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Integrating affective features with engineering features to seek the optimal product varieties with respect to the niche segments

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ABSTRACT

In recent years, the popularity of smart phones substantially leads to poor sales of the low-end digital cameras. One of the most astounding industry news is Kodak's bankruptcy in 2011 although Kodak was a pioneer in the field of digital still cameras. In reality, not only functional capability but also affective design can influence user purchase intentions on consumer electronics. In this paper, both affective features (AFs), and engineering features (EFs) are considered to achieve successful product planning. In particular, two critical issues are addressed: (1) market partitioning and (2) product differentiation. Initially, Kansei engineering is employed to capture user attitude toward AFs. Then, a classification tree is constructed to carry out effective market partitioning. Secondly, correspondence analysis is applied to capture user perceptions of EFs for identifying the core features that best characterize distinct market segments. Finally, VIKOR (*VlseKriterijumska Optimizacija I Kompromisno Resenje*) ranking is conducted to prioritize various product portfolios to accomplish product differentiation. In summary, the presented framework can help industrial practitioners transform diverse customer requirements into attractive alternatives while keep controllable manufacturing costs.

1. Introduction

Although consumer demand for consumer-electronics like laptops, tablets, smart phones, digital cameras and wearable devices has been increasing for many years, it can be found that many products in this sector are slowly growing or even flat [37]. On the one hand, diverse customer requirements result in much shorter product lifecycles than before [34]. On the other hand, rapid technology advances also incur more competitors to enter this market [33]. Today, not only manufacturing firms but also brand companies are embroiled and need to survive in a fiercely competitive environment. In other words, they cannot enjoy large profits and sometimes even suffer huge losses. In general, price driven competition focuses on cost leadership in a red-ocean market while non-price driven business model emphasizes product or service differentiation in a blue-ocean market [23].

1.1. Industrial backgrounds of consumer electronics

As mentioned earlier, shorter product lifecycles in consumer electronics coupled with dynamically changing customer desires lead to an intensively competing environment. One of the most significant characteristics is the fast-declining price. Additionally, the market shares among the competing companies are usually fluctuating. For example, the top 5 smartphone vendors in 20162Q are Samsung (22.4%), Apple (11.8%), Huawei (9.4%), Oppo (6.6%) and Vivo (4.8%) that are quite different from the situation in 2015 (http://www.idc.com/getdoc.jsp?containerId=prUS41636516). It is observed that Apple's market share is now below 12%, compared to 14% in 2015. Meanwhile, Xiaomi cannot stay within the top-five positions because of its decreasing shipments.

In fact, not only functional capability but also affective design may influence users' purchase intentions on consumer electronics [19,29]. A good example is Apple's iMac, iPod, iPhone, iPad and iWatch series, which have been heralded as an aesthetic paradigm in industrial design [8]. Samsung's smartphone strategy that covers a wide spectrum of screen size and display specifications is another good example to consolidate its mobile territory. A famous slogan was proposed by Nokia: "*Technology always originates from humanity*", although Nokia was merged by Microsoft in 2014 because it lags in transforming close systems in mobile phones into open systems in smart phones. Since 2011, the popularity of smart phone significantly results in poor sales and declining shipment of digital cameras, as shown in Fig. 1. One of the most astounding industry

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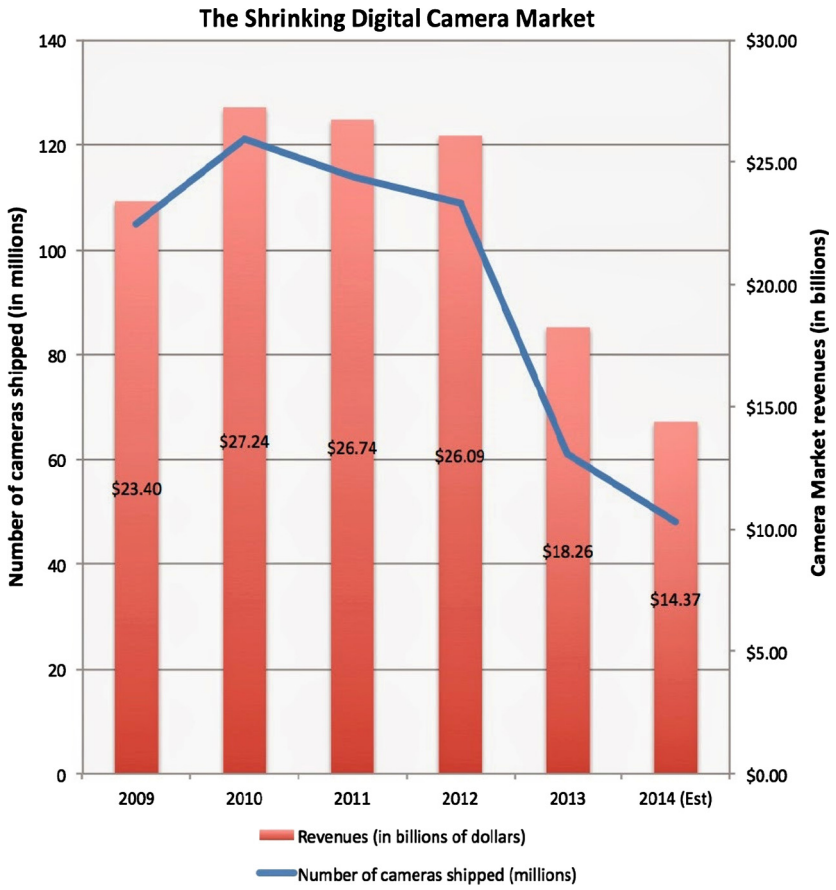

Fig. 1. A declining trend in the market share of digital still cameras (http://aswathdamodaran.blogspot.tw/2014/10/go-pro-camera-or-smartphone-social.html).

news is Kodak's bankruptcy in 2011 although Kodak was a pioneer in this field.

In order to avoid intense competition caused by smartphones, most camera makers begin rethinking and repositioning their products. Without loss of generality, digital cameras are separated into three types: single lens reflex (SLR), non-SLR and built-in lens (see Fig. 2). Different from the traditional built-in lens, non-SLR covers specific but powerful usage, such as big aperture, ultra-zoom, water proof, and extreme-sport. Apparently, to enhance profit margin in digital cameras, Fig. 2 implies that brand companies should allocate more resources in developing portable SLR or powerful high-end digital cameras. Consequently, this paper aims to emphasize two critical issues in product planning: market partitioning and product differentiation.

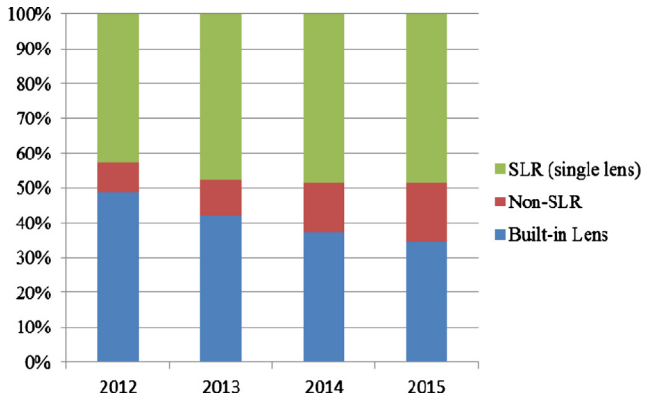

Fig. 2. Worldwide camera's shipment value in terms of relative percentages (https://photographylife.com/a-few-thoughts-about-the-camera-market).

1.2. Research motives

In a highly competitive global economy, product planners and designers need to fit diverse requirements of the *ad-hoc* segments [11,33]. The entire market is divided by using several variables, such as affordable prices, user preferences and customers' psychological backgrounds. Thereafter, product differentiation can be conducted with respect to the identified segment(s) to enhance its effectiveness and efficiency [23]. Specifically, "market partitioning" allows dividing a macro market into the micro segments in which consumers demonstrate homogeneously within a group but behave heterogeneously between groups [36]. Moreover, "product differentiation" is creating tangible or intangible feelings to ensure these characteristics can occupy a unique position in the minds of customers [19]. In fact, product differentiation refers to configuring a set of product features to satisfy diverse customer needs [22].

In the past, several quantitative schemes were proposed or fused to solve different problems [1,2,30]. However, most of them are focusing on engineering features (functional capability) without incorporating affective features (aesthetic design). In reality, user attitude, user preferences and user perceptions and do not only influence product sales, but also affect firms' brand or product image [12]. Inspired by the concept of Kansei engineering, both affective features (AFs) and engineering features (EFs) are considered and incorporated into the entire decision-making process. In particular, several critical issues are addressed in this study:

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