

Article

Analyzing Dynamic Change in Customer Requirements: An Approach Using Review-Based Kano Analysis

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Abstract: To seek sustainable product development, understanding customer requirements is critically important where the life cycle of products or services is so fast, and continuous updates should be provided. In particular, how a customer feels for the specific function of the product/service and how their needs have changed is a critical question. According to Kano model dynamics, customer requirements for certain functions change over time, because customers firstly feel attracted to the new service characteristics but come to take them for granted over time. However, previous research on proving this theory has relied on customer surveys and interviews, which are highly time-consuming and expensive. In response, this study suggests customer review-based analysis to investigate Kano model dynamics, because customer reviews can be considered to be excellent sources for reflecting customer needs. This study firstly categorizes customer reviews into two types—positive reviews and supplementation-required reviews—and suggests a five-section framework according to the frequency of each review type. We define characteristics of each section from the perspective of the Kano model. Based on this framework, we analyze the dynamics of customer requirements in the online businesses, for which customer reviews are the main indicator of service quality.

Keywords: Kano model; dynamics; customer requirements; customer review

1. Introduction

Due to rapid business changes and diversified technological innovation, many services are generated and consumed in a short-term period [1]. In such a fast and volatile environment, seeking sustainability is critical. For this reason, understanding what customers want is a critical task. According to the service-dominant (S-D) logic, the customer is always a co-creator of value [2–4]. Since this value creation process is generally conducted in an online marketplace in a recent environment, how to understand customer requirements is considered to be vital. Especially, customers' bargaining power is significantly increasing, since customers not only diffuse information by online word-of-mouth [5,6], but also share their impressions through several forms of online media such as social network services (SNS) [6].

Customer evaluations of service experiences, such as customer reviews, are evidently an outcome of the interactions among companies, processes, employees, and customers in a service context [7]. In particular, how a customer feels for the specific function of the product/service is a critical question to be answered. In general, when new products or services are launched in a market, customers feel attracted to them. However, as time passes, customers' recognition of these 'new' products changes continuously, and they begin to take them for granted. This change has been studied

by [8]. Originally, the Kano model classified customer requirements or product attributes into several sub-categories based on the level of customer satisfaction according to the fulfillment of customer requirements: must-be, one-dimensional, and attractive [8,9]. Extending the Kano model, a new theory, which suggests that must-be attributes change to attractive attributes over time, has been suggested [8]. Customers feel attracted to the new features or new characteristics of certain products, but come to take them for granted, which makes these new attributes no longer attractive and transforms them into must-be attributes [8].

To support this theory, several empirical studies have been conducted. Research was conducted to prove the changes in customer requirements for TV remote controllers [8]. This study was extended into service-related areas [10], confirming that changes in customer requirements for online ticket services take place over time. Even though these previous studies are meaningful and worthwhile, they have a common limitation—the use of customer surveys and direct interviews, which are very expensive and time-consuming.

However, the recent business environment has great potential to prove this theory. With the era of big data, large amounts of customer reviews are generated on the Web, which makes it effective for analyzing customers' needs and satisfaction with certain products or services. Therefore, this study uses the customer reviews to analyze the characteristics for customers' requirements, and suggests a framework to prove the dynamic changes in customer requirements proposed in [8]'s work. Customer reviews can be considered as an excellent source to reflect both customer requirements and customer satisfaction, together with the business changes from offline to online [11]. They have been extensively used in practice, especially in many e-commerce environments [12]. They are also very trustworthy data since customers write their opinions or feelings voluntarily after using the products or services [13]. This means that customers' reviews can successfully replace the previous survey-based data in terms of representing their opinion regarding certain products or services.

In response, this study suggests a review-based framework to analyze the dynamic changes in customer requirements proposed in [8]'s work. Using this framework, firms can check how the characteristics of certain functions have changed over time. Firstly, we collected customer reviews from a website and classified them into two types: positive customer reviews and supplementation-required customer reviews. Second, we checked the dynamic changes in customer opinions for these two different types of review. We assumed that the relative frequency of these two types of review can provide an important clue for analyzing the dynamics of customer requirements and classify the total timeline into five different sub-sections. The sub-sections were named the function appearance area, supplementation appearance area, supplementation diffusion area, overtaking area, and stabilizing area. Each area was characterized based on the customer requirement categories proposed in the Kano model. Using this framework, we conducted a case study for application services, and showed this dynamic pattern is different according to the types of services.

The remainder of this study is as follows. The literature review deals with the basic concepts and relevant studies related to the Kano model, an underlying method of this paper. The research framework deals with the overall and detailed processes of this paper. To demonstrate the applicability of the method, a case study is conducted. Finally, contributions and limitations are provided in the Conclusion section.

2. Literature Review

2.1. Customers in Service Innovation

So far, the body of literature has been almost unanimous in understanding customers as an important task to the service business [2,14]. Service-dominant logic (S-D) logic, which explains the paradigm changes towards service-dominant society, has been suggested by Vargo and Lusch [2]. In this theory, customers are considered to be always co-creator of value, by determining value based on their experience. Therefore, evaluation of service experiences is a substantial part in new service

development [7]. Despite the general consensus that understanding customers in service industries is beneficial, there is a lack of agreement regarding how to understand customer co-creation process and customer experience [15].

Service researchers have long described the needs and benefits of understanding the customer co-creation process [2,14]. From the perspective of customer participation and co-creation process in services, two types—direct involvement and indirect—exist. Direct involvement of customers means that customers actively participate in the service process and make service outcome with the service providers. This is quite natural when considering the inseparability of production and consumption in IHIP (intangibility, heterogeneity, inseparability, and perishability) characteristics of services [16]. In addition, customers take a significant role in service operation, which means that customer co-creation should be considered in the literature [17].

Even if customers are not directly involved in the service process, customers may take a significant role in designing, developing, and realizing new services because customers actively express their needs and requirements to the service development process, and make their needs reflected to the service realization process. Especially, indirect involvement of customers becomes critical in recent online-based business environment where a lot of customer requirements and feedbacks are generated in the web-based platform. This trend is accelerated with the rise of smartphones, in which a significant number of services are delivered as a form of smartphone application services. What is notable is that the launch and update of such smartphone application services are very quick and frequent, which means that customers' feedback is critically important, since companies keep checking customers' response for the update.

2.2. Kano Model and Its Dynamic Characteristics

The Kano model is a model for categorizing the attributes of certain products or services, based on Herzberg's motivator-hygiene (M-H) theory [18,19]. In the M-H theory, the motivational features are the factors that cause user satisfaction and the hygiene features are those that cause dissatisfaction [10,20]. Extending Herzberg's M-H theory, the Kano model classifies the attributes of a product into six categories: must-be, attractive, one-dimensional, indifferent, questionable, and reversal.

First, must-be (M) attributes are factors for which superiority brings no user satisfaction, but user dissatisfaction grows as their performance worsens. In contrast, attractive (A) attributes can greatly excite customers with good performance, while their poor performance does not disappoint them. Meanwhile, better performance of one-dimensional (O) attributes results in better customer satisfaction. The performance of indifferent (I) attributes has no effect on either customer satisfaction or customer dissatisfaction, while questionable (Q) attributes cannot be mapped because any level of their performance can lead to customer satisfaction or dissatisfaction. Finally, reversal (R) attributes act in the opposite way to one-dimensional attributes—their superiority in performance leads to customer dissatisfaction, and their poor performance produces satisfaction [18].

This model has been employed for classifying and understanding the effects of different quality attributes [20] and has been used widely in the new product development and quality management literatures [18,21–23]. Lin and Niu [24] applied the Kano model to electricity service requirements. Huiskonen and Pirttilä [25] employed it model to analyze logistics service quality, whereas Matzler et al. [26] work employed the Kano model to analyze employees' satisfaction. Kim et al. [27] extended Kano model by integrating customers' disparate technology readiness and suggested four new types of customer requirements.

In addition, there have been several studies to suggest Kano model dynamics. The prominent work dealing with the dynamics of product/service attributes was undertaken in Kano's work [8]. In this work, a certain product feature evolves from the attractive attribute to the must-be attribute over time. When the product is first launched, a function is provided to the customers who do not expect it, which means that they seem to be satisfied with it. However, as time passes, customers

expect this function more and take it for granted that they can utilize it. Kano [8] conducted an empirical study regarding this point using TV remote controllers. TV remote controllers, which were considered to be attractive in 1983, changed into a must-be attribute in 1998. Nilsson-Witell and Fundin's [10] work defined eight functions of online ticket services and conducted an empirical study to analyze the dynamic nature of customer requirements. In addition, Randall Brandt [28] defined the characteristics of service elements into several categories: minimum requirement, value enhancing, hybrid, and unimportant as a determinant.

2.3. Customer Review as an Excellent Source in Internet Commerce

Customer evaluations of service experiences are evidently an outcome of the interactions among companies, processes, employees, and customers in a service context [7]. Customer reviews are the representative and prominent data source for analysis in a recent business environment where most of services are launched in an online marketplace. Especially, the analysis of customer review is a critical process to the firm, since it allows firms to understand how customers feel about their products in a continuous manner, and to adapt their offerings to customer preferences [7]. This is especially important in an e-commerce environment where many customers make purchasing decisions after reading relevant reviews [12].

Therefore, many companies collect customer feedback using quantitative methods, such as from customer questionnaires, e-mail, and company websites. Among many sources to collect customer feedback, what has been actively used is the customer reviews. Due to technological advances such as Internet and the mobile environment, many channels have been suggested to reflect customer feedback in a textual and unstructured format [15]. The customer reviews, with their role in expressing customers' experience and requirements, are of greater relevance than any other structured approach, because customers voluntarily express their opinions and impressions, and so customer reviews can effectively reflect customer motivation [29].

Online reviews can be the importance source of innovative ideas, providing input for new product designs and enhancements [30]. Therefore, significant number of studies has employed customer reviews as an important source for understanding customer requirements and feedbacks [30–32]. Qi et al. [30] developed an automatic filtering model to predict the helpfulness of online reviews. They employed a Kano model to the mapping rules for identifying qualified customer reviews.

2.4. Sentiment Analysis for Analyzing Customer Reviews

Sentiment analysis has been employed as an important method for analyzing customer reviews. By analyzing the ways in which sentiment is expressed in texts and whether such expressions include positive or negative opinions on a certain product or service [33], the polarity of each document is identified [34]. The sentiment analysis can be categorized into two different ways: linguistic and nonlinguistic [7,35]. Linguistic techniques consider the document as the set of natural languages and structure such as syntax and grammar, whereas nonlinguistic techniques regard documents as a series of characters [36]. Therefore, linguistic techniques measure the document sentiment based on the word dictionaries such as WordNet, whereas non-linguistic techniques do based on the word proximity to other related terms in the document or in related documents [7,37].

There have been substantial studies for employing sentiment analysis to analyze customer reviews. Song et al. [38] conducted a sentiment analysis for diagnosing service quality using customer reviews. By employing sentiment analysis, they identified customers' expectations and actual experience at the service-feature level. Salehan et al. [39] investigated the factors determining the likelihood of customers paying attention to a review as well as the perceived helpfulness of a review. As a result, they found that when positive sentiments are frequently found in the title, this customer reviews have a good readability [39]. Kang and Park [34] employed sentiment analysis-based VIKOR (in Serbian: ViseKriterijumsa Optimizacija I Kompromisno Resenje) approach to measure customer satisfaction for

the mobile services. They used expert-based sentiment dictionary which contains both polarity and strength for the 287 sentiment words.

3. Proposed Approach

3.1. Research Framework

This study suggests a new framework to analyze the dynamics of customer requirements using customer reviews. Figure 1 shows the research framework of this paper. Basically, our study consists of four parts. First, customer reviews, which are the main data source of our study and a proxy for customer opinion, were collected from a website. After data collection, we classified our customer reviews into two types: positive customer reviews and supplementation-required customer reviews. Third, we checked the dynamic changes in customer opinions for these two different types of review by suggesting a new framework. We analyzed the dynamics based on a two-dimensional graph, in which the x axis represents the timeline and the y axis represents the number of reviews. Based on the frequency patterns, we classified the whole area into five different sub-sections. Each area was characterized based on the customer requirement categories proposed in the Kano model.

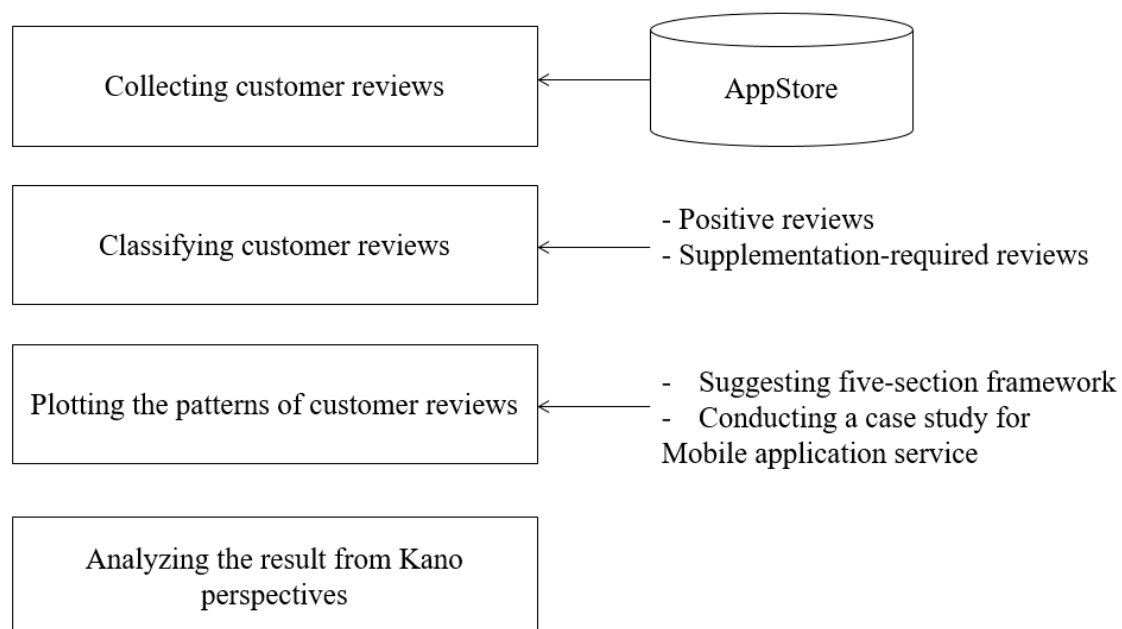


Figure 1. Overall process of this paper.

3.2. Assumption

This study is exploratory research to investigate the Kano model dynamic; thus, several assumptions were necessary. First, this study assumed that, when functions are first provided, they are so new that customers generally do not expect them from their current service. Therefore, functions are considered to be attractive attributes when they are first launched in the market. Second, we assumed that customers post reviews when they are satisfied with the service or experience unexpected pleasures. However, customers do not post reviews if they take a certain function for granted.

3.3. Collecting Customer Reviews

The first step of this study was to collect the customer reviews. Online review data could be considered to be an important and prominent data source to analyze both customer requirements and customer satisfaction, since business trends have changed from offline to online [10]. More importantly, customer reviews can strongly be considered to be a proxy for customer surveys,

since customers write reviews voluntarily when they have experienced services or products [12]. In particular, the review-based approach can save the time and effort required by the traditional survey-based approach. The use of data analytics, such as the review frequency, sentiment of each review, and increasing patterns of customer reviews, can provide a great source for capturing customer opinions.

3.4. Classifying Customer Reviews

After collecting the customer reviews, we classified each one according to the contents that it conveyed. There are two different approaches to evaluating customer reviews: the subjective method and the analytic method. The subjective approach classifies customer reviews based on expert judgment, whereas the analytic approach classifies customer reviews based on keyword occurrence information or the topics that each review conveys. The selection of the subjective method or the analytic method depends on the context that firms are facing.

In this research, customer reviews in which contains positive opinions are classified as positive reviews. Reviews in which customers express a need to update, modify, or add new functions or new features are classified as supplementation-required reviews. These supplementation-required reviews are again classified into three subtypes—update-required reviews, modification-required reviews, and addition-required review—according to the customers' opinion. The strength of opinion in supplementation-required reviews differs according to their sub-types, but we assume that the strength of opinion is the same. Table 1 shows the types of reviews and their examples.

Table 1. Types of reviews and their examples.

Types of Reviews		Examples
Positive reviews		I love this service! This is very convenient.
Supplementation-required reviews	Update-required reviews	This service is too old-fashioned. Please update this.
	Modification-required reviews	Ctrl-V is not working. Please amend it.
	Addition-required reviews	We need menus for clearing options. Please add these.

3.5. Plotting the Dynamic Pattern of Customer Reviews

After classifying customer reviews, we plotted the two types of customer review in the two-dimensional space. This graph represents time-based frequency changes, in which the x axis represents the timeline and the y axis represents the number of reviews. Instead of the number of reviews, the relative frequency can be used according to the circumstances. Based on the frequency patterns, we classified the whole area into five different sub-sections. Figure 2 shows the time-based review pattern indicating the dynamics of each type of customer review. Note that Figure 3 represents the general aspect or general appearance, and the details of this graph can change according to the service characteristics.

The graph in Figure 2 can be classified into four different areas. The first area is the area from the time when the service first launched, to the time when a supplementation-required review first emerged. The second area is the area from the time when a supplementation-required review first emerges, to the time when the number of positive reviews and the number of supplementation-required reviews were the same. Note that the second area can be divided again into two sub-sections but can also be treated as a homogeneous area according to the analyst. The third area is the area from the time when the number of positive reviews and the number of supplementation-required reviews are the same, to the time when the number of supplementation-required reviews reaches its maximum. Finally, the fourth area is the area in which both the numbers of both types of reviews are decreasing. Note that the second area can be divided into two or more areas according to the length of each area. The ratio to divide the second area can differ according to the firms' intention.

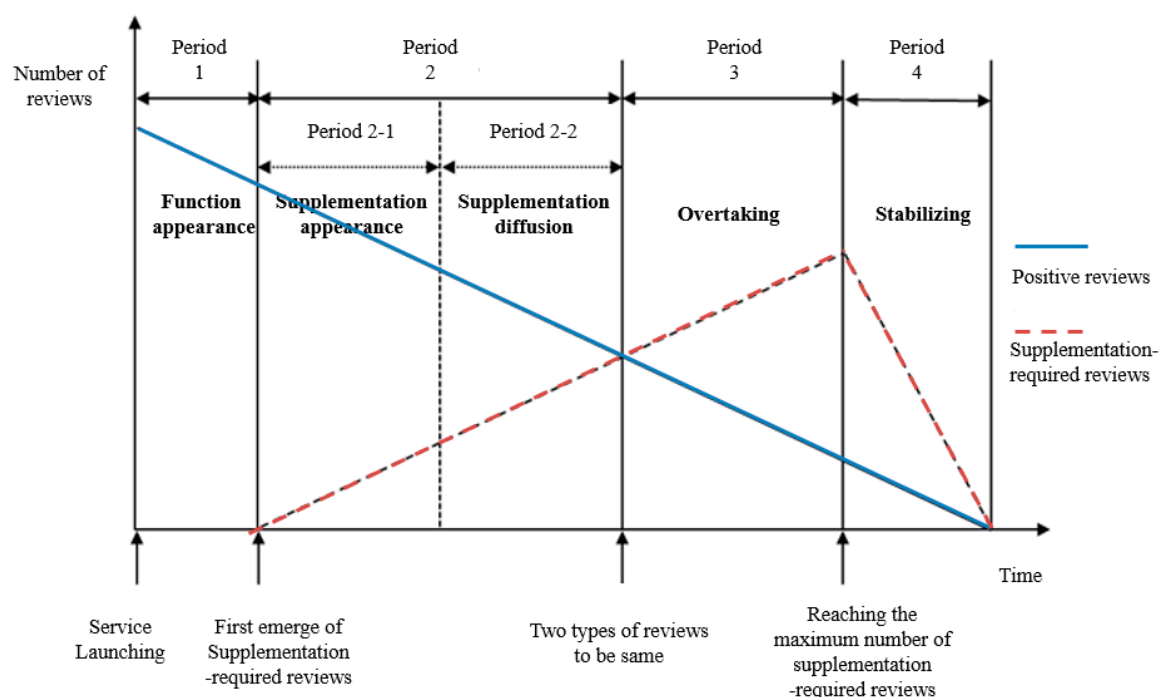


Figure 2. Expected dynamics of customer reviews over time.

3.6. Analyzing the Result from Kano Perspectives

Table 2 shows the definition and characteristic of each area. The function appearance area has only positive reviews, and customers feel that the service function is entirely attractive. The second area starts when a supplementation-required review first appears, and ends when the two types of reviews are the same. The next area, the supplementation-appearance area, deals with the first mention of supplementation-required reviews, which means that not all customers feel attracted by the function. In the following area, customers' needs for updating or modifying the function diffuse. This means that more customers feel that this function requires modification to some extent. In the overtaking area, the number of supplementation-required reviews increases and finally reaches its maximum. Finally, services are stabilized with the decrease in both types of reviews. As time passes from the first area to the fourth area, the service characteristics change from attractive to must-be.

Table 2. Characteristics of each area.

Area	Area Name	Starting Point	Ending Point	Kano Feature
1	Function appearance area	Service first launched	Supplementation-review first emerges	Attractive
2-1	Supplementation appearance area	Supplementation-review first emerges	Supplementation-required reviews reach their predefined ratio	
2-2	Supplementation diffusion area	Supplementation-required reviews reach their predefined ratio	The number of positive and supplementation-required reviews are the same	
3	Overtaking area	The number of positive and supplementation-required reviews are the same	The number of supplementation-required reviews reach its maximum	
4	Stabilizing area	The number of supplementation-required reviews reach its maximum	The number of two types of reviews decreases	Must-be

4. Illustrative Examples

4.1. Case Overview

To illustrate the proposed approach, we conducted a case study for mobile application services. To investigate the characteristics of service-specific characteristics, we downloaded customer reviews from two different categories: hedonic and utilitarian. According to previous literature, mobile services can be divided into utilitarian and hedonic services according to their value—the purpose, motivation, and result [40–42]. Therefore, we selected two services—Aviary, Camera360—from the hedonic category, and two services—Google Maps-navigation and Google Maps-traffic—from the utilitarian category.

Note that Google Maps-navigation and Google Maps-traffic are not actual services. The original application service is Google Maps. Instead of downloading the entire customer review for Google Maps, we firstly defined a target function, and extracted customer reviews that contained this target function. For example, Google Maps-navigation means that we used customer reviews of Google Maps application that contains the keywords ‘navigation.’ This is because customers express their opinion for many different functions in one service. Some customers express their opinion for the specific function, whereas other customers post the customer review for the other functions in the same service. However, Kano model deals with functions, not the entire products. Therefore, we had to extract function-specific customer reviews, if the application service had many different functions such as Google Maps. As a result, we generated two subsets for Google Maps—Google Maps-Navigation and Google Maps-traffic—in order to extract the customer reviews that are related to the specific function only. Customer reviews for each application service were downloaded from the first review in Appstore to April 2015, which is described in Table 3.

Table 3. Data overview.

Target	First Review in App Store	Characteristics	Number of Review
Aviary	1 June 2012	A photo-related application to use professionally designed filters, creative stickers and frames, and touch-up tools and to share photo in social network services (SNS)	1112
Camera360	22 June 2011	A photo-editing application using hundreds of professional filters and fun stickers, providing active community with famous stars	863
Google Maps-navigation	13 December 2012	A navigation application to find the way to the desired places and get the information that users want. The real-time updates and traffic information is provided Transit information using bus, train, or ride-share is also provided. Live traffic, incidents, and road closures are also provided	4286
Google Maps-traffic			1208

To preprocess the text data, we employed the KoRpus package in R. Lemmatization and POS (part of speech)-tagging were conducted for each customer review using TreeTagger, which is a language-independent POS tagger developed by the Institute for Computational Linguistics of the University of Stuttgart [43]. We made vector verbs, nouns, adjectives, and adverbs, which were extracted and then processed for lemmatization, as shown in Figure 3. Unigram language model was used for this purpose.

After preprocessing, we developed a dictionary for classifying customer reviews into two different types: positive reviews and supplementation-required reviews. Therefore, we developed two types of word dictionary: a positive word dictionary and a supplementation-required word dictionary. For the positive dictionary, we used an existing positive words dictionary from the University of Illinois. A list of English positive and negative opinion words or sentiment words (around 6800 words) was employed [44]. The positive dictionary that we used can be downloaded from the following website <http://www.cs.uic.edu/~liub/FBS/sentiment-analysis.html> [44], and we used only 2140 positive words from this dictionary.

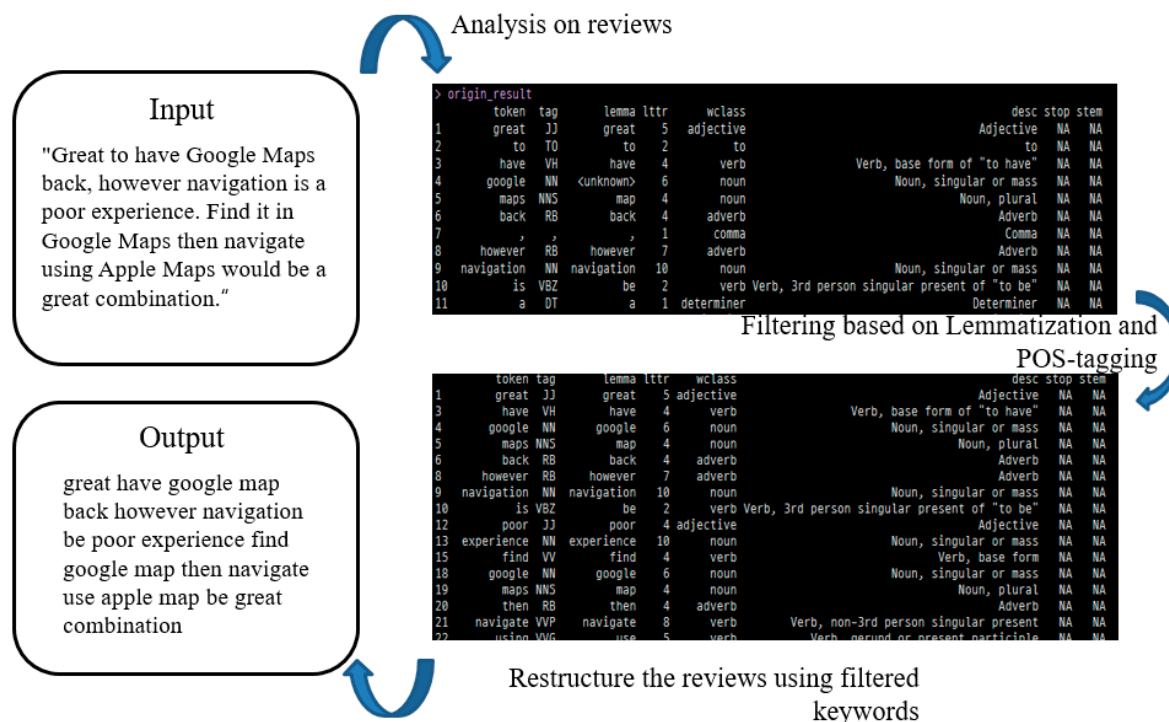


Figure 3. Example of preprocessing.

We developed the supplementation-required word dictionary ourselves using text mining, extracting the words that express modification, updates, and additions for certain functions or request. The reason that we did not employ predefined dictionary for supplementation-required words is that supplementation-required words are not same as negative words. When customers express their opinion for updates or supplementation, customers sometimes do not feel uncomfortable. Customers who are satisfied with services can express their opinion of updating some functions or adding some functions. This means we cannot use predefined (existing) dictionary for negative words, because words used in supplementation-required reviews are not same with negative words. As a result, 119 supplementation-required words were used, as listed in Appendix A.

Each customer review is classified as a positive customer review or supplementation-required review according to the words that it contains. The basic classification procedure is as follows.

1. When at least one supplementation-required word occurs in the customer review, this review is classified as a supplementation-required customer review.
2. When positive words occur without any supplementation-required words, this review is classified as a positive customer review.
3. When only one supplementation-required words occurs and the number of positive words >5 supplementation-required words, this review is classified as a positive customer review even if supplementation-required words occur. The rule is used because there are many cases that customers feel really happy for the service, but may suggest a minor update. Therefore, when the number of positive words is more than five words (which mean that customers are really satisfied) and only one supplementation-required word occurs (which means customers' suggestion might be minor compared to their satisfaction), this review is classified as a positive customer review even if supplementation-required words occur.

4.2. Result

Figure 4 shows the result of the dynamic pattern of application services considering the two types of customer reviews. However, the result was not the same as suggested in Figure 2. Figure 4a,b show the results of hedonic services, and Figure 4c,d are the result of utilitarian services.

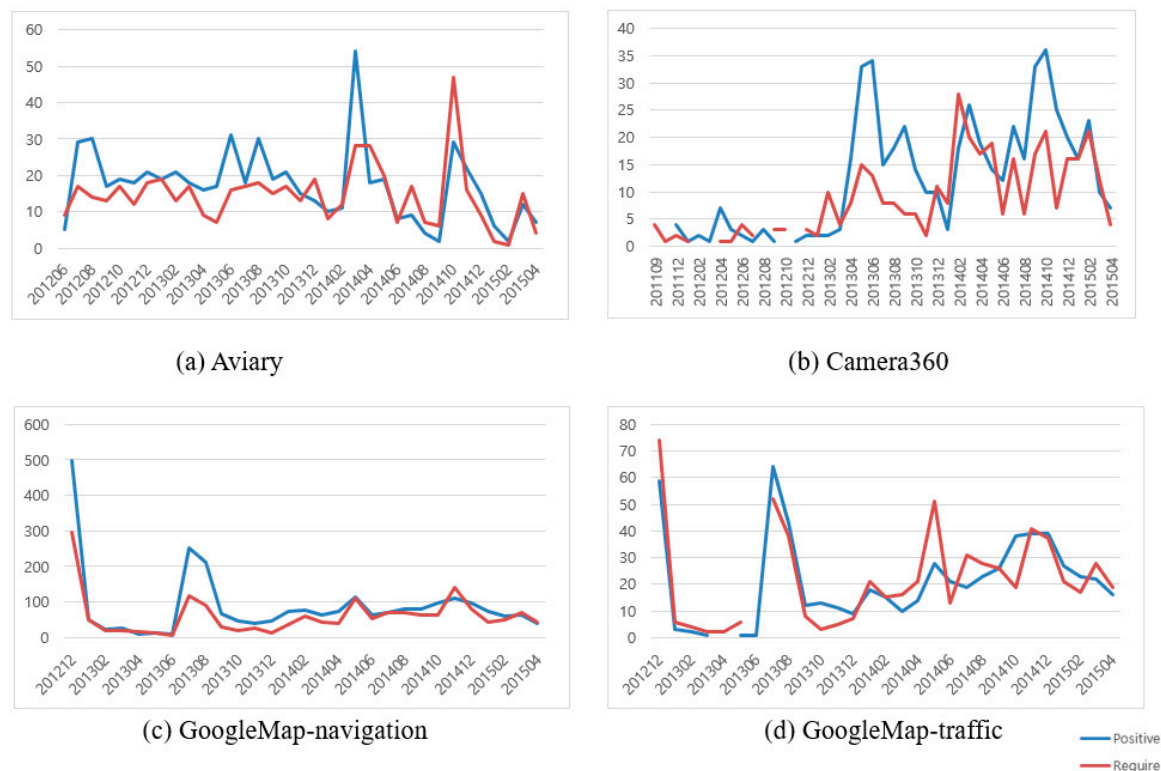


Figure 4. Result of the dynamic analysis.

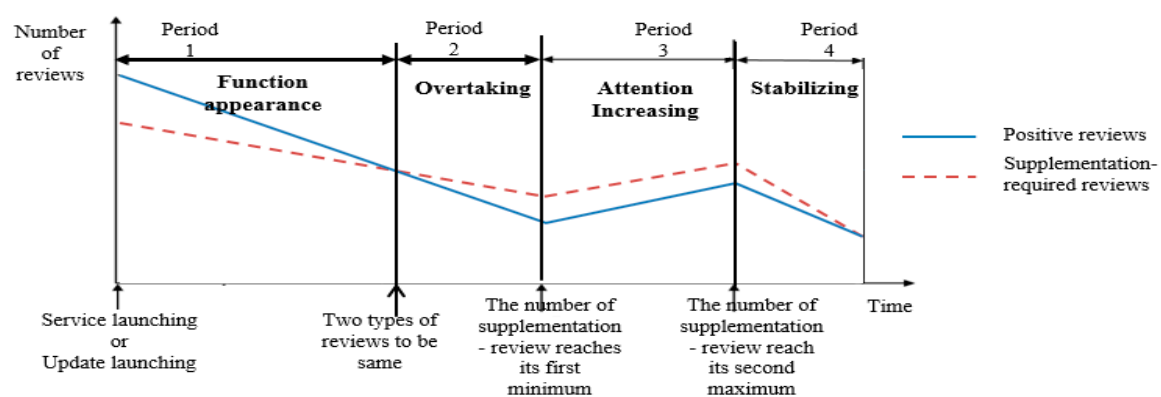
First, the number of supplementation-required reviews was very high at the time of the launch, which was quite different from our suggested dynamic pattern. This is because of the characteristics of the mobile application market. Since many customers actively post their opinion in the website, supplementation-required reviews emerge at the very beginning of the service launch, which was different from our expectation. In addition, many negative reviews are generated than positive reviews at the launch of services, since customers who are satisfied with the products or services seldom express their opinions, unlike those who are not satisfied. In addition, the customer groups are heterogeneous, so the customer demands are diversified. This can result in a relatively high ratio of supplementation-required reviews.

Second, the results showed periodical fluctuation over time. This also stemmed from the characteristics of the online application market. When an updated version is launched, the number of customer reviews temporarily increases. In addition, when a certain application service is posted on the social networking service or introduced to the news or media, the number of downloads and customer reviews fluctuates temporarily.

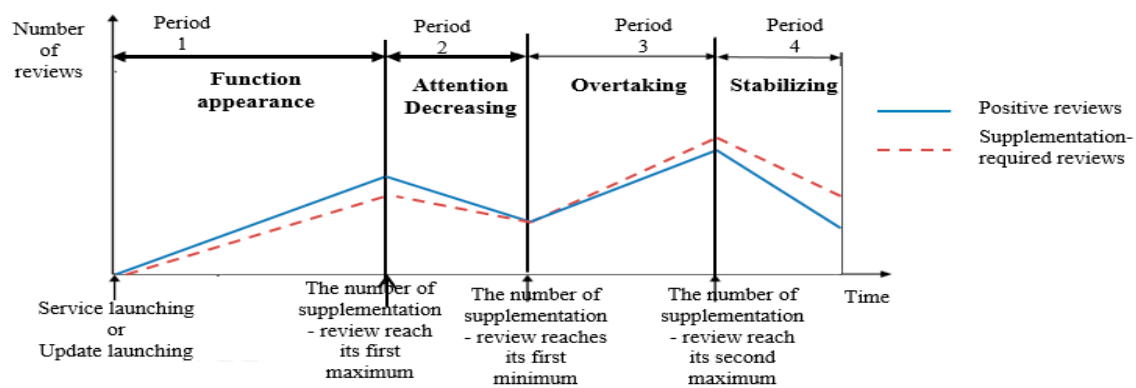
Considering this, when we divided the period according to the peak of the paper and considered only one update period, general patterns could be described, as shown in Figure 5. Figure 5 shows two different patterns for the application services: (a) for utilitarian application service (Google Maps), and (b) for hedonic application services (Aviary and Camera360).

In Figure 5a, the expected dynamic pattern was divided into four areas, which are discussed in Table 4. Note that Figure 5 represents the period for a single update. First, when a new service or new function is launched, customers experience this service and express their opinion about it extensively.

This is especially true in famous utilitarian application services where a lot of customer expect qualified function and extensive use, such as Google Maps. In addition, the reason that the number of initial customer reviews is so high is that this application service is extensively powerful in this category, and customers' perceived substitutes are seldom. Therefore, customers' expectation is high together, with the influence of brand power. The number of positive reviews and supplementation-required reviews decrease over time. Then, the overtaking area starts with the point where the number of supplementation-required reviews exceeds the number of positive reviews, which means that customer complaints or customer requirements for the update increase. This area ends with the point where the number of supplementation-required review reaches its first minimum. The area of attention increasing starts when both the number of positive reviews and supplementation-required reviews are increasing, and ends when the number of supplementation- review reach its second maximum. Finally, the function moves to the stabilizing area, in which customers take it granted for this function.



(a) A case of utilitarian application service



(b) A case of hedonic application service

Figure 5. Expected dynamic patterns in mobile application services.

Figure 5b and Table 5 show the dynamic patterns for hedonic application services. The pattern is different from the utilitarian application services, in terms of initial number of customer reviews. This is because in the hedonic application services, customers freely choose their application services, which means customers' perceived substitutes are many.

Even if the patterns in Figure 5 did not exactly match with Figure 2, overall patterns that the number of supplementation-required reviews increases over time and that of positive customer reviews decreases over time was the same with Figure 2. This implies that customers are generally satisfied with what they get, but express their opinion about what they want from the services over time, which is in line with our assumption that each function (or each application service) changes from the attractive attribute to the must-be attribute over time.

Table 4. Characteristics of each area—a case of utilitarian application service.

Area	Area Name	Starting Point	Ending Point	Kano Feature
1	Function appearance area	Service first launched	The number of positive and supplementation-required reviews are the same	Attractive
2	Overtaking area	The number of positive and supplementation-required reviews are the same	The number of supplementation-required reviews reaches its first minimum	
3	Attention Increasing area	The number of supplementation-required reviews reaches its first minimum	The number of supplementation-required reviews reaches its second maximum	
4	Stabilizing area	The number of supplementation-required reviews reaches its second maximum	The number of two types of reviews decreases	Must-be

Table 5. Characteristics of each area—a case of hedonic application service.

Area	Area Name	Starting Point	Ending Point	Kano Feature
1	Function appearance area	Service first launched	The number of supplementation- required reviews reaches its first maximum	Attractive
2	Attention decreasing area	The number of supplementation- required reviews reaches its first maximum	The number of supplementation- required reviews reaches its first minimum	
3	Overtaking area	The number of supplementation- required reviews reaches its first minimum	The number of supplementation- required reviews reaches its second maximum	
4	Stabilizing area	The number of supplementation- required reviews reaches its second maximum	The number of the two types of reviews decreases	Must-be

4.3. Discussion

The result of the case study was not exactly the same as expected, and there are several reasons for these phenomena. Most of the reasons stem from the target of this case study: application services.

4.3.1. Function vs. Service

The Kano model was developed based on the functions of the product. However, the case study was conducted for the application service, which is a unit of a “product” or “service”, not a “function.” Generally, a product provides many different functions, and it is hard to guarantee that customers are posting reviews for a certain function only. To overcome this problem, we selected a service that is more likely to be composed of a single function. In addition, we extracted customer review separately for each function if the service is big enough, such as Google Maps-navigation and Google Maps-traffic. However, there is a possibility that the results are distorted due to the multiple functions. If customer reviews for a single function could be extracted, the results would be more reliable.

4.3.2. Emergence Time of Supplementation Required Review

Regarding the research framework suggested in Figure 2, it is assumed that all customers are satisfied with the new function; thus, this new function is considered to be purely attractive. However, this is hard to apply in practice, since many competitors and reference application services exist in the market. In addition, customer feedback is particularly plentiful and updates are significantly fast. Therefore, our assumption may not be valid in practice. As shown in Figure 4, many supplementation-required reviews exist at the very beginning of the launch.

4.3.3. Unbalanced Dictionary

We employed two types of word dictionaries: a positive word dictionary and a supplementation-required word dictionary, as seen in Appendix A. The positive dictionary was adopted from an existing dictionary from the University of Illinois, whereas the supplementation-required word dictionary was developed manually, considering the words that occurred in each customer review. This is because supplementation-required words are different from negative words, which means that the existing dictionary did not work in extracting supplementation-required reviews. Due to this reason, the number of words in the two dictionaries differs significantly—2140 positive words and 119 supplementation-required words. This could damage the balance of the review classification, which is a limitation of this paper. If the supplementation-required dictionary was updated, the result might be improved.

4.4. Managerial Implication

Using the suggested framework, firms can understand customers' requirements changes over time, and this change can be analyzed using customer reviews. The contribution of our study was to suggest a method to analyze the characteristics of product/services' function based on Kano model. Firms can understand whether the function of specific products or services is must-be or attractive, and how these characteristics have changed over time. This decision can help firms to decide how to treat this function in future product/service development.

The suggested framework is expected to be helpful in recent business environments where a lot of new services are provided via online platforms, and lots of customer reviews are generated. Even if many firms operate their services via application services and devote much effort to analyzing customers' responses, the analysis framework used in practice is quite simple. However, our framework suggests how to track the changes of each function by categorizing each customer review into positive reviews or supplementation-required reviews, and plotting two types of review into the two-dimensional space. This can be very helpful for identifying how the characteristics of each function change over time and understanding the current condition of each function.

One important thing is that our case study was conducted for application services only, so it might not be effective in other types of services. However, analyzing the relative ratio of two types of reviews and understanding overall dynamic patterns of two types of reviews are still helpful to understand the current phenomena and to plan the future direction of each function.

In summary, this study can contribute to the practice by suggesting a method for analyzing the characteristics of each product/service function using customer reviews. Based on the Kano model, this study suggests how to identify whether this function is must-be or attractive using customer reviews, and how these characteristics change over time. This is also helpful for understanding the functions' perceived characteristics by customers, which might not be the same as the firms' intentions.

5. Conclusions

This study aims to show how characteristics of customer requirements change over time, considering Kano model dynamics. The fact that customer requirements in the Kano model change from attractive to must-be has been proven by several literatures. However, this has been proven by a survey-based approach, which might be not relevant in the recent online business

environment. Therefore, we suggest a method to analyze the Kano mode dynamics using text-mining of customer requirements.

More specifically, we suggested a generalized framework for tracking the changes of customer requirements over time, which consists of five different sections. Using a practical case study, we also suggested a revised framework which is more suitable for application services. However, this is not the deterministic framework. Rather, the details can be changed according to the service characteristics. What is important is that the characteristics of customer requirements change over time (from attractive to must-be), and that firms can track this changes using customer reviews when necessary.

This study contributes to the field in that it firstly provides a review-based framework to investigate empirical Kano model dynamics using two different types of customer reviews. The use of customer reviews instead of customer surveys which are relatively expensive and time-consuming, can provide an easy and effective framework for firms that are equipped with data analysis techniques. The five different sections proposed in this research can provide a seed for new service development by investigating the service characteristics and checking the service life cycle. This study is also expected to help managers to understand that functional characteristics in mobile application services change over time, and how this dynamic differs, according to the types of services, e.g., hedonic or utilitarian.

Despite its contribution, however, this study is subject to some limitations. First, services are composed of many different functions, but this study assumed that each service has a dominant function, in order to simplify the framework. Future research should deal with the general characteristics of services as a mixture of different functions. Second, even though supplementation-required reviews can be classified into several subtypes, such as update-required, modification-required, and addition-required, these subtypes are not employed to plot the patterns of positive reviews and supplementation-required reviews. Since our study is exploratory research on a review-based framework, future research should deal with the different characteristics of each subtype of supplementation-required reviews. In addition, this study did not consider the emotional strength of each review and simply classified each review as a positive or supplementation-required review. Finally, we only conducted a case study for an application service only. However, the scope of services is very wide and there are many different types of services which are meaningful to investigate. Future work can cover case studies of different industries or different domains in which the service characteristics are quite different.

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Appendix A

Table A1. Positive Words and Supplementation-Required Words Used for This Study.

Positive words	Opinion lexicon from https://www.cs.uic.edu/~liub/FBS/sentiment-analysis.html#lexicon (This is a list of English positive and negative opinion words, and we extract only positive words [44])
Supplementation-required words	cannot?, not possible, impossible, want, please, pls, plz, need, would be better, d be better, would be great, would like to, d like to, have to, hope, wish, must, try, if i can, let's make, can you make, can u make, if there, if only there, if you could, should be able to, fix, revise, adjust, modify, convert, renovate, gripe, rather than, change, error, mistake, wrong, inaccurate, rubbish, dangerous, disappoint, not work, poor, lost, delete, bug, fix, incorrect, frustrate, useless, drawback, unnecessary, delete, sluggish, different, inability, out of date, stupid, ignore, unlike, shock, slow, buffer, terrible, fuss, confuse, danger, not easy, not work, skip, ugly, hard, issue, misplace, awful, rubbish, fault, not clear, try again, crash, old, cancel, loose, lost, flaw, not find, frustrate, fail, worst, horrible, accident, unable, refuse, annoy, unintelligible, lack, wait, go back, problem, disappoint, lag, miss, problem, improve, improving, develop, complain, solve, put, addition, add more, few, make it, create, unusable, put it back, useful, improve

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