How Consumers Assess Product’s Features?: A Case Study of Product Features of Smartphone

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Abstract: Assessing product features is often a multiple criteria decision-making problem. Consumers may mentally link related product features to simplify the decision making process. This study tests the above idea by using the case study of consumers assessing the product features of smartphones. Our analysis revealed that this is the case and a bi-directional relationship may exist between product features. This has implications for new technology features such as NFC and its associated application (e-wallet). New product features need to entrench themselves as a collective part of the product by “locking” (linking) themselves to other existing and more established features. Other implications arising from the analysis are also discussed.

Key-Words: smartphone, product features, multiple criteria decision-making problem, DEMATEL

1 Introduction
Consumer decision making is always a central theme in marketing research. Studies (e.g. [1]) have shown that consumers follow a two-stage strategy to making choices. Consumers include some brands which they are aware of (the awareness set) in their consideration set and make comparison within the latter set to finalize their decision. Having a product in the consideration set is often a precondition for final purchase choice [2]. A product’s inclusion may depend on its features. Products with features absent in other competitors can increase its appeal [3]. However, there is also argument that new features do not always improve product evaluation [4].

Many studies aim to find product features that customers feel important or desirable. After these features have been identified, suggestions on how to improve and market the products can then be made. Quite often, studies such as those using the Analytic Hierarchy Process (AHP) method, assume that the features are independent of one another. However, everyday experience suggests otherwise.

Real-life decision making is often multiple criteria decision-making (MCDM) problem. Human can make poor choice if the decision is complex and involves many attributes [5]. This study suggests that consumers may mentally link related product features to simplify the decision making process. In other word, customer’s perception of some of the product features is built and based on a collection of perceptions of other inter-linked features. This idea is not far-fetched as feedback loops exist in many causal processes [6]. Hence, the recursive model, which is frequently used in many system adoption studies, may be restrictive for our purpose.

Pursuing the above ideas further and getting the mental map of consumers is not just a matter of academic interest. It also has important practical implications. It helps in designing and marketing next generation products, in specific, allowing manufacturers and marketers to focus more efforts on the “cause” features (those which affect others) than the “effect” features (those affected by others).

This study uses a case study of consumers assessing the smartphone features to shed light on the above issues. This case study is appropriate for theoretical and practical reasons. Its nature contributes theoretically to the lack of research on the relationship between feature preferences [4], especially in the context of MCDM problem. Consumers consider many product features simultaneously when choosing smartphones. Hence, it is a MCDM problem. Given the array of complex features, it is unreasonable to treat these features as independent of one another. Hence, consumers simplifying their decision making process by associating some of the product feature’s perception to a collective set of perceptions of other inter-linked features is possible. The smartphone industry is also of great practical importance. Consumers are adopting smartphones at a remarkable pace and see smartphones as personal expressions of their lifestyle [7]. Smartphones have short life-cycles. Competition between manufacturers is fierce and
new smartphone features are introduced at a dazzling pace to attract buyers. Nokia and Apple introduced Near Field Communication (NFC) and Siri software respectively in their latest models.

This study uses the Decision Making Trial and Evaluation Laboratory (DEMATEL) method [8] as the analytical tool. A MCDM method, DEMATEL can discover the cause and effect relations between factors and allow one to visualize its structural model [9]. Since the case study is a MCDM problem and the objective is to get the consumer’s assessment mental picture of how some smartphone features are built on the collective perception of other features, it is appropriate to apply this method to construct the cause-effect structural model.

This paper is structured as follows: relevant literatures are first presented, follows by research method, results, discussion and conclusion.

2 Literature Review

Many academic researchers and practitioners have investigated issues related to smartphone usage. Study [10] found that personal innovativeness, perceived enjoyment and smartphone satisfaction positively impact compulsive usage of smartphones.

Determining which smartphone features are attractive and important in purchase decisions is also a common research area. Using two criteria (user-related criteria and product-related criteria), [11] used the MCDM approach to evaluate mobile phone options in respect to the users’ preference order. The product-related criteria comprises: basic requirements (e.g. reasonable price, standard part used), physical characteristics (e.g. weight, dimension) and technical features (e.g. talk time, safety standards). The sub-criteria of user-related criteria are: functionality (ease of use), brand choice and customer excitement (e.g. games, ringing tones).

Study [12] investigated diversity in smartphone usage along four dimensions: user interactions, application use, network traffic and energy drain.


Users’ overall satisfaction with smartphone is higher for devices that are of a specific size and weight and equipped with the latest technological advancements [14]. The same report also mentioned that 42% of the owners received free mobile phone when subscribing to a wireless service (the price plan), and touch screen-only smartphones generate higher satisfaction with ease of operation than QWERTY-only based devices.

Based on their needs and interests, to enhance user experience [14], and partly for enjoyment [15], smartphone users install applications of their liking. Two-thirds of them download games and social networking applications, more than one-half use entertainment-oriented applications, while 52% download travel software [14]. Hence, there is huge market opportunity for mobile software and contents.

A successful smartphone brand should engage users in an emotional experience [16]. In that aspect, Apple has created a very strong marketing strategy for its iPhone [17], and ranks highest among manufacturers of smartphones in customer satisfaction, followed by HTC [14].

Smartphone manufacturers often introduce new features to attract buyers. One recent move is to add NFC to the phone (such as the recent Nokia launch). NFC allows for wireless exchange of data between devices within a radius of about 10cm. NFC can be used as e-wallet [18], enabling mobile micro-payments at physical stores and transport services.

3 Research Method - DEMATEL

DEMATEL is very suitable for studying and analysing complicated and intertwined problems. It classifies factors of the problem into cause group (factors that have more effect on others) and effect group (factors that receive more influence from others). It also identifies the interdependence among factors. Using digraphs, the structure of complicated causal relationships can be visualized through an intelligible cause-effect structural model [19]. DEMATEL’s procedure is as follows:

Step 1 - With n factors and H respondents, each respondent states the degree a factor i affects factor j with score ranging from 0 as “no influence” to 4 as “very high influence”. Using n×n answer matrix X^k with 1 ≤ k ≤ H, the initial direct relation matrix A is:

\[ a_{ij} = \frac{1}{H} \sum_{k=1}^{H} X^k_{ij} \]  

(1)

Step 2 - Normalised initial direct-relation matrix D is obtained by D = A/s where:

\[ s = \max_{1 \leq i,j \leq n} \left[ \max_{1 \leq k \leq n} \sum_{j=1}^{n} a_{ij}, \max_{1 \leq k \leq n} \sum_{i=1}^{n} a_{ij} \right] \]  

(2)
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4 Survey and Analysis

4.1 Smartphone Features and Survey Design
Using literature review and product specification sheets provided by manufacturers, a preliminary list of common features was obtained. Discussion with experts and postgraduate students was conducted to obtain a more manageable list of eleven features. NFC and its application, e-wallet, were included as postgraduates, ambiguous wordings were rephrased to obtain a more manageable list of eleven features.

4.2 Importance-Understanding Analysis
Table 1 summarizes the average understanding and importance level of each feature.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Understanding</th>
<th>Importance</th>
<th>Mean</th>
<th>S.D.</th>
<th>Mean</th>
<th>S.D.</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1: Price</td>
<td>3.49</td>
<td>3.85</td>
<td>3.69</td>
<td>1.05</td>
<td>1.00</td>
<td>1.00</td>
</tr>
<tr>
<td>A2: Price Plan</td>
<td>3.36</td>
<td>4.11</td>
<td>3.68</td>
<td>1.08</td>
<td>0.93</td>
<td>0.93</td>
</tr>
<tr>
<td>B1: OS</td>
<td>3.36</td>
<td>3.61</td>
<td>3.60</td>
<td>0.98</td>
<td>0.99</td>
<td>0.99</td>
</tr>
<tr>
<td>B2: NFC</td>
<td>2.63</td>
<td>3.19</td>
<td>3.27</td>
<td>1.11</td>
<td>0.89</td>
<td>0.89</td>
</tr>
<tr>
<td>B3: Transmission</td>
<td>3.27</td>
<td>3.67</td>
<td>3.50</td>
<td>1.09</td>
<td>0.83</td>
<td>0.83</td>
</tr>
<tr>
<td>C1: Screen</td>
<td>3.60</td>
<td>3.98</td>
<td>3.55</td>
<td>0.99</td>
<td>0.87</td>
<td>0.87</td>
</tr>
<tr>
<td>C2: Body Design</td>
<td>2.94</td>
<td>2.91</td>
<td>3.42</td>
<td>1.12</td>
<td>0.98</td>
<td>0.98</td>
</tr>
<tr>
<td>D1: e-Wallet</td>
<td>3.73</td>
<td>3.68</td>
<td>3.59</td>
<td>0.83</td>
<td>0.85</td>
<td>0.85</td>
</tr>
<tr>
<td>D2: APPs</td>
<td>3.73</td>
<td>3.68</td>
<td>3.59</td>
<td>0.83</td>
<td>0.85</td>
<td>0.85</td>
</tr>
<tr>
<td>Average</td>
<td>3.358</td>
<td>3.656</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The top 3 features which respondents understood most, in order of importance, are brand (3.73), screen (3.60) and fashion (3.59). The 3 least understood features are NFC (2.63), e-wallet (2.94) and transmission (3.27). The top 3 most important features are price plan (4.11), screen (3.98) and body design (3.96). The 3 least important features are e-wallet (2.91), NFC (3.19) and fashion (3.34).

The overall understanding and importance mean are 3.358 and 3.656 respectively. The importance-understanding matrix grid is shown in Fig. 1 with two overall means as the dividing lines for the 4 quadrants. NFC and e-wallet features are in the “less important-least understood” quadrant. Transmission is the only feature in the “more important-least understood” quadrant. OS and fashion features are in the “less importance-most understood” quadrant. The other 6 features are in the “most important-most understood” quadrant.

Fig. 1: Importance-understanding matrix grid

4.3 DEMATEL Analysis
Total relation matrix T was obtained using (3). The sum of rows \( r \) and sum of columns \( c \) of \( T \) were then obtained using (4). The sum \( r_i + c_i \) and difference \( r_i - c_i \) were calculated and shown as Table 2.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Value</th>
<th>Rank</th>
<th>Value</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price</td>
<td>18.60</td>
<td>1</td>
<td>-0.13</td>
<td>4</td>
</tr>
<tr>
<td>A2: Price Plan</td>
<td>17.39</td>
<td>4</td>
<td>-0.14</td>
<td>2</td>
</tr>
<tr>
<td>B1: OS</td>
<td>17.55</td>
<td>3</td>
<td>0.19</td>
<td>4</td>
</tr>
<tr>
<td>B2: NFC</td>
<td>15.56</td>
<td>9</td>
<td>0.45</td>
<td>2</td>
</tr>
<tr>
<td>B3: Transmission</td>
<td>15.27</td>
<td>10</td>
<td>-0.02</td>
<td>6</td>
</tr>
<tr>
<td>C1: Screen</td>
<td>17.04</td>
<td>7</td>
<td>-0.14</td>
<td>2</td>
</tr>
<tr>
<td>C2: Body Design</td>
<td>16.49</td>
<td>8</td>
<td>-0.13</td>
<td>4</td>
</tr>
</tbody>
</table>

The 3 factors with the highest \( r_i + c_i \) value are price, brand and OS. The top 3 net causer factors \( r_i - c_i > 0 \) are fashion, NFC and brand. The top 3 net receiver factors \( r_i - c_i < 0 \) are APPs, screen and price plan. The influence map was obtained and for better clarify shown separately as Fig. 2 and 3.

Fig. 2: Influence map (bi-directional relationship)

Fig. 3: Influence map (uni-directional relationship)

5 Discussion and Conclusion
As shown in Section 4, consumer’s assessment of the product features of smartphone is a MCDM problem. The influence maps also show that consumers mentally link features to simplify the decision making process. Hence, customer’s perception of some of the features is built and based on a collection of perceptions of other inter-linked features. For example, consumers do not view price in isolation, their perception of price is closely associated and inter-linked to other features such as OS, screen and brand. The results thus justify our intention to abandon recursive model in this study.
Generally, consumers do not view technology-related feature criteria (OS, data transmission and NFC) as important as other feature criteria. They also do not understand NFC and data transmission as well as OS. Such a perception has an impact on the much poorer performance of NFC and transmission methods in terms of total effects given and received by these two factors. It also causes NFC and transmission methods to become standalone features in the influence maps. Consumers are not able to associate these two features with other smartphone features. These observations have several implications. Rapid introduction of advanced and new technologies (such as NFC) in the smartphones do not always win the hearts of the consumers. Consumers must have some basic awareness of the technologies (similar to the concept of “awareness set”) before they are willing to consider them (“consideration set”), buy in, and tying them to other features. The often discussion of Android and iOS in mass media and in layman’s terms has increased consumer’s awareness of OS and enabled it to play a more important role than the other two technology-related features in the mental map of customers (the influence map). Hence, OS has a bi-directional relationship with price and brand, and influences APPs uni-directionally.

NFC, being closely associated with e-wallet, provides further insight on the problems associated with introducing less-known technology as a smartphone feature. Its related application, e-wallet, is the second least understood and least important feature. NFC and e-wallet are in the “less important-least understood” quadrant. Both of them are also standalone features in the influence map. Even though academia and engineers often associate NFC with e-wallet, consumers simply don’t think there is any relationship between them. NFC and e-wallet are also unable to entrench themselves as an essential and collective part of the smartphone by “locking” (linking) themselves to other existing and more established features. The NFC-e-wallet pair provides a useful message to designers and marketers that it is not enough to introduce new technologies and their associated applications. When they are being introduced, manufacturers and marketers must ascertain whether the consumers know about them. If it is not so, there should be enough promotion before and immediately after the launch to increase customer’s understanding and appreciation of their usefulness and importance. They can design their messages so that consumers can associate them with other integral part of smartphone features such as brand and fashion. Otherwise, customers will not be able to appreciate the good intent of manufacturers and marketers in enhancing the functions of smartphones and making the phone more useful.

Except for the lead users and early majority users who hotly pursue the latest technology, majority of the consumers focus on how smartphone adds value in ease of use and usefulness. APPs feature is the fourth most important features after price plan, screen display and body design. The influence map also shows that APPs feature is the strongest net receiver feature. Price, price plan, OS, brand and fashion influence perception of APPs. In other word, consumers use these five features to provide an indication of APPs feature. Hence, manufacturers and marketers do not need to allocate too much resources and effort on promoting the huge and rich collection of APPs to purchasers. Instead, they can focus on features such as brand. Consumers will logically use them to provide an indication of the richness of APPs. Obviously, such kind of mechanism is absent between NFC and e-wallet.

Fashion is the strongest net effect feature. Fashion influences price, price plan and APPs. This result may be a surprise to some observers since fashion is expected to be the outcome of other features. This outcome is a strong indication of the success of smartphone industry and bear witness to smartphones being a personal expression of user’s lifestyle. Many consumers now take fashion as a “given”. This study also shows that the industry is brand-driven. Fashion and brand are two sides of the same coin, evidenced by their bi-directional relationship. Brand also shares bi-directional relationship with OS and price and affects screen, price plan and APPs uni-directionally.

The price of smartphone is highly inter-related with other features (price plan, OS, screen, brand). Price is influenced by fashion and in turn influences APPs uni-directionally. Hence, customers do not view price in isolation when assessing whether the smartphone is worth its value. The mental map of the consumers also takes into account features closely associated with price. Hence, as long as the manufacturers and marketers manage related features carefully and are reasonable in their pricing, it is easier to justify higher price by inducing consumers to link and justify price with other important features. Our interviews with some respondents reveal that some of them even associate high price with quality smartphone features.

On limitations and future research directions, this study considers only one case study. Hence, generalization of result may be limited. This study suggests that other consumer decision-making
scenario can be considered. This study also shows that new product features need to entrench themselves as a collective part of the product by “locking” themselves to other existing and more established features. This issue can be studied further. Another limitation is the sample size. The reason is DEMATEL survey is not easy to fill up and this study has to put in lot of effort to encourage participation. Despite this limitation, this study still provides useful ideas on how consumers assess product features.

To conclude, using consumers assessing smartphone features as the case study, this study shows that in MCDM decision-making problem, consumers may mentally link product features to simplify the decision making process. Bi-directional relationship may also exist between product features, thereby imposing a limit to the applicability of recursive model. Since customers perceive some features as inter-linked, manufacturers may group them together in the product R&D process. Marketers also need to take into account this issue for better marketing outcome.

References: