

# Consumer Categorization of Hybrid Products: The Applicability of Fuzzy-based Approach for Managing the Technology Convergence

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## Abstract

The central issue in this research is the product management. Especially, hybrid products are focused. It is the one that is integrated more than two category technologies into one product. It has been getting a lot of attention as the new approach of the product development. However, there is the category problem. As hybrid product has more than two category technologies, it does not be categorized explicitly. Therefore, marketing manager cannot build the strategy in the explicit category. For this managerial problem, we applied the fuzzy-based approach and demonstrate the appropriate category and marketing strategy for the hybrid product.

**Keywords:** categorization, hybrid product, fuzzy-based approach, technology convergence

## 1. Background

Recently, the intensity of marketing competition has been increasing more and more in various industries. To cope with this situation, the product development process has become shortened rapidly and the new products with additional added value have appeared one after another in the market. Those product's developments have two strategic purposes. One is that the product is positioned tactically to

response to the marketing competition on the level of product lines. The other is that the product is positioned strategically to take away from the competitors' share in the growing market. However there is a common mission in product development; it is essential to put the added value which exceeds the competitors' product performance to a new product in order to secure a competitive advantage. Integration of two product category technologies into one product is a good example of such development, and by that development, the smart phone, which is made by integration of a personal digital assistant technology and a mobile phone function, became widely spread.

These products are called as "multiple-category products", "boundary-spanning products", "convergence products", or "hybrid products" (Rajagopal and Burnkrant 2009). In this research, I will use "hybrid products" to call the product which is made by integration of more than two technologies. Any hybrid products have the potential of being categorized into more than two product categories, as more than two technologies are integrated (Lajos, Katona, Chattopadhyay, and Sarvary 2009). The development of hybrid products is not a new phenomenon.

The first hybrid product in the world is the pencil with an eraser developed by Hymen Lipman in U.S.A. in 1858. Even in Japan, electric companies (e.g. Pana-

sonic, SONY, TO-SHIBA) also developed hybrid products. For instance, JVC developed "Ratecase" that integrated three technologies (radio, television, and cassette recorder) into one product in 1976. As another example, Canon developed "NAVI" that integrated four technologies (personal computer, fax, word processor, and telephone) into one product in 1988.

Today, the development of hybrid products has been gaining huge attention again, as manufactures try to address the diversified consumers' needs by integrating their technologies. Simultaneously, the development of hybrid products also has been gaining a lot of attention in the field of marketing (Gregan-Paxton, Hoeffler, and Zhao 2005; Han, Chung, and Sohn 2009; Lajos, Katona, Chattopadhyay, and Sarvary 2009; Rajagopal and Burnkrant 2009). Then, the purpose of this research is to suggest new approaches and implications of how product management of hybrid products should be.

## 2. Hybrid Product

The development of hybrid products is becoming main stream. As previously stated, the hybrid product is the product, which is developed by integration of more than two product category technologies. The origin of the development of hybrid products in Japan is known to be "Ratecase" and "NAVI.", which I mentioned. And in recent years, the information technology, that has made rapid progress, is getting a lot of attention as the new added value for the hybrid products. Mobile phone equipped with a camera, which was developed in 2000 in Japan, is the earliest hybrid product with information technology. And after the big hit of the digital video camera "IXY DV M2 KIT" by Canon in 2003, the hybrid product came into the public limelight. Before launch the "IXY DV M2 KIT",

Canon had less than 9% market share in digital video and camera market, while the other top three makers (SONY, Matsushita, and JVC) had much larger market shares. However, after the "IXY DV M2 KIT" went on the market, the Canon's share increased rapidly and became approximately 18% in that market. And this sales record is still the greatest event for the Canon's digital video and camera segment.

At the time, other hybrid products were also being developed. For instance, there were an HDD hybrid DVD recorder with games, a printer with a scanner, a portable game machine with a media player, and so on. In recent years, the developments of hybrid products are increasingly progressing rapidly, such as Apple's iPhone.

Although, I illustrated only the digital electric products as a hybrid product example, it is certain that the hybrid product is not only developed in digital electric product industry, but also developed in the industry of home electronic products. A laundry with a dryer made by Matsushita (Panasonic) and an air conditioner with a humidifier made by Daikin Industries are good examples.

In addition, an automobile industry has developed hybrid products from 2003. The mini-minivan "cube<sup>3</sup>" made by NISSAN and sporty-minivan "ODYSSEY" made by HONDA are pioneers of the automobile hybrid products. Mini-minivan has both the comfortable driving technology of a compact car and larger space of a minivan. Sporty-minivan has both the smooth driving technology like a sedan or a station wagon and larger space of a minivan. Recently, each automobile manufacture is developing the hybrid product techniques so much in order to cope with the diversified consumers' needs.

There are two reasons for why the hybrid product is getting a lot of attention now. One is slump which manufacturers

face to develop new technologies. Even if the innovative technology cannot be created, the manufacture need to released new products to win marketing competitions. Therefore they focus on the hybrid product furiously to create new value by integration of some existent technologies. The second is the product development cost. Developing a hybrid product is required less development risk and lower costs. Moreover, a hybrid product is able to require higher price than a single technology product, as it has multiple technologies. Therefore manufactures put most their efforts into the hybrid products development, and want to grow a cash cow on the products portfolio management.

### 3. Literature Review

As the hybrid products development is getting a lot of attention in recent year, research of the hybrid product has also increased in the field of marketing, and these researches are focused into two things. One is that how consumer categorizes the hybrid product. As the hybrid product is made by more than two products category technologies, marketers would like to know where the consumers categorized the products. The other research is about the consumer recognition of newness in hybrid product, as it was made by integration of existent multiple technologies. This research will focus on the former topic, the categorization of the hybrid product.

The focus of this research becomes to discuss the critical question of whether it is activated in the single category or the multiple-category (Murphy and Ross 1994; Murphy and Ross 1999; Ross and Murphy 1996). A series of research has extensively discussed the mobile phone with the PDA and the digital camera with the media player as objects.

Often referred to as a key research in this field, Gregan-Paxton, Hoeffler, and Zhao (2005) proved that the heterogeneity of consumer categorization for the hybrid product by depending on the familiarity to the category and the category cue. Through a combination of these conditions, they proved both the single category activation and the multiple-category activation.

Gill and Dubé (2007) proved that the hybrid product categorization will be differed by changing the benefits of the integrated technologies. In addition, Gill (2008) classified the hybrid product (ex. PDA with MP3 player) categorization into the hedonic benefit (listening to music) to the utilitarian benefit (managing one's schedule). In this research, it also shows the heterogeneity of consumer categorization for the hybrid product by parallelizing the products which is made by integration of the utilitarian benefit to the hedonic benefit and the hedonic benefit is integrated to the utilitarian benefit. Namely he provided the evidences of the categorization heterogeneity for the hybrid product.

In Rajagopal and Burnkrant (2009), they proved the heterogeneity of the hybrid product categorization occurred by the level of technology integration; product attribution level technology or product benefit level technology, and they identify the modifier category and the head category as category features. They pointed out that the heterogeneity of the hybrid product categorization as below. In the case of integration at the attribute level, consumer categorizes the hybrid product activating the analytical processing in the multiple-category. In contrast, if the integration has occurred at the benefit level, consumer categorizes of the hybrid product in a single category.

Moreover, in Lajos et al. (2009), they showed that the hybrid product categorization is performed at the subordinate

level of the hierarchical category structure (Rosch 1978). In this research, they applied the concept of “subtyping” proposed in Taylor (1981), supposed the hybrid product as the atypical product for existent products, and proved the heterogeneity of the hybrid product categorization by the structure of the subordinate category level differences.

As refers those researches, there is different information process for consumers’ hybrid product categorization. In other words, if the stimulus for the hybrid product categorizing was different, consumers might change their processing of categorization. And recently researches show many implications from the heterogeneity of categorizing the hybrid product by combining various stimuli.

According to the researches, there is a converging perspective of categorizing the hybrid product; consumer tends to categorize the hybrid product in the single category unless there are stimuli (Macrae, Bodenhausen, and Milne 1995; Malt, Ross, and Murphy 1995; Moreau, Markman, and Lehmann 2001). Therefore it is important for marketers who manage the hybrid product to control the area of consumer categorization. In this research, I design the fuzzy-based model which investigates consumers’ categorization for the hybrid product, and suggest new approaches and managerial implications that help the marketer to control the consumer categorization to a certain category.

## **4. Analysis**

### **4.1. Objects**

Although I introduced many hybrid products in digital electronic industry, home electronic industry, and automobile industry, these are high involvement products and not object for this analysis, as these high involvement hybrid products have high potential to be categorized in

the multiple-category. As I mentioned above, the purpose of this research is to suggest the managerial implication that helps the marketer to control the consumer categorization to a certain category. In addition, this result is applied to the future technology convergence similar to the investigation in the empirical research. Therefore ideal product for this research should be the hybrid product that has an advantage of identifying the categorization in the specific single category.

By two reasons, this research focuses on the commodity product. One is to pursue the possibility of the hybrid product as the new product development approach for capturing high added values in the commodity market where is easy to become the price competition. The other is distribution-channel problem in Japanese commodity market. In the case of hybrid products, the problem is that retailers cannot set the hybrid product in the appropriate shelf, because it doesn’t belong to the explicit product category. Therefore it comes to be eliminated immediately in the market. Namely the hybrid product in the commodity market has the high distribution risk. Thus setting the explicit single category for the hybrid product is essential to become popular. Therefore, in this research, I select the sports drink with carbonic acid “AQUARIUS Freestyle” as the one of objects. AQUARIUS Freestyle was developed for the people who want to refresh with the carbonic acid drink after exercising, but who do not like unhealthy things. Data is from subjects’ perception of twelve brands (including AQUARIUS Freestyle) that has the possibility to belong to either the carbon acid drink category or the sports drink category.

### **4.2. Approach**

First of all, I asked consumer to classify twelve brands (AQUARIUS Freestyle is included) into two groups voluntarily. By

this way, I capture the category membership matrix that indicates how consumer  $i$  ( $i=1, \dots, I$ ) classify each brand  $j$  ( $j=1, \dots, J$ ) into the same group (equation 1). The category membership matrix  $M_{ij}$  is defined as below (The subscript 7 indicates "AQUARIUS Freestyle" that is the hybrid product).

$$M_{ij}^* = \begin{cases} 1 & \text{if } M_{ij} = M_{i7} \\ 0 & \text{if } M_{ij} \neq M_{i7} \end{cases} \quad (1)$$

Second, I calculate the correlation matrix  $R_{ij}$  that is estimated from each brand  $j$  classified by consumer  $i$ . Then, I capture the factor score  $f_i$  of each brand  $j$  simultaneously, estimating the factor loadings of one dimension  $\beta$ , and capture the fuzzy-based score that indicates that consumer  $i$  categorizes the hybrid product (AQUARIUS Freestyle) in a single category.

Third, I estimate  $c_i$  that indicates the single category that each consumer  $i$  categorized AQUARIUS Freestyle from the factor score for each brand  $j$  and AQUARIUS Freestyle's category membership matrix  $M^*$  (Equation 2). In addition, I estimated  $\alpha_i$  by the logit transformation of  $c_i$  that indicates that AQUARIUS Freestyle is categorized in the single category (Equation 3).

$$c_i = (M_i^*)' f \quad (2)$$

$$\alpha_i = \frac{\exp(c_i)}{1 + \exp(c_i)} \quad (3)$$

Finally, I estimate the weighted linear regression model whose dependent variable is  $y_i$ , which indicates the intention to buy AQUARIUS Freestyle, and independent variable is  $x_{ij}$ , which indicates evaluations of AQUARIUS Freestyle's USPs (Unique Selling Points) (Equation 4).

$$y_i = \sum_{j=1}^J x_{ij} [\alpha_i \beta_j + (1 - \alpha_i) \gamma_j] + \varepsilon_i \quad (4)$$

$$\alpha_i \in [0, 1]$$

### 5. Results and Conclusions

According to the above-mentioned approaches, I proved that the hybrid product (AQUARIUS Freestyle) recognized in the single category, which is based on fuzzy set. Also, the evaluations of AQUARIUS Freestyle are weighted and I prove appropriate USPs for each fuzzy-based single category, where AQUARIUS Freestyle is categorized. Namely I identify the single category that the marketer has to control for the hybrid product and appropriate USPs.

The results are as follows, when AQUARIUS Freestyle is categorized in the sports drink category, the marketer should communicate "AQUARIUS Freestyle is the sports drink for recovering physical condition ( $\beta=1.710, p<.01$ )", "AQUARIUS Freestyle is casual ( $\beta=1.417, p<.05$ )", and "AQUARIUS Freestyle has amino acid ( $\beta=1.447, p<.05$ ).". In contrast, when AQUARIUS Freestyle is categorized in the carbon acid drink category, the marketer should communicate "AQUARIUS Freestyle has ion ( $\beta=0.475, p<.01$ )", "AQUARIUS Freestyle is the carbon acid drink for dieting ( $\beta=0.446, p<.05$ )", and "AQUARIUS Freestyle is the carbon acid drink for refreshing ( $\beta=0.229, p<.1$ )."

This research suggests the new approach for the hybrid product categorization by applying the commodity-product as one of objects. Also this approach will be able to be applied to the hybrid product which includes information technology. For the future research, I will investigate the applicability of this approach to

the hybrid product which includes the information technology.

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