

CHANGES IN PRODUCT VALUE CONTRIBUTING TO CUSTOMER SATISFACTION: THE CASE OF THE DIGITAL CAMERA

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ABSTRACT

Using time series information, we identify the changes in the benefit items of products contributing to customer satisfaction. Through multiple regression analysis, where the customer satisfaction ratings are the outcome variable and the evaluation items are the predictors, we compare initial and successor digital camera models from the same manufacturer; benefit items differ depending on the models. We found that design is significant in the initial models while functionality is significant in successor models.

KEY WORDS

Quantitative analysis, utilitarian benefits, hedonic benefits, customer satisfaction, word-of-mouth communication.

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Introduction

Value is composed of functional value and semantic value, and it is necessary for companies to focus on the creation of both. Based primarily on concepts from Nobeoka (2010), Chitturi et al. (2008), and Hirschman and Holbrook (1982), we assert that despite the difference in terminology, functional value and utilitarian benefits are the same in that they can serve as objective evaluations of the function and quality of a product or service. Similarly, semantic value and hedonic benefits are alike in that they reflect the subjective judgments of the consumers themselves with respect to a product or service. In this study, we define objective or quantitatively measurable evaluation items as utilitarian benefits, and we define items that are evaluated by subjective or qualitative human judgment as hedonic benefits.

In recent years, design attributes have been attracting attention as certain products have become more commoditised. Through the diffusion of social media, many people are able to disseminate information via the Internet, and this form of word-of-mouth communication includes potentially influential product and service evaluations. In order for companies to be able to use this information, it is important to understand how certain attributes contribute to customer satisfaction¹.

Previous research in this area has had several limitations. Researchers have tried to measure concepts for which it is difficult to make quantitative judgments, such

¹ According to Kotler and Armstrong (2011), customer satisfaction is defined as "the extent to which a product's perceived performance matches a buyer's expectations". We follow this definition in this study.

as design. Information has generally been collected through interviews and questionnaires, and in particular, surveys regarding product design only involve showing its appearance and cannot be used in practice. Therefore, it becomes an evaluation of impressions, and no rational evaluation has been made. Finally, prior studies have focused on only one point in time, and changes over time could not be observed.

The objective of this research is to seek clarification on the changes in the benefit items of different models of a product that contribute to customer satisfaction. To undertake said analysis, we use word-of-mouth communication on the Internet as the basis of information pertaining to the fact that consumers actually used the products and services that we are targeting. Further, we focus on the product model in order to undertake a time series analysis. If benefit items are known to be different, the company could devise the appropriate product and marketing strategy. In this study, we make use of word-of-mouth communication on the Internet for the specific case of digital camera products in Japan. For the initial and subsequent models of a digital camera line by Canon, Inc., we conduct a quantitative analysis of the correlation between the evaluation score² from the word-of-mouth communication site and the level of customer satisfaction. In addition, we examine whether the company focuses on the creation of hedonic benefits as well as utilitarian benefits. This paper is structured as follows: Section 1 includes the literature review; Section 2 describes the materials and methodology; Section 3 explains the findings; and Section 4 comprises the discussion, which is followed by the conclusions.

² Kakaku.com uses the term "evaluation item" to evaluate the product. Therefore, when referring to data from the site, it is expressed using this term.

1. Theoretical background

Value is defined as the sum of the functional value (such as quality and performance) "brought by the height of functions that can be objectively evaluated" and the semantic value (such as design and brand) "created by the customer's interpretation and meaning" (Nobeoka, 2010). Chitturi et al. (2008) define utilitarian benefits as "the functional, instrumental, and practical benefits of consumption offerings," while Holbrook and Hirschman (1982) define hedonic benefits as referring "to consumers' multisensory images, fantasies and emotional arousal in using products".

Nobeoka (2010) points out that Japanese companies need to implement sustainable value creation using examples of strategies previously implemented by Japanese companies. Moreover, he also claims that semantic value is important in order to create added value, and that while Japanese companies have historically focused on the creation of functional value, they now need to turn their focus to the creation of semantic value. However, as semantic value exists based on functional value, the assertion that Japanese companies need to focus only on the creation of semantic value is misleading. Japanese companies need to focus on both functional value and semantic value.

Swan and Combs (1976) explain that instrumental performance corresponds "to the performance of the physical product" and expressive performance relates "to a psychological level of performance". From a service perspective, Shimaguchi (1994) makes the distinction between instrumental services and expressive services. Instrumental services are defined as "service attributes that the customer naturally expects to receive for price," and expressive services are defined as "expected services that are not necessarily expected but are considered better to have".

Kano et al. (1984) point out that qualities required by consumers can be classified under the following: attractive quality, one-dimensional quality, or “must-be” quality. An attractive quality is one that “causes satisfaction if satisfied, but is accepted even if it is unsatisfactory”. A one-dimensional quality is one that “causes satisfaction if satisfied, and dissatisfaction when not fulfilled”. A must-be quality is one that “is accepted even if it is satisfied, but causes dissatisfaction if it is not satisfied”.

The works of Shimaguchi (1984) and Kano et al. (1984) demonstrate that customer satisfaction is not improved even if the instrumental services and “must-be” qualities are elevated above the minimum acceptable level. Achieving a minimum level of service and quality is sufficient. On the other hand, by improving expressive services and attractive qualities, customer satisfaction will also be improved. In other words, it is necessary to avoid dissatisfaction using instrumental services and “must-be” qualities and increase customer satisfaction using expressive services and attractive qualities.

Nobeoka (2010), Chitturi et al. (2008), and Hirschman and Holbrook (1982) focus on whether value can be determined quantitatively. Their concepts can be applied universally, regardless of the time period. On the other hand, Shimaguchi (1984) and Kano et al. (1984) both acknowledge that their approach to determining value produces different results depending on the time period. In the specific case of the digital camera, it was not previously necessary to have access to a wireless Internet connection. Now, given the diffusion of social networking services, it is considered necessary to have the capacity to upload pictures wirelessly. Although the conceptual definitions may differ, design can be classified as both a semantic value (Nobeoka, 2010) and an expressive service (Bjorn et al., 2009).

Several empirical studies have emphasised the importance of design. Nobeoka (2010) points out that Apple’s smartphone, Dyson’s vacuum cleaner, and Samsung’s LCD TV are all success stories of semantic value expressed through design. Gemser and Leenders (2001) conducted interviews with 47 managers in the Dutch furniture and precision instruments industry, concluding that a focus on industrial design is positive for business performance. Based on a review of the existing literature, Homberg et al. (2015) define product design as a series of components that the consumer perceives and organises as a multi-dimensional structure consisting of aesthetics, functionality, and symbolism. Through interviews and quantitative analysis, it was revealed that these three design dimensions have significant influence on the related dependent variables of purchase intentions, word-of-mouth communication, and willingness-to-pay.

Goto et al. (2017) quantitatively analyse product reviews from Kakaku.com, a review site for household appliances, and product specification data from the manufacturers of each product; they conclude that, following the commoditisation of the digital camera, both technology and design significantly affect competitive advantage. Chikara and Fujino (1997) also propose a method to quantitatively measure attractive qualities, one-dimensional qualities, and “must-be” qualities for customer satisfaction.

The following are empirical studies that use the concept of hedonic value and utilitarian value. Wang (2017) identifies product features as hedonic attributes and utilitarian attributes. In a study targeting Padbook, Ultrabook, and Notebook, with the use of questionnaires, association rule mining, and cognitive pairwise rating, Wang reveals the high-priority features according to the customers for each hedonic

and utilitarian attribute. The most significant hedonic attribute was “keyboard interface” for a Padbook, “body material” for an Ultrabook, and “screen size” for a Notebook. The most significant utilitarian attribute was “CPU performance,” which is consistent for the three products. The experimental results show that hedonic attributes have a greater impact on product positioning because the priorities of the hedonic attributes are very different for each product (Padbook, Ultrabook, and Notebook).

Teng and Wu (2019) investigate how the hedonic value and the utilitarian value affect consumer preference through a study involving consumers who go to green restaurants, where they use the Partial Least Squares (PLS) Method and questionnaires. They clarify the following: both hedonic value and utilitarian value have a significant impact on consumer preferences, and in addition, utilitarian values have a positive impact on consumer behavioural intentions, while hedonic values do not.

In another study, Shin et al. (2019) use Structural Equation Modelling (SEM) to identify the value that affects consumers' intention to visit a food truck. The hedonic value of the food truck has a positive influence on consumers' intentions to visit. However, the utilitarian value of a food truck dining experience does not positively influence consumers' intentions to visit. In the case of the food truck visit, they reveal that the hedonic value was more important than the utilitarian value. Han et al. (2019) also use Structural Equation Modelling (SEM) in their study involving customers of Korean airlines. They find that core-product and service encounter performance have a great influence on hedonic value and utilitarian value. The two values can indirectly but significantly affect the overall image of the airlines. However, the influence of hedonic value is greater than that

of utilitarian value. In other words, airline users attach importance to hedonic value.

The aforementioned research studies have focused on the types of value and benefits and the relationship between them. However, as noted above, these studies have been unable to provide a rational analysis that considers changes over time. The current study seeks to remedy this issue and contribute a novel approach to understanding how changes in product benefits contribute to customer satisfaction.

2. Methodology

As mentioned above, the benefits received by the consumer include both utilitarian and hedonic benefits, and as such, Japanese companies need to focus on the creation of both. However, they have often neglected the creation of hedonic benefits. In recent years, it has become generally understood that design is important for the creation of value. Therefore, in this study, we conduct a quantitative analysis on the scores of the evaluation items based on word-of-mouth communication. The research question adopted in the paper is: Can the benefits that contribute to customer satisfaction be predicted by evaluation on a review site, and are they different depending on the time period? The following hypotheses have been formulated to answer the research question:

Hypothesis H1: The degree of customer satisfaction has a linear correlation with the evaluation score on the review site.

Hypothesis H2: Depending on the time series of the product, the aspect of correlation differs between utilitarian benefits and hedonic benefits.

For this case, we used Kakaku.com, similar to Goto et al., (2017). We targeted three digital cameras manufactured by Canon: the PowerShot SX700HS (release date: February 2014; number of samples: 34), the

PowerShot SX710HS (release date: February 2015; number of samples: 53), and the PowerShot SX720 HS (release date: March 2016; number of samples: 37)³. The PowerShot SX720 HS was featured in the Nikkei Morning, Kamiya newspaper, as it was expected to be a high-profile product.

In the case of the digital cameras on Kakaku.com, there are eight evaluation values such as "Design," "Image quality," "Operability," "Battery," "Portability," "Functionality," "Liquid crystal," and "Sense of hold". In addition, there is "Customer

Satisfaction". These evaluation values use a 5-point scale (1 being the lowest, 5 the highest). Firstly, we collect eight evaluation values and customer satisfaction for each product model from Kakaku.com. Secondly, we perform a multiple regression analysis using Microsoft Excel with customer satisfaction treated as the outcome variable and the eight evaluation values treated as predictors for each product models. Table 1 shows the list of digital camera evaluation items and evaluation criteria.

Table 1. Evaluation items and evaluation criteria

Evaluation item	Evaluation criteria	Classification
Design	Good appearance, texture	Hedonic benefit
Image quality	Fineness of image, less noise, etc.	Utilitarian benefit
Operability	Ease of menu operation and function setting	Hedonic benefit
Battery	Positive response to battery presence	Utilitarian benefit
Portability	Lightness, compactness	Utilitarian benefit
Functionality	Image stabilisation, shooting mode, etc.	Utilitarian benefit
Liquid crystal	Viewing ease of LCD screen	Hedonic benefit
Sense of hold	Possible to hold firmly	Hedonic benefit

Source: Own elaboration based on Kakaku.com

We classify the evaluation items as being either a utilitarian benefit or a hedonic benefit. Applying Hirschman and Holbrook's (1982) definition of hedonic benefits, in the case of conventional mobile phones, Chituri et al. (2008) classifies "network cover, battery life, and sound quality" as utilitarian benefits and "folded cell phone, body colour, and new ringtone" as hedonic benefits. For laptop computers, they classify "processing speed, memory size, and sound quality" as utilitarian benefits and "liquid crystal size, body colour, and ring

tones" as hedonic benefits. Furthermore, March (1994) notes that operability should be considered as one of the components of the design, and the sense of hold can also be considered as a type of operability. For the purposes of this analysis, in the case of digital cameras, "image quality, battery, portability, and functionality" are classified as utilitarian benefits, while "design, operability, liquid crystal, and sense of hold" are classified as hedonic benefits.

3. Findings

Tables 2, 3, and 4 illustrate the results of the regression analyses for the PowerShot SX700 HS, the PowerShot SX710 HS, and the PowerShot SX720 HS, respectively. In this section, the results associated with each product model are discussed in greater detail.

³ Image quality is the number of pixels, battery refers to the battery life, portability refers to the product weight, and functionality is the type of shooting mode. Since all of them can be measured, they can be classified as utilitarian benefits. Design, operability, liquid crystal, and sense of hold are subjective judgments that are difficult to measure, so they can be classified as hedonic benefits.

Table 2. Results of the PowerShot SX700 HS

Variable	Coefficient	t-value
Intercept	-0.256	-0.517
Design	-0.032	-0.276
Image quality	0.248	1.994
Operability	0.048	0.128
Battery	-0.058	-0.715
Portability	***0.226	2.834
Functionality	0.218	1.713
Liquid crystal	***0.486	3.298
Sense of hold	-0.047	-0.399
Adjusted R-squared	0.807	
F-statistic	0.000	

***p < 0.001

Source: Own elaboration.

In the case of the PowerShot SX700 HS, the adjusted R-squared is high at 0.807. The F-statistic is less than 0.01. Therefore, the reliability of the regression equation is high. The VIF

ranges from 1.02 to 2.17, and there is no issue of multicollinearity. Y is the level of customer satisfaction, and X is the evaluation item.

The regression equation is:

$$\begin{aligned}
 Y = & (-0.256) + (-0.032) \times Design(X_1) + 0.248 \times Image\ Quality(X_2) + 0.048 \\
 & \times Operability(X_3) + (-0.058) \times Battery(X_4) + 0.226 \times Portability(X_5) \\
 & *** + 0.218 \times Functionality(X_6) + 0.486 \times Liquid\ Crystal(X_7) ** \\
 & * + (-0.047) \times Sense\ of\ Hold(X_8).
 \end{aligned}$$

***p < 0.001

Table 3. Results of the PowerShot SX710 HS

Variable	Coefficient	t-value
Intercept	0.637	1.238
Design	***0.283	3.740
Image quality	***0.329	4.176
Operability	0.101	1.082
Battery	-0.044	-0.510
Portability	***0.188	3.278
Functionality	0.125	1.099
Liquid crystal	-0.062	-0.515
Sense of hold	-0.030	-0.403
Adjusted R-squared	0.603	
F-statistic	0.000	

***p < 0.001

Source: Own elaboration.

In the case of the PowerShot SX710 HS, the adjusted R-squared is high at 0.603. The F-statistic is less than 0.01. The reliability of this regression equation is also high. The VIF ranges from 1.01 to 1.66, and

again, there is no issue of multicollinearity. As with the previous equation, Y is the level of customer satisfaction, and X is the evaluation item.

The regression equation is:

$$Y = 0.637 + 0.283 \times Design(X_1) *** + 0.329 \times Image\ Quality(X_2) *** + 0.101 \\ \times Operability(X_3) + (-0.044) \times Battery(X_4) + 0.188 \times Portability(X_5) \\ *** + 0.125 \times Functionality(X_6) + (-0.062) \times Liquid\ Crystal(X_7) \\ + (-0.030) \times Sense\ of\ Hold(X_8).$$

***p < 0.001

Table 4. Results of the PowerShot SX720 HS

Variable	Coefficient	t-value
Intercept	0.965	1.441
Design	-0.097	-0.755
Image quality	0.000	0.067
Operability	**0.403	2.560
Battery	0.054	0.390
Portability	-0.162	-1.550
Functionality	***0.364	3.763
Liquid crystal	0.292	1.826
Sense of hold	-0.074	-0.413
Adjusted R-squared	0.567	
F-statistic	0.000	

***p < 0.001, **p < 0.05

Source: Own elaboration.

In the case of the PowerShot SX720 HS, the adjusted R-squared is 0.567, and fixed results were obtained. The F-statistic is less than 0.01. The reliability of the regression equation is high. The VIF ranges from

1.00 to 1.93, and there is no problem of multicollinearity. Y and X are the same as in the previous equations.

The regression equation is:

$$Y = 0.965 + (-0.097) \times Design(X_1) + 0.000 \times Image\ Quality(X_2) + 0.403 \\ \times Operability(X_3) ** + 0.054 \times Battery(X_4) + (-0.162) \\ \times Portability(X_5) + 0.364 \times Functionality(X_6) *** + 0.292 \\ \times Liquid\ Crystal(X_7) + (-0.074) \times Sense\ of\ Hold(X_8).$$

***p < 0.001, **p < 0.05

4. Discussion

For the initial model, the PowerShot SX700 HS, customer satisfaction can be explained by the camera's portability and liquid crystal features; but for the subsequent model, the PowerShot SX 710 HS, customer satisfaction can be explained by its design, which is a hedonic benefit, in addition to image quality and portability. The level of customer satisfaction with the

PowerShot SX720 HS, another subsequent model, can be explained by operability and functionality; however, it was confirmed that design did not play a material role in customer satisfaction. From the above, the product benefit items that contribute to customer satisfaction can be predicted by the score of the evaluation item from the word-of-mouth communication site and

the multiple regression analysis. It was also confirmed that the prediction of utilitarian benefits and hedonic benefits differs depending on the product model. Therefore, Hypotheses 1 and 2 are supported.

It is easy to analyse using a conventional statistical method and word-of-mouth communication; in this case, however, raw data is used directly. Thus, there is a problem of reliability. For example, there may have been skills who have posted on the site. Ott et al. (2013) developed a technique that discriminates spam using natural language processing. It is also necessary to cleanse the data using such techniques. Our method analyses the scores of evaluation items and customer satisfaction in time series using multiple regression analysis. Anyone can easily use such data with the same structure.

The similarity of this study with previous research is as follows. Eisenman (2013: 340) points out that “aesthetic innovation will be more important as new technologies emerge and when they mature”. Therefore, the initial model is considered to show a positive correlation between utilitarian benefits and customer satisfaction, and the successor models are considered to show a positive correlation between hedonic benefits and customer satisfaction. As indicated in Tables 2 through 4, the results are similar to those indicated by previous studies.

The following are some differences from previous studies. The successor models also have a positive correlation between utilitarian benefits and customer satisfaction. In the successor model, the design, which is a hedonic benefit, was negative. If aesthetic differentiation becomes difficult, new features may be added and differentiated. Therefore, utilitarian benefits may be important.

The following is a description of integration with previous research. Kotler and Keller (2011) point out that when sales begin to

decline in the product life cycle, the cycle may occur again on the basis of promotions or new product features, uses, and user discoveries. There may have been significant changes (external changes) or innovation (business models, products, processes) to revitalise the market. As a result, the value standards will change and the cycle will occur again, so utilitarian benefits become important. When evaluating items that contribute to a change in levels of customer satisfaction, from utilitarian benefits to hedonic benefits, it is possible to take into account significant changes (external changes) or the occurrence of innovation. According to the CANON website, the PowerShot SX710HS emphasises its 30-pixel optical zoom lens and the slim body, and the PowerShot SX720HS emphasises the 40-pixel optical zoom. However, the body is not emphasised. In recent years, the performance of smartphone cameras has improved. It is difficult for digital cameras to maintain differentiation and significance when compared to smartphones. Hence, it is assumed that CANON emphasises the 40-pixel optical zoom (utilitarian benefit) for differentiation and significance. In the case of digital cameras, due to significant changes in the market, smartphones have become alternatives to digital cameras. Therefore, utilitarian benefits are considered to have become significant again.

In addition, Goto et al. (2019) identify the evaluation items of digital cameras listed on Kakaku.com as hedonic value and utilitarian value using exploratory factor analysis. They identify “Functionality, Liquid crystal, Battery, Image quality, Operability, and Sense of hold” as utilitarian values and “Design and Portability” as hedonic values. Meanwhile, the image quality and the sense of hold were high in both hedonic value and utilitarian value. From this, we can see that it is not easy to identify the

evaluation items as having either hedonic value or utilitarian value. However, in order to make the definition stricter, we need to consider a method of quantitative identification rather than arbitrary identification.

Conclusions

By using the digital camera as an example, this study demonstrates that changes in product benefit items contribute to customer satisfaction. It was confirmed that the benefit items that explain customer satisfaction and the specific hedonic benefits that contribute to customer satisfaction differ, even for product models from the same manufacturer. This field has a high level of practicality and is a highly interesting field from the perspective of various industries. There is no need to create a questionnaire from scratch because open data is available. This means that anyone can easily adopt the methods used without sacrificing the cost of time.

There are three main limitations to this analysis. First, we only used three products, and it would be necessary to increase the number of products in order to make useful generalisations. Second, the significance of the benefit items and the hedonic benefits that explain customer satisfaction differ depending on the model. It is necessary to investigate the factors behind these differences. As a result of focusing on utilitarian benefits first and then hedonic benefits, for the PowerShot SX710 HS, the design of hedonic benefits was important. However, for the PowerShot SX720 HS, the functionality of the utilitarian benefits was to become important. It is also necessary to further investigate the factors. Third, the analysis was performed using only the evaluation score, but for future work, it would be helpful to target the text as well. Xu and Li (2016) used Booking.com, a hotel review site, and Latent Semantic Analysis to identify and compare

the determinants of customer satisfaction and dissatisfaction among the four types of hotels. However, it takes considerable time and effort to delete and apply appropriate weights for words in data analysis. It would be necessary to take this into consideration when developing future research.

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