (James, et al., 2006). Disparate behaviors by gender and age segment will be clarified in the analysis of standard behaviors.

SMMM for the evolution of market creation activities improves "innovative automobile dealer sales activity know how" regarding repeat users of various manufacturers' vehicles. Its characteristics are described below.

(I) VUCMIN: The proposed VUCMIN uses video advertisements, and is developed based on scientific approaches and analyses that focus on the standard behavioral movements of customers who visit dealers

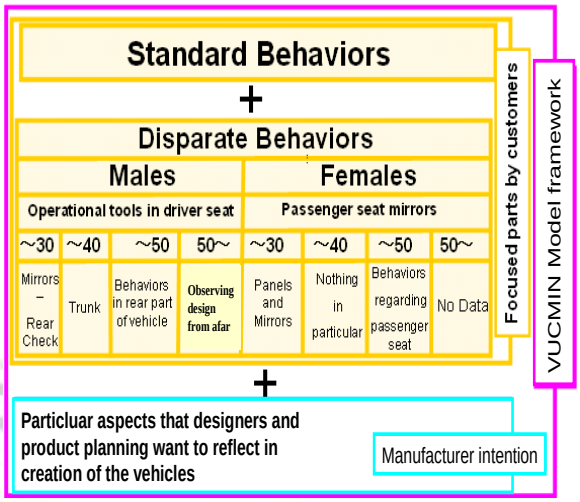

Figure.5- Frame of VUCMIN

when choosing an automobile (Yamaji, et al., 2010).

This method, which is based on the different approaches identified in target customer profiles, aims to make customers more eager to visit automobile dealers. After creating this video advertisement, customers are verified as having a positive opinion towards visiting dealers with a plan to purchase the vehicle featured in the video.

More concretely, based on the research approach outlined in the previous chapter, the framework of VUCMIN was established as in Figure5. In this figure, i) standard behaviors and ii) disparate behaviors by gender are identified and classified. After classifying the subjects by age, the details of disparate behaviors are identified mainly in terms of the front seat of the vehicle (driver's seat features, passenger rearview mirror, etc.) and the rear seat (not shown in figure). This knowledge of customer behaviors and knowledge of the parts that product planning and designers wish to show to customers are taken into consideration as the basis for the VUCMIN model framework.

(II) CMP-FDM: In this study, the authors establish a method of creating attractive flyer designs while using customer behavior analysis with videos that help dealers attract customers and aim to reform conventional marketing activities. Firstly, CMP-FDM analyzes how customers see flyers, and the authors create attractive designs that guarantee each customer's satisfaction. Next, the authors integrate the design elements into one that will satisfy all types of customers (universal type) by organizing the design features (design elements), and then validating the method (Koyama, et al., 2010).

More concretely, the authors show the steps (1 to 5) for establishing CMP-FDM as shown in Figure 6. The proposed CMP-FDM utilizing SQC Technical Methods (Amasaka, 2003) consists roughly of two processes: research and flyer design. In the first process, the authors check the current state of flyers as preliminary research.

In step 1, the authors analyze customer behavior towards the flyers using video recordings in order to understand how to the materials are actually viewed. Then, the authors prove that customers can be classified into three types: "active customers," "collection-first customers," and "indifferent customers".

In step 2, to address problems with the current flyer design (information appearing on the flyer, such as exterior photos, price, car name, loan information, and interior photos), the authors clarify what each customer type wants to know from the content. One problem is the provision of a lot of unnecessary information and a lack of necessary information.

In step 3, to solve problems in flyer layout, the authors clarify what kind of layout each customer group wants. One problem is typeface that is too small to see or information that is too varied to understand. In step 4, based on the results of steps 2 and 3, the authors incorporate the design elements into one flyer that it is attractive to all customer type. In step 5, the authors conduct a survey to compare the composite flyer developed in step 4.

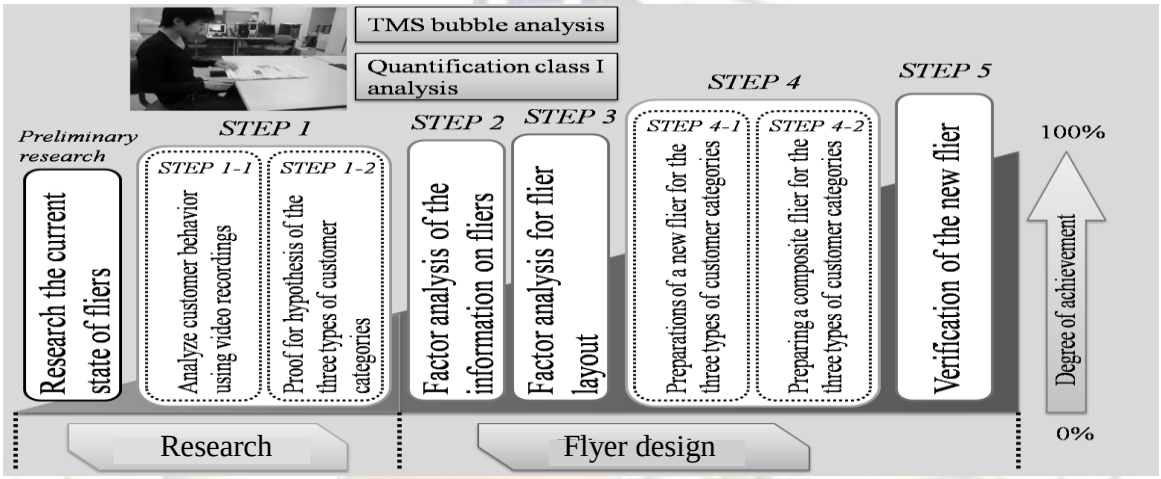

Figure. 6 - Steps of establishing CMP-FDM

(III) AGTCA: This study deals with train car advertisements (hanging posters, above-window posters, and sticker ads) that have become increasingly popular in recent years. Focusing on transit advertising, which has a good contact rate and provides long-term contact, the authors decided to examine customer relationships and how they relate to train car advertising with the aim of defining the ideal format for this type of media. The goal was to first quantify the way passengers pay attention to train car advertisements, and then propose the ideal form that in-car train advertising should take based on a visual representation of passenger information.

More concretely, the purpose of AGTCA is to examine the correlations between passenger information and riding conditions in train car advertising in order to discover the ideal way to advertise inside passenger trains, using the same research steps as CMP-FDM employing SQC Technical Methods (Ogura, et al., 2013). These steps are as follows.

Step 1: Look at overall trends in passenger information using a cross-tabulation method that focuses on whether passenger attention turned to hanging posters, above-window posters, or sticker advertisements and others.

Step 2: Perform a cluster analysis on riding conditions and group the results using Quantification Theory Type III. Then, look at the relationship between (1) the riding conditions grouped in the cross tabulation and (2) whether passenger attention turned to hanging posters, above-window posters, or sticker advertisements.

Step 3: Research the grouped riding condition data and basic passenger information to determine how it relates to attention rates established for the three types of advertising using a Categorical Automatic Interaction Detector (CAID) analysis (Murayama, et al., 1982: Amasaka, et al., 1998: Amasaka, 2011).

(IV) PMOS-DM: No clear processes are used at car dealers when deciding target customers for direct mail campaigns, and individual sales representatives tend to rely on their personal experience when making such decisions (Bult and Wansbeek, 2005: Jhonker, et al., 2006: Bell, et al.,2006: Beco and Jagric, 2011). This means that dealer strategies lose their effectiveness and dealers fail to achieve the desired increase in customer visits.

Thus, for this study, the authors establish a practical method using PMOS-DM as a method of deciding the most suitable target customers for direct mail campaigns (Ishiguro and Amasaka, 2012a, 2012b). Specifically, in order to both clarify the dealer's target customer types and increase the number of customer visits, the authors apply mathematical programming (combinatorial

optimization) using statistics to establish a model for determining the most suitable target customers for direct mail campaigns.

More concretely, this model was created using the same research steps as CMP-FDM employing SQC Technical Methods: a three-pronged approach to resolving dealers' current problems with direct mail activities. The step 1 is to increase the response rate, or the percentage of customers who visit the dealer as a result of receiving direct mail. To achieve this, the PMOS-DM uses statistical analysis to determine which customers are most likely to respond. The step 2 is to reflect dealer aims in the recipient selection process. This is achieved by using a simulation driven by mathematical programming to optimize the selection of target customers (refer to Appendix 1: Optimal selection using a model formula). Finally, the step 3 is to clarify the recipient selection process by providing dealers with a model that outlines a specific approach.

Following an explicit model informed by statistics and mathematical programming keeps inconsistency among salespeople to a minimum. The three-pronged approach proposed in this study therefore provides a direct mail method that allows dealers to both target their desired customer segment and boost response rates at the same time. In short, the PMOS-DM uses statistics and mathematical programming to create an objective decision-making process that does not rely on the current selection methods used by salespeople, which are based on personal knowledge and experience and therefore vague and implicit. At the same time, the model aims to boost the direct mail response rate in line with dealer targets.

V. EXAMPLE APPLICATIONS

This section validates the effectiveness of SMMM for effective advertising designed to bring customers into auto dealerships by use of four core elements (VUCKMIN, CMP-FDM, AGTCA, PMOS-DN), and a Customer Science approach to quantitatively assess the effectiveness of various advertising (mass media, direct advertising, and multimedia).

Visualizing Causal Relationships in Customer Purchase Behavior

SMMM was developed in order to draw more attention to the vehicle, spark interest in the vehicle, and make customer want to visit the dealer. In order to achieve the purpose of this research, a field survey on vehicle advertising was conducted to identify the core elements of each media type and to visualize the relationship between those elements and the media as well as the causal relationships between each media type and (a) vehicle awareness, (b) vehicle interest, and (c) desire to visit dealers (sales shops).

A survey was conducted in order to better understand the causal relationships among different types of media, media elements, and customer (consumer) purchase behavior. The advertising and marketing division at Xmotor company, Japan Toyota Dealer Y, and the Zmarket survey company helped to conduct an in-person survey on advertising and marketing by visiting male and female licensed drivers age 18 and older living in Tokyo, Fukuoka, and Sapporo.A total of 318valid responses(197 male and 121 female, generally uniform age balance) were collected.

The investigation period was the five months leading up to therelease of the new Q model by Japan Toyota. Based onthe authors' existing research and knowledge (Amasaka, 2007, 2009, 2011), they were able to identify media mix effects in each form of media using a purchasing action model, TV ads, radio ads and newspaper ads (early June 2005), as well as internet ads (early July) andtrain car (transportation) ads (mid-August) before the new car sale, and flyerand magazine ads (late August), DM ads(early September) and DH ads. (mid-September)issued by Japan Toyota Dealer Y. Participants were shown TV commecials and newspaper ads promoting Japan Toyota'snew Qcar and then asked questions inquiring about their purchase behavior and about the media and media elements.

The collected data was analyzed and the causal relationships between media, media elements, and consumer purchase behavior were outlined (Ogura et al., 2012). The questions that the authors used in the survey are listed in Table 1. The questionnaire was multiple choice and asked respondents to describe their opinion (item ① was yes-no, and the five-point scale initems ③ and ④was converted into binary data).

Table 1 - Survey questions

①	Are you aware of the Japan Toyota Q model?
②	What media did you see advertising this vehicle?
③	Are you interested in this vehicle?
④	Do you want to or did you actually visit a dealer to inquire about this car?
⑤	What kind of influence does each type of media have on you in terms of your attention, interest, and desire?
⑥	What was your impression of the advertisement?
⑦	Which advertising elements do you consider most important?

Elements in each form of media were identified using multivariate analysis (cluster analysis, quantification theory type III) and other statistical methods shown in Figure 7.

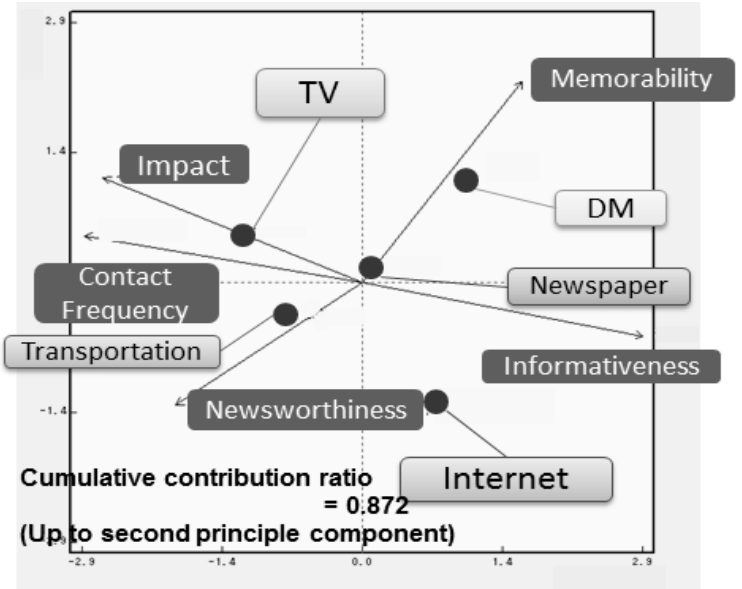

Figure 7 - A scatter diagram with the principle component scores using quantification theory type III

As the example in the figure shows, the critical elements in terms of generating the distinct promotional outcomes that consumers expect are: impact, contact frequency, newsworthiness, informativeness, and memorability (Ogura, et al., 2013).

The figure also positions TV ads, transportation ads, internet ads,newspaper ads, DM in order to identify the expected advertising effectiveness of each. Finally, the insights gained through scientific analysis were used to describe in VUCMIN creation (Yamaji, 2010). The Mark X specific chracteristics of the four core elements of the proposed SMMM (VUCMIN, AGTCA, CMP-FDM, and PMOS-D) below so that more customers would be drawn to visit auto dealers.

Applicationof VUCKMIN

In their previous research, the authors identified behavioral patterns of customers as they focus on the exterior of a vehicle. Insights gained during this research were used to explain the influence of product planning and designer intentions was used as a target vehicle in design inquiries.

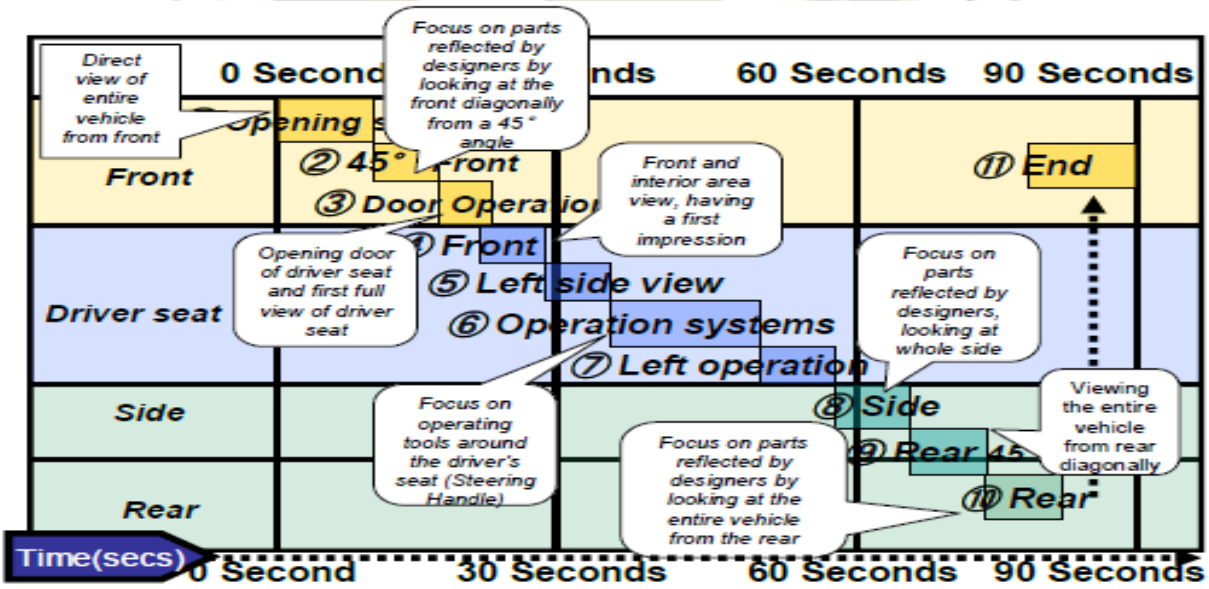

Figure 8 - VUCMIN creation timetable (Males in their 50s, Mark X)

According to common opinions from designers and product planning at Toyota Motor Corporation, the parts that are given the most attention when the vehicle is shown to customers are the (i) front proportions, (ii) streamlined side proportions, (iii) tri-beam headlamps (lenses), (iv) widened console box, and (v) sharpened rear.

More concretely, the video created for the target profile of males in their 50s is explained using the timetable in Figure 8. The timetable shows video time asset to 90 seconds. Video shooting order is composed specifically of scenes from 1 to 11 starting from the front, driver seat, side, and rear of the vehicle. Scenes are: (1) direct front scene, (2) diagonal front view scene, (3)driver side door opening scene , (4) entire driver seat view scene, (5) console box and shift lever scene, (6) steering wheel scene, (7) driver seat operational scene, (8) side view scene from driver's seat, (9) rear side view scene, (10) entire view of vehicle from rear, and lastly, (11) moving from back to front, the entire view of the vehicle scene.

The scenes that form the VUCMIN video were composed on the basis of the standard and disparate behaviors of customers. Example photos representing these scenes (1 to 11) are shown in Figure 9. Using the same approach, VUCMIN was created for each age and gender. In this section,

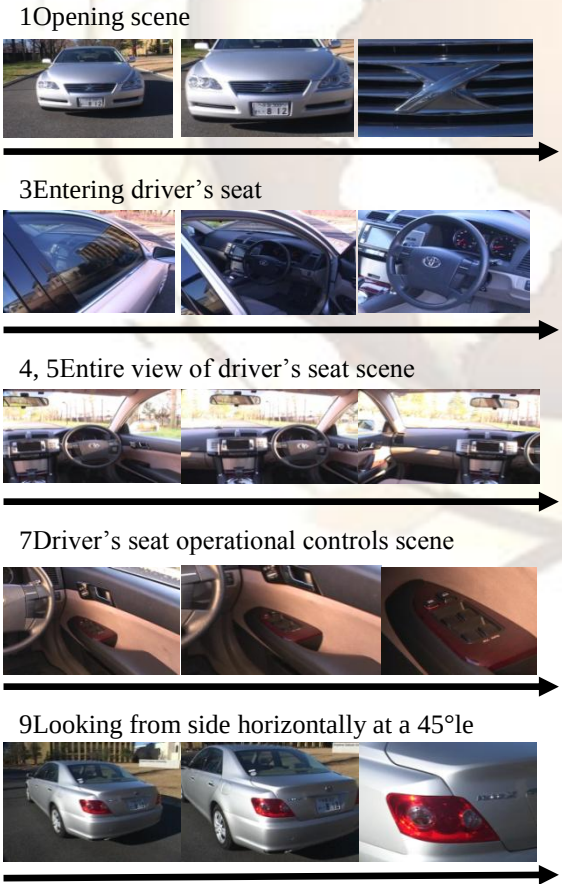

Figure. 9 - Example of representative photos for VUCMIN video

customer surveys were executed in order to test the validity of VUCMIN. This was done by asking customers, "After seeing the Mark X video, when do you think you might visit a Toyota dealer to consider purchasing one?" to verify their desire to visit dealers (high, low).

According to the survey results, the desire to visit dealers (early consideration of Mark X purchase) not only increased for current Toyota vehicle owners but also for customers who own vehicles from other manufacturers. The authors are currently promoting the results of this research as part of the strategic advertising method VUCMIN, which utilizes an internet interface in collaboration with universities and industrial players.

Applicationof CMP-FDM

Flyers are a form of advertising media important for raising the customer-attraction effect. However, the results of an interviews by the authors at to six dealers (national and foreign-affiliated) and two advertising agencies specializing in flyers showed that the dealers did not think that designing flyers was important—their only priority was distribution, and they outsourced the design. Moreover, they did not understand actual customer behavior (how customers looked at flyers and what they paid attention to). Therefore, customer behavior customer behavior is not attractive to customers who want to visit dealers.

The authors studied how customers view flyers by analyzing browsing behavior (Koyama, et al., 2010). In order to resolve the problems with the information contained in current flyer designs, the author identified which information each consumer type focuses on. In step 1 and 2, the purchase group is taken up as an example of the factor analysis results, with the Text Mining Studio corresponding bubble analysis results focusing on the purchase group shown in Figure 10.

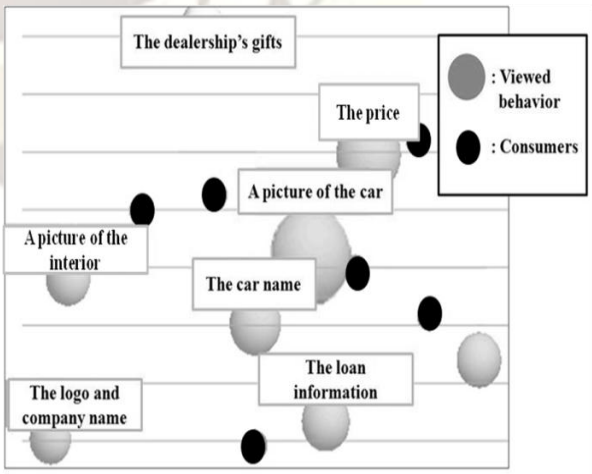

Figure 10 - Results for the information on flyers for the purchase group using Text Mining Studio corresponding bubble analysis

From this figure, it can be seen that the purchase group strongly correlated with viewing behaviors in the following order: (1) Looking at a picture of the car, (2) looking at the price, (3) looking at the car name, (4) looking at the loan information, (5) looking at a picture of the interior, (6) looking at dealer gifts, and (7) looking at the logo and company name.

Figure 11 -Example of new arttractive flyerdesign

Through this analysis the authors were able to clearly reveal the information on flyers that consumers actually focus their attention on, which dealers had heretofore been unable to grasp. In step 3, in order to resolve problems with the flyer layout, the authors clarified the position and size of the information on flyers that each consumer type focuses their attention on. In step 4an attractive flyer design is created based on the knowledge gained insteps 1 to 3.

An example of a new attractive flyer design for Toyota's new vehicle as shown in Figure 11. This design was intended to be appealing for a universal type of consumer.The effectiveness of the CMP-FDM method for creating the appealing flyer design shown in Figure 11was confirmed from the survey procedures and analysis obtained from steps1 through 5, as well as the acquired results.

Applicationof AGTCA

Firstly, the authors researchedthecausal relationship between basic passenger information and ad awareness (Ogura, et al., 2013). In step 1, the authors performed a cross tabulation on the survey data and researched the correlations between whether passengers notice each form of train car advertising and passenger information (age and gender) in order see how passenger information relates to attention rates.

Secondly, the authors researched the causal relationship between riding conditions and ad awareness of passengers. In step 2, the authors used the survey data gathered to represent current in-train advertising conditions, and subjected it to a cluster analysis of group riding conditions as shown in Figure 12.

Since the first group consisted of standing passengers who ride the train for 0–15 minutes, they were labeled "short-distance passengers". The second group rode the train for a longer period of time and tended to sit, so this group was called the "long-distance passengers".

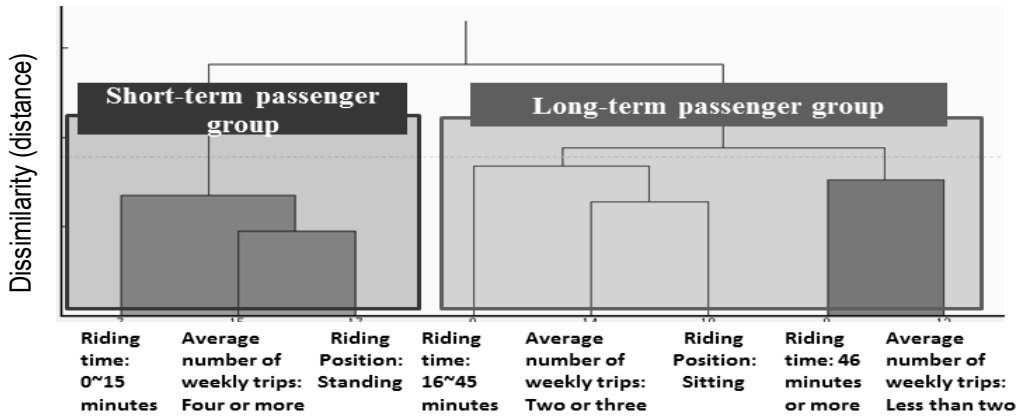

Figure 12 - Cluster analysis of the ride condition

Thirdly, the authors researched the causal relationships among basic passenger information, riding conditions and ad awareness of passengers. In step 3, Figure 13 shows the results of the awareness rate for hanging posters among short-term riders, which was used as a criterion variable in the CAID analysis. The results indicate that the highest awareness rate in this group is among men in the

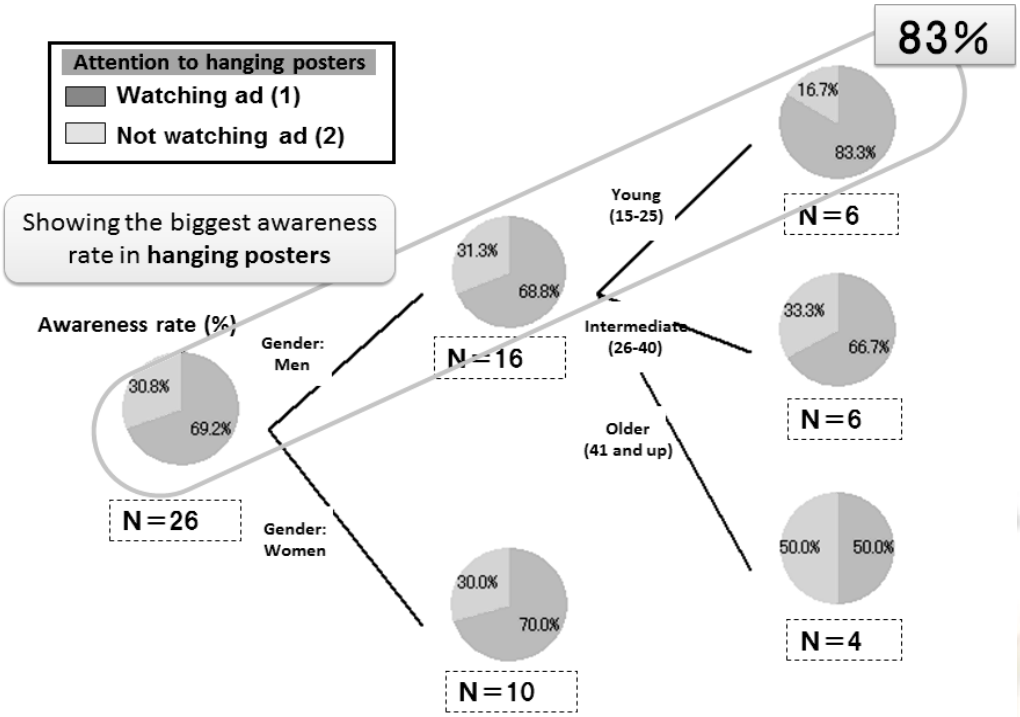

Figure 13 - The results of the CAID analysis on the short-term passenger group

youngest age category (15–25). Barring a few exceptions, the results indicate an overall trend where awareness rates are higher among younger people. Comparing the two groups, the authors found that the short-term passengers (who tended to stand when riding) had higher awareness rates in general.

Passengers who sat, on the other hand, had more opportunities to engage in different activities during their ride, such as reading or doing work, which probably contributed to their paying less attention to advertisements than the passengers who were standing. The analysis revealed that women passengers 26 and older in particular did not look at in-car advertisements. It also indicated that older passengers frequently paid attention to advertisements located above windows.

Based on these conclusions, the authors' first recommendation is for existing train car advertising. Because hanging posters, stickers, and other in-car advertisements are likely to attract younger riders, this space should be used to advertise weekly manga magazines, fashion magazines, sales, or other products likely to appeal to this generation. Another important consideration is using popular celebrities to catch the eye of these passengers.

Above-window advertising space, on the other hand, may be better used to appeal to those of the older generation. These passengers are more likely to be married and have children, so it may be beneficial to feature family-friendly topics.

Specifically, posters advertising events for families or travel may be ideal in this location. Also, because it was found that standing passengers tend to look at advertisements frequently, riders may pay attention not only to ads that help them pass the time while standing, but also those that stimulate their interest or desire. Instead of showing just a picture, a magazine ad, for example, could feature headlines or other clever designs aimed at stimulating purchase behavior. It is important that other advertisements do not simply catch the eye, but encourage viewers to linger.

Secondly, the authors suggest that trains adopt new forms of advertising media. The analysis results indicated that passengers who stand tend to have high awareness rates when it comes to in-car advertising, but advertisements on the floor may be easier for sitting passengers to see. Riders who sit naturally allow their eyes to fall downward, making a floor advertisement an eye-catching option. Those who sit and read are also looking downward as well, increasing the chances that they may see these advertisements.

Focusing on train car ads, which have a good contact rate and long-term contact, the authors decided to examine those relationships and how they

relate to train car advertising with the aim of defining the ideal format for this type of media.

Application of PMOS-DM

(1) Putting POMS-DM to work

The researchers teamed up with Company M to guide direct mailing efforts in conjunction with an event showcasing multiple new vehicle models (Kojima, et al., 2010: Ishiguro, et al., 2012a, 2012b). The following steps show how optimal selection using a model formula was applied with the formulas shown in (1) to (5) (Refer to Appendix 1).

(Step 1) Organizing customer information

First, participating dealers had information on a total of 391 customers, which included data on sex (male/female), age (20s, 30s, 40s, 50s, 60+), and age of current vehicle (3-5 years, 6-8 years, 9+ years).

There were a total of 391 values assigned to *j*: Customer number in the formula, and a total of 10 different values assigned to*m* (customer attributes: e.g. sex, age, age of current vehicle). A binary code (0 or 1) was then assigned to the collected customer information in order to analyze it. This resulted in values for the f_j^m (Indicates whether or not customer *j* has attribute *m* (0 or 1))variable. Recipients of direct mailing could now be determined based on the dealers' customer information.

(Step 2) Determining response likelihood

The next step was to conduct a survey and analyze the data to determine which customer attributes were most likely to lead customers to visit a dealer as a result of receiving direct mail. The survey method used in this study was to ask customers of varying attributes (sex, age, vehicle age, etc.) whether receiving direct mail had ever caused them to visit the dealer. Once the results were collected, they were quantified and subjected to a Type II analysis determine which customers had the highest likelihood of responding to direct mail.

This made it possible to analyze customer attributes in terms of whether or not they were likely to lead to a dealer visit in terms of an external standard. These response likelihood values were then assigned the variable E^m (Effect of customer attribute dealer). The formula below shows the results of this analysis. The discriminant ratio for the analysis results was 77.36%, indicating that they were fairly reliable. The linear discriminant formula produced from the analysis results is below.

$$y = 0x_{11} - 1.4x_{12} + 0x_{21} + 0.9x_{22} + 2.1x_{23} + 3.7x_{24} + 1.7x_{25} + 0x_{31} - 1.3x_{32} - 0.9x_{33} - 1.4$$

If the linear discriminant is greater than 0, the customer is likely to visit the dealer as a result of receiving direct mail. If it is less than zero, it indicates that they are not likely to visit. Therefore, the coefficient produced by this formula indicates the response likelihood for the customer attribute as expressed by E^m. The results of this analysis, which allowed us to identify which customers were likely to visit the dealer, are summarized in Table 2.

Table 2 –Response likelihood by attribute

Customer attribute	Response likelihood
Men	0
Women	-1.4
22-29 years old	0
30-39 years old	0.89
40-49 years old	2.1
50-59 years old	3.7
60+ years old	1.7
Currently driving a vehicle 3–5 years old	0
Currently driving a vehicle 6–8 years old	-1.3
Currently driving a vehicle 9+ years old	-0.9

(Step 3) Selecting DM recipients

First, the customer information collected in Step 1 is plugged into f_j^m, and the information on response likelihood for each customer attribute is plugged into E^m. The number of direct mailings to be sent is plugged into C (total number of direct mailing sent). The upper and lower limits for the percentage of direct mailings to go to customers with each attribute is set at the dealer's discretion using the variables H^m (upper limit for the percentage of direct mailings sent to customers with attribute *m*) and L^m (lower limit for the percentage of direct mailings sent to customers with attribute *m*). Once all the parameters are set, the simulation is carried out.

During this process, formulas (3) through (5) are solved as a weighted constraint satisfaction problem. In the weighted constraint satisfaction problem, the weighted constraints are moved to the target function as in (A), where they are added as a way of minimizing the level of deviation outside of the given limits. Even if a feasible solution that satisfies the constraints does not exist, the formula allows dealers to come as close as possible to meeting the constraints.

Here, in constraining the number of mailings sent to customers with the attributes defined in formula (5), it is difficult to set customer attributes L^m and H^m, ensuring that a feasible solution is more likely to exist. Therefore, when approaching the issue as weighted constraint satisfaction problem, it is best to find a solution that best satisfies formula (5). In other words, this allows dealers to send direct mail to those

customers most likely to come into the shop based on dealer strategy.

$$MIN \quad -\sum_m (E^m \sum_j (f_j^m x_j)) + \sum_m W^m (L^m C - f_j^m x_j) + \sum_m W^m (H^m C - f_j^m x_j) \qquad (A)$$

(Step 4)Evaluating the results

Once the recipients of direct mailings are selected based on the simulation, whoever is sending out the direct mail checks the simulation results to make sure that they accurately reflect the dealer's marketing strategy.

If the desired results are not achieved, the causes for the discrepancy are identified, the parameters are adjusted, and the simulation is run again.

(2) Effectiveness of PMOS-DM

The effectiveness of the PMOS-DM was assessed by comparing the response rates (percentage of direct mail recipients who visited the dealer as a result) when salespeople selected direct mail recipients based on personal knowledge and experience and when recipients were selected using the model.

Five new models were showcased at the event held. Four of the design concepts targeted female buyers, and one targeted male buyers. As a result, the dealer's marketing strategy was to target women in particular throughout a wide range of age groups.

This strategy was thus taken into account when verifying the effectiveness of the model. These verification results are summarized in Table 3. The response rate when direct mail recipients were selected on the basis of personal knowledge and experience of the sales staff was 19%. When selection was made using the PMOS-DM model, the rate was 20.4%.

Table 4 shows the same information for female customers only (those targeted in the dealer's marketing strategy). Salespeople generated a 4.2% response rate using their personal knowledge and experience, while the model generated a 19.8% response rate, signaling a significant improvement.

The effectiveness of the model was thereby verified in the course of this study.

Verification Results

Using the analysis results obtained in the previous section (Visualizing Causal Relationships in Customer Purchase Behavior), a follow-up survey using questionnaire data from Table 1 was then conducted to verify whether the research achieved its aim of bringing more customers into the dealers by means of raising the percentage of people affected.

Table 3 - Verification results (all)

	Dealer	PMOS-DM
Number of direct mailings sent	269	269
Number of resulting dealer visitors	51	59
Response rate	19.0%	20.4%

Table 4 - Verification results (women)

	Dealer	PMOS-DM
Number of direct mailings sent	48	61
Number of resulting dealer visitors	2	12
Response rate	4.2%	19.8%

Figure 14 shows the verification results from "Application of new mixed media by a SMMM" for raising the percentage of people affected.

SMMM is effective due to its composition of four core elements (VUCMIN, CMP-FDM, AGTCA and PMOS-DM) and use as a new strategic advertisement in nine media elements (TV, radio, newspapers, internet, train cars, flyers, magazines, direct mail and handbills) designed by the authors.

The figure shows the result of a follow-up survey using SMMM, where 16 people (percentage of people affected: 11.8%) actually visited the dealer, while 8 people signed a sales contract. Comparative verification was done by looking at the results of "the usual experience of mixed media" when the dealer in the figure announced the old model Q four years ago in a survey of similar size.

In this case, the percentage of people affected was just 1.1%, thus validating the effectiveness of SMMM.

VI. CONCLUSION

The aim of this research study was to bring more customers into auto dealers. In order to achieve this, A SMMM (Scientific Mixed Media Model) was developed as a way to improve the quality of the consumer purchase behavior model in terms of vehicle awareness, vehicle interest, and desire to visit dealers.

The collected research results are now being widely distributed as part of Toyota's current sales strategy.

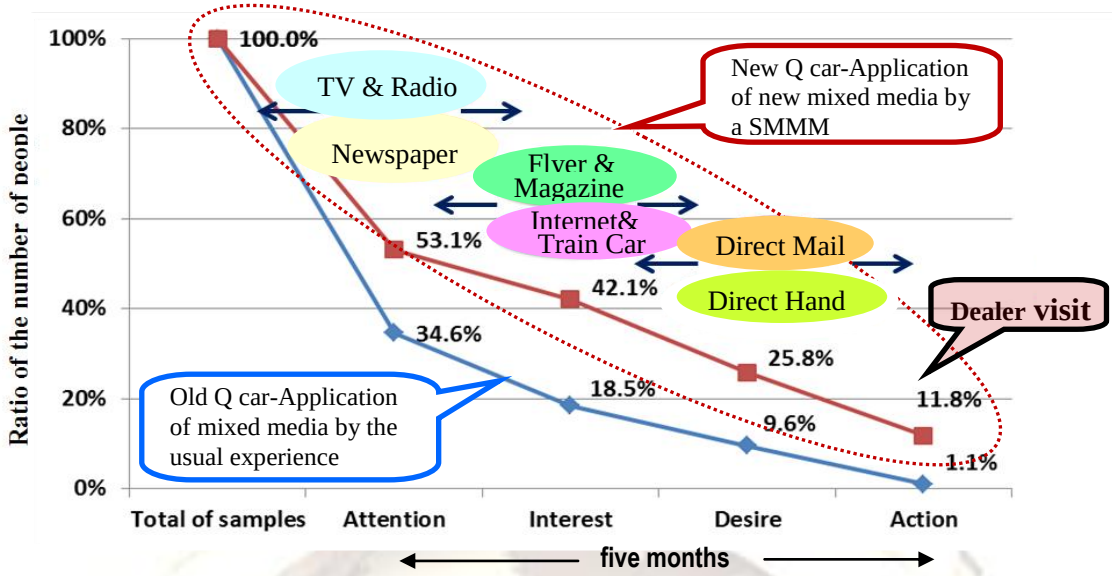

Figure 14 – Verification results

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Appendix 1: Optimal Selection Using a Model Formula

Using numerical simulation, the PMOS-DM model uses a mathematical formula to select target customers for direct mail. In coming up with a formula to determine who should be targeted by direct mail, the authors referred to the formulas shown in (1) and (2) below, which were developed by Kojima et al. (Kojima, et al., 2010: Ishiguro, H. and Amasaka, K., 2012a, 2012b).

$$\text{MIN} \quad \sum_{m \in M} W^m \Big(\sum_{j \in J} f_j^m x_j - CR^m \Big)^2 \qquad (1)$$

$$\text{subject to} \quad L^m C \le \sum_j f_j^m x_j \le H^m C \qquad (2)$$

m	Customer attributes (e.g. sex, age, age of current vehicle)
j	Customer number
W^m	Weighting for customers with customer attributes m in direct mail target group
f_j^m	Indicates whether or not customer j has attribute m (0 or 1)
x_j	Marks customer j for direct mailing (0 or 1)
R^m	Ideal percentage with customer attributes m in direct mail target group
C	Total number of direct mailings sent
L^m	Lower limit for the percentage of direct mailings sent to customers with attribute m
H^m	Upper limit for the percentage of direct mailings sent to customers with attribute m

The target function of formula (1) is to minimize the gap between the ideal number of direct mailings sent to customers with attribute m (CR^m) and the number actually sent to customers with that attribute ($\Sigma f_j^m x_j$). In other words, the formula expresses the concept of setting a target value when

sending out direct mail. Accordingly, the formula can be adapted to cases where a clear, rational target value can be set. However, the formula cannot be used when it is difficult to set a logical target value for the number of direct mailings to be sent—and a dozen or so of the dealers that the authors studied did not set one.

For those dealers, the authors set up a formula that would clarify the process that senior sales staff used to determine who should be targeted by a given direct mail campaign. In the process of conducting interviews, the authors learned that senior sales staff use an abstract method of targeting those customers who seem like they would have an easy time coming into the dealer. The authors then constructed a makeshift definition of this group of customers as follows.

Each group of customers defined by a given attribute (male, female, 20s, 30s, etc.) has different preferences that would motivate them to come into the dealer. Each customer's willingness to come in can be assigned a cumulative value based on that person's attributes. Those with a high cumulative value can be considered the ones who are likely to come into the shop.

With this line of thinking, the authors developed a formula for calculating the total willingness for customers targeted by direct mail. They then constructed a model for optimizing those values. Finally, the authors came up with a set of constraints in order to put limits on the number of mailings dealers would send, with the aim of maximizing the effectiveness of those that were sent.

(1) Model formula

This is the model formula used in the numerical simulation.

$$\text{MAX} \quad \sum_j (E^m \sum_m (f_j^m x_j)) \qquad (3)$$

$$\text{subject to} \quad \sum_j x_j = C \qquad (4)$$

$$L^m C \le \sum_j f_j^m x_j \le H^m C \qquad (5)$$

- m Customer attributes (e.g. sex, age, age of current vehicle)
- j Customer number
- E^m Effect of customer attribute (m) on the likelihood that the customer will visit the dealer
- f_j^m Indicates whether or not customer j has attribute m (0 or 1)
- x_j Marks customer j for direct mailing (0 or 1)
- C Total number of direct mailings sent
- L^m Lower limit for the percentage of direct mailings sent to customers with attribute m
- H^m Upper limit for the percentage of direct mailings sent to customers with attribute m

This mathematical formula is designed to determine a value for the variable x_j. If the value is 1, mailings should be sent to the customer number indicated by j. If it is 0, a direct mailing should not be sent. The other variables are parameters that must be given values before solving the formula. C, L^m, and H^m are set at the discretion of whoever is sending out the direct mail. The value f_j^m is determined based on the customer information that the dealer has. E^m is determined later via statistical analysis. The roles of the individual formulas are as follows. The objective function in formula (3) is used to maximize the customer response rate (the percentage of customers that come to the dealer as a result of the direct mail). The constraint in formula (4) determines the number of direct mailings that are to be sent out.

The constraint in formula (5) determines how many direct mailings are to be sent to each customer segment, which is how dealer aims are incorporated into the model. The mathematical formula is designed so that the number of customer attributes it handles (m) can be increased at will. Depending on what customer information dealers have, they can limit these attributes to basic life stages or expand them to include hobbies, preferences, and other lifestyle characteristics.

(2) Recipient Selection Process

The authors describe the procedure for using the mathematical formula provided to select direct mail recipients. First, a "response likelihood" value must be set for each customer using the variable E^m. The list of customers is then reordered with those with the highest likelihood of responding at the top. The purpose of the objective function in formula (3) is to order customers according to their likelihood of responding (visiting the dealer as a result of direct mail). Next, this list is used to select the number of customers equal to the number of direct mailings (the constraint) to be sent out, starting with those most likely to respond. For example, if 50 direct mailings are to be sent, they would be sent to the top 50 customers most likely to respond to them. This is the basic principle behind the development of the formulas.

In addition, when the dealer has a specific aim in mind (e.g. sending a large number of direct mailings to women), the constraint function in formula (5) can be used to incorporate that aim in the calculations. For example, if the dealer wanted at least 60% of the 50 mailings to go to women, the women customers would be listed in order of response likelihood and the top 30 customers would be selected to receive direct mail. The remaining 20 recipients would be selected from the entire pool of target customers in order of their response likelihood as well. The purpose of this function is to allow dealers to use their marketing strategies to boost response rate.