The Analysis of Smartphones' Operating System and Customers' Purchasing Decision: Application to HarmonyOS and Other Smartphone Companies

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ABSTRACT

Nowadays, the smartphone industry steps into a period of prosperity and development. While more and more phones with a variety of features have been released, Android and iOS seize the majority of the operating system market. At the same time, Huawei has just introduced its original system on smartphones, the HarmonyOS. Therefore, this article compares the advantages and disadvantages of Android and iOS, and provides suggestions about the future development for HarmonyOS based on past successful cases, such as system privacy security and application accessibility. In addition, the paper will analyze the internal and external factors that consumers will consider before the deal of a smartphone, which renders ideas of the marketing strategy to smartphone companies. In this paper, secondary data observation and analysis are applied as the research methods. The majority of people purchase a phone because they really demand it, and they will ponder over the internal elements of a phone such as the price, the phone's operation interface. Since advertisements do not actually help a lot for the decision to buy a smartphone, a company should invest more on the quality of their products instead of promoting them too much.

Keywords：*Smartphone; Operating system; Analysis; HarmonyOS; Purchasing decision*

1. INTRODUCTION

In recent years, smartphones have evolved from a conventional communication apparatus to a mobile device with multifarious features. These portable and miniature computers not only make and receive phone calls or texts, but also access the Internet and other digital media like pictures and videos. Along with their significant progress, smartphones have become an integral part of modern life. According to the data from statista.com on smartphone users worldwide, an exponential growth in people who own and use smartphones is revealed. Within 5 years, the number of users have increased from approximately 3.7 billion in 2016 to 6.4 billion in 2021 [1].

Despite the immense number of consumers, the mobile operating systems (OS) market is actually monopolized by Google's Android and Apple's iOS, which together occupy over 99% of the entire market, and only a few competitors against them exist in the market [2]. The two operating systems have their respective advantages that attract most of the customers.

Meanwhile, as one of the leading global providers of information and communications technology (ICT) infrastructure and smart devices, Huawei has launched HarmonyOS. This operating system is a new microkernel-based, distributed operating system designed to deliver a cohesive user experience across all devices and scenarios [3]. Basically, questions that the paper will try to answer is: (1) what makes Android and iOS such successful operating systems, and (2) if the operating system is a crucial element that influences people's purchasing decision on a smartphone, what other factors will have an impact on people's choices. This paper studies the similarities and differences between iOS and Android that make them such popular systems within the enormous market, and offers several suggestions for HarmonyOS and other operating systems to help them figure out what influences customers' purchase decisions with Android and iOS' statistics.

2. MAIN BODY

2.1. Data and Research Methods

In this research, the data for Android and iOS comparison is derived from a survey with more than 150 participants in a secondary source [4]. The data regarding customers' selections of smartphones is based on the questionnaire done by Yu-Syuan Chen, Tso-Jen, and their fellow researchers in 2016 [4]. It consists of personal information, internal and external elements of consumers' behavior, the determinant of purchasing decision, and the brand relationship quality. A total of two hundred and fifty-two smartphone users have done this survey. The other statistics about the number of smartphone users in the world and the proportions of each operating system are retrieved from statistia.com and statcounter.com [1][2]. With these essential statistics about Android and iOS operating systems, the paper will observe the evident traits and analyze the secondary data in depth.

2.2. Operating Systems Comparison

Google's Android is a Linux-based and open-source operating system, the most widely used smartphone and tablet platform on the market, while iOS is an operating system developed by Apple Inc, originally created for the iPhone and later expanded to include other Apple devices such as the iPod and iPad. Since security and Data accessibility are two major factors that affect buyers' purchase decisions [5], the paper will compare the two operating systems in these two aspects in the following paragraphs.

2.2.1. Security

Android's security features are Components Protection, Memory Management Unit (MMU), Application Permissions, Type Safety. As an open-source model, it is slightly more vulnerable to hacking and cyber threats. The open and decentralized nature of installing applications in the devices, more often from third parties, exposes the Android OS to some security issues. iOS is considered as one of the safest operating systems for smartphones. Apple designers have enhanced their models to exclude them from any third-party antivirus software. Their security models focus on data security, network security, device security, and application security. In contrast, Android, a competitive operating system, has four major security features: component protection, memory management unit, application permissions, and type safety. According to Toppo & Dhote (2021), when users are asked to choose a better operating system for personal data protection, 69.8% chose iOS and only 22.8% chose Android, as shown in Figure 1 [5].
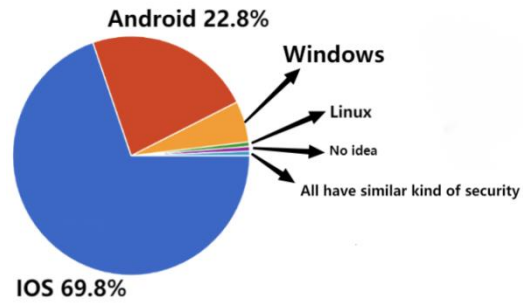

Figure 1: Operating System Preferences Based on Data Security [5]

2.2.2. Design Accessibility

Android provides the flexibility to modify the device and improve the operating system permissions according to the user's inclinations and requests. In addition, it can run different implementations like outsiders, middleware applications, and media, which all benefit its customers. The latest version of iOS has a built-in accessibility feature and a developer tool which together provide a high-level mobile experience for every customer. For example, a comprehensive screen assists blind and low vision users. In comparison, Android is created based on universal design principles that will help applications meet basic usability standards.

From the survey [5], people's suggestions to improve the operating systems are: apps accessibility, overheating issues, storage management, bugs issues, customization of OS, graphical interface, and new features such as artificial intelligence and machine learning to better predict human behavior. Most of these issues have been improved in the latest versions of iOS, but Android is still a work in progress. Based on these observations, HarmonyOS, which tries to replace Google's apps [6], should find some alternatives to improve its accessibility of other applications.

2.3. Customers Purchasing Decision

Before the purchase of a smartphone, consumers would consider numerous elements, for example, price and function of the product. Those various stimuli that influence smartphone consumers' buying decisions. Understanding and utilizing the concept properly, a company can attract customers by creating incentives that tempt the potential buyer.

Kotler and Armstrong claim that an acceptable price for both the sellers and the buyers is difficult but fundamental. Also, the manufacturer should always innovate so that the function of the product can precisely target people's demands. A customer's behavior is impacted by social factors, such as friends and family's recommendation [7]. Besides, the outer appearance of a product can affect consumers' estimation and impress them [8]. Brand awareness, additionally, enables the

customer to quickly recognize the company's trademark [9]. Last but not least, brand relationship quality brings the business and the customers closer to each other, and arouses their intention to repurchase or recommend [10]. There are certainly more factors that determine customers' valuation of a product, but ones that are mentioned previously play the key role in purchasing decisions.

Among the two hundred and fifty-two participants in the research [4], two hundred and thirty-eight people (94%) agreed that they buy a smartphone for their need of using it, while about eighty-eight (35%) and ninety-five (38%) users respectively disagrees that they purchase a smartphone to go with the fad and because of other people's influence. Surprisingly, seventy-five (30%) participants disagree that the reason they buy a

brand's product was because have seen or heard an advertisement for that brand. Beside the external factors, some internal elements also affect people's decision on purchasing a smartphone. For example, most of the responses agree that the price (214, 85%), the functions of the cell phone (224, 89%), a user-friendly operation interface (219, 87%), battery life (224, 89%), and the outward design (214, 85%) are necessary factors in buying decisions. Regarding the brand relationship quality, 204 participants (81%) agree that they can recall the logo of a specific brand and 201 (80%) concur that the after-sale service will impact their willingness to repurchase the same brand. Conversely, 88 people (35%) agree they will continue to buy a brand with poor evaluation. The listed information is visualize in Table 1 and Figure 2:

Table 1: Factors Affecting Customers' Purchasing Decisions

External Factors				
	Demand	Trend	People's Influence	Advertisement
Number of Participants	238	88	95	35
Percentage	94%	35%	38%	30%

Internal Factors					
	Price	Functions	Operation Interface	Battery Life	Outward Design
Number of Participants	214	224	219	224	214
Percentage	85%	89%	87%	89%	85%

Brand Relationship Quality			
	Symbolic Logo	After-sale Service	Brand Evaluation
Number of Participants	204	201	88
Percentage	81%	80%	35%

As shown in Figure 2, the actual demand of the usage of a smartphone is the major reason for people to purchase a phone and the advertisement does not really motivate customers' to buy the product. Moreover, most

of the internal elements of a phone such as price, internal functions, operation interface, battery life, and outward design are the main determinants of the deal.
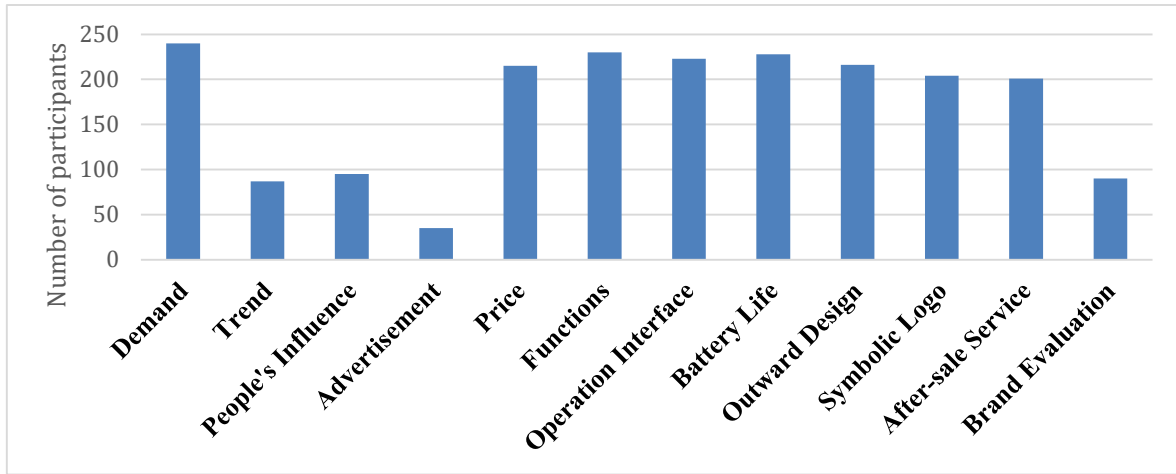
Figure 2: Major Reasons for Phone Purchasing

3. CONCLUSION

In this paper, the features between Android and iOS are compared first. While iOS is deemed as a secure operating system that protects users' personal data, it also sets some restrictions over the accessibility of applications. Conversely, Android, due to its universal design principles, makes most of the applications as available as possible, which also leads to some privacy concerns. There are still a lot of aspects that the two companies can improve on their operating systems. For example, adding new features such as more advanced artificial intelligence and machine learning is suggested by the customers [5].

Also, for Android, it prevails over other operating systems because of its adaptability to modifications in the devices and its access to all kinds of applications; on the other hand, iOS wins customers with its highly secure system.In addition to the operating system being a crucial element that influences people's purchasing decisions on a smartphone,the content of this paper also corroborates information on the internal and external factors that influence people's smartphone purchase decisions.

The information about both the internal and external factors that influence people's smartphone purchasing decision is presented and categorized. As shown in Table 1 and Figure 2, most people purchase a phone for the sake of their demands, and they also agree on the fact that the internal factors such as the price and the function of a smartphone are crucial. The quality of the relationship between brand and customers plays a significant role in people's decision to repurchase or recommend the brand. Unexpectedly, advertisements and other people's influence does not impact one's buying decision on smartphones a lot. Thus, a smartphone company should focus more on the development of their products, endeavoring to meet consumers' requests, instead of investing money on expensive advertisements. Likewise, the firms of various operating systems should innovate

on their functions rather than aiming at the promotions of their functions.

Though Huawei's HarmonyOS is completely different from the former [3], it can draw the advantages from the two successful operating systems to compete with them. For instance, it can develop a sophisticated app ecosystem which satisfies both the security demand and its applications availability at the same time. Meanwhile, Huawei needs to persistently devise novel and efficient models of smartphone to attract more customers and grow stably. SinceHarmonyOS on smartphones has just been released recently and is relatively novel, little information regarding its users' experience can be found, but it does have the potential to thrive and eventually keep up with Android and iOS. In the future when more data is gathered, researchers can find if HarmonyOS or other operating systems meet customers' demands. Besides, people can study on how to find a balance between private security and applications' accessibility.

There are several aspects that still need to be improved in this paper; for example, those relatively uncommon operating systems, which probably have their own advantages, have not been investigated. Mathematical models can also be applied to examine customers' purchasing preferences in the smartphone industry. In the future when sufficient data about HarmonyOS are available, researchers can also analyze this particular operating system and provide targeted advice.

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