Disruptive Product Innovation Through Modularity: Potential Impact of ARA on Mobile Handset Business In India

Sayantan Khanra

Indian Institute of Management Rohtak
E-mail: sayantan.khanra@iimrohtak.ac.in

Abstract—*High level of hardware integration to reduce size of the consumer electronics products diminishes the flexibility to the end customers. Google's project Ara is looking forward to address the issue by designing modular smartphone. Modularity has often reduced complexity in product design. This paper attempts to analyze the probable impact of modular smartphones in the Indian market through primary and secondary research.*

1. INTRODUCTION

Modularity has commonly been used to reduce complexity both in manufacturing industries such as automobiles and service sector like software designing. But in case of consumer electronics, we have witnessed a high level of integration yielding a continuous reduction of physical dimensions with the advancement of technology over the years. This type of hardware integration often causes customer dissatisfaction for providing lesser scopes to customize, upgrade and repairing. To address this issue, Google has undertaken project Ara to bring modular smartphone in the market. The design and technical features of the product strongly demonstrate the potential of Ara to become another example of disruptive innovation once it is launched in the market. As the attractiveness of the Indian market is irresistibly growing towards the global technology companies, we are most likely to observe a revolution in the very foreseeable future.

As this paper attempts to analyze the impact of modular smartphones in the Indian market, the structure of the paper is as follows: a brief review of the previous literature precedes idea about the project Ara. Next, key objectives have been precisely mentioned and those objectives have been addressed thoroughly. Limitations and future research scopes are carefully mentioned before the paper concludes.

2. LITERATURE REVIEW

Scholars in various contexts have discussed the advantages of modularity. Ulrich and Eppinger [1] have argued that modular structures help the manufacturers over the integrated structure when flexibility and rapid up gradation are focused rather than the overall performance. A similar argument was extended by Galunic and Eisenhardt [2] as they viewed adaptation of modularity as a reactive strategy to ever-changing business conditions. Recombination of diversified resources and product-market domain can be achieved by using this strategy. Extending the thought process, Schilling and Steensma [3] have given the perspective that modular product designs enhance the freedom of outsourcing. Therefore, modular innovations come with the potential to downsize the essential activities that a firm has to perform in house.

Links have often been established between modularity and innovation. For example, Baldwin and Clark [4] were confidant about the idea that proper application of modularization can significantly boost product innovation. They have prescribed two mechanisms for that: (i) autonomous innovation- to be applied within a particular component and (ii) modular innovation- subjected to the mix and match of different interdependent modules. However, in his classic book titled '*The Innovator's Dilemma*', Clayton Christensen [5] has nicely explained certain nature and characteristics of the products that disruptive innovation generally yields. According to Christensen, who coined the term 'disruptive innovation', such products are "cheaper, simpler, smaller, and, frequently, more convenient to use." Therefore, it can be seen that the prospect of a modular smartphone is looking bright from the aspects discussed here.

3. PROJECT ARA

Ara is a very ambitious project undertaken by Advanced Technologies And Projects (Atap) Group at Google to build a modular smartphone. More specifically, Google is attempting to offer an open hardware platform named endoskeleton. Endoskeleton is basically a structural frame, which is designed to hold several modules for performing specific functionalities. There will be essential modules like battery, LCD and speaker. Separate modules will also be available for common smartphone features like camera, WiFi connectivity,

graphics card etc. The open hardware platform also provides room for unique features, such as medical devices, environmental pollution measurers, receipt printers, laser pointers, pico-projectors, night vision sensors etc.

Google has launched the market pilot of project Ara in Puerto Rico in the second half of 2015. Ara was actually conceptualized to provide enormous flexibility to the customers to customize their smartphones as per their specific requirements, upgrade without changing the entire device, carry extra or backup modules and easily swap out malfunctioning modules.

The inception of the very idea of modular smartphones lies in Google's purchase of some patents from a Israel based company Modu in 2012. But the idea went viral when Dutch designer Dave Hakkens publicly shared his project on 'Phoneblocks' in 2013. Meanwhile, a Finnish company named Circular Devices were carrying out a parallel project called Puzzlephone with similar objective since 2013. Puzzlephone has just three modules: first one contains the basic structure with LCD and speaker, second one rooms battery and secondary electronics and the third is designed to accommodate processor and camera.

4.   KEY OBJECTIVES OF THIS PAPER

"The smartphone is one of the most empowering and intimate objects in our lives. Yet most of us have little say in how the device is made, what it does, and how it looks. And 5 billion of us don't have one. What if you could make thoughtful choices about exactly what your phone does, and use it as a creative canvas to tell your own story? Introducing Project Ara. Designed exclusively for 6 billion people."

 ---Google [as displayed on the official website of Project Ara]

Google has made their vision very clear about the project Ara through the message. But, though Ara has been developed for 6 billion people, it has a stronger focus on the developing and emerging countries. Reason behind the focus is that the smartphone penetration in such countries is significantly lower than that of developed countries. Hence, these markets offer huge scope to achieve exponential growth that every product coming from disruptive innovations aspires for.

Google intends to launch a starter kit comprising of a frame and basic modules at a competitive price of around $70, or slightly more than that. As Google is providing technical support to the developers who are interested in designing and manufacturing modules for the open source hardware platform, pricing of modules is also expected to be as competitive as the starter kit. In this paper, following aspects are analyzed, specifically in the context of Indian market:

- Do Ara has the potential to be as successful in hardware platform as android is in software platform?

- To what extent Ara can change the consumer behavior and purchase intention of Indian customers?

- What strategies should the existing players adapt to retain their businesses in india?

5.   DATA COLLECTION

In the recent past, Google has disrupted the mobile phone industry with Android, their open source software platform. Now, their statement about the project Ara clearly shows the intention to disrupt the hardware system of mobile phones. To logically predict the success of Ara, an augmented version of Technology Acceptance Model [Exhibit-1] has been used in this article. The author has interviewed 20 mobile phone users from different age group with a different usage pattern to obtain insights about designing a survey questionnaire form.

The author adopted convenient sampling procedure for collecting data from 200 respondents. Five responses were rejected due to inconsistency issue. Hence, the constructs of the aforesaid model will be analyzed based on 195 valid responses to the questionnaire form. Female respondents constitute only 15% of the sample. Charts 1.(a) and 1.(b) in Exhibit 3 shows the demographic profiles based on occupation and age group of the valid respondents respectively.

6.   CAN ARA BE THE ANDROID OF HARDWARE?

According to the findings of the primary research, perceived usefulness of the product found to be very is high thanks to high job relevance. As per the responses, provision to upgrade and freedom to customize are found to be two most important usefulness of Ara. These job relevancies excite 64% and 58% of the valid respondents respectively.

Product image and, consequently, perceived output quality has also been found to be quite promising, primarily due to the association with the brand name of Google. As more than 80% smartphone users in our data set use Android platform, self-efficacy is observed to be very high. Since the user interface of Ara is similar to that of existing smartphones, playfulness is found to be high while anxiety to use the new product was quite low.

Due to the freedom of customizing and upgrading, perceived enjoyment and objective usability are quite encouraging. Overall, the perceived ease of use is very high. Therefore, banking on the excitement that the author has observed among the respondents, it will not be an exaggeration to say that Ara can be the next big thing in the mobile phone market.

7.   POSSIBLE IMPACTS ON INDIAN CUSTOMERS

Arrivals of new technologies in a category have often impacted the ways customers perceive a product within the respective category. Thus, the Unified Theory of Acceptance and Use of Technology model [Exhibit 2] has been adopted to analyze the collected data. In line with this concept, the

majority of the interviewees has also hinted that the flexibilities that Ara is aiming to offer will provoke them to expect similar freedom from the existing mobile phone makers. Therefore, it can be forecasted that the conventional smartphone makers will face changing consumer behavior to an uncertain degree on arrival of modular smartphone.

Interestingly, responses varied to a certain extent with respect to gender and age groups. Among the interviewees, older respondents have expressed their concerns about the effort expectancy to use the device which appears new to them. Younger respondents are, however, concerned with performance expectancy and facilitating conditions. Female respondents are found to be more sensitive towards the social influence than the male respondents. Considering these trends, it can be inferred that Ara is less likely to be an instant hit in India. The success of modular smartphones in India is expected to heavily depend on the following two factors:

7.1. Marketing Campaign

In our survey seven out of every ten respondents either wish to be a late adopter or a laggard. Hence, the new form of smartphones may take some time to achieve a solid customer base in the Indian market. But, considering the enthusiasm expressed by the youth, mostly students and young professionals among the interviewees, it may not be a big problem for Ara to get enough early adopters in our country if they can educate the potential customers addressing their latent demand of customizability and upgradability of smartphones. Notably, more than one fourth of the respondents have expressed their interest to be an early adopter of Ara. Thereafter, the success of Ara is expected to depend heavily on verbal and non-verbal Word Of mouth.

7.2. The Availability And Price Of Modules

More than 80% of the valid respondents are ready to spend more than Rs.5000 for a basic Ara handset. Therefore, the willingness to pay for an Ara crosses the minimum price Google has set ($70). But the attractiveness of Ara depends on its customizability and upgradability. The whole concept of modular smartphone may be questioned if the availability and price of the modules do not meet customer expectation.

8. POTENTIAL STRATEGIES FOR EXISTING PLAYERS

Out of the 1.3 billion Indian citizen, around 850 millions are active mobile phone users [Mid-2015]. With approximately 118 million annual sales of smartphones in FY2014-15, India is currently the third largest market and projected to become second largest by 2017 for smartphones [6]. More importantly, India is the only market where smartphone sales are expected to grow at double digits for several more years. Quite obviously, to retain their businesses, established players like Samsung and Micromax have to come up with strategies.

Most of the established players in the Indian market are currently adopting a 'wait and watch policy' while some multinational companies like Toshiba, LG and Sony have started designing modules for the platform of Ara. Here are few possible strategies that are derived from the interviews and interactions with experienced cell phone users:

8.1. Launch Function Specific Product Portfolio

Requirements of different people are different. Some focus on the speed of processors, some on camera while some people wish to have better sound quality. Companies may consider launching function specific product portfolio to fulfill the requirements of various customers. Pricing should be set lower than the combined sum to what would take to purchase a basic Ara model and additional modules.

8.2. Launch Gender Specific Product Portfolio

A report published in The Guardian by Charles Arthur [9] shows that the specifications women look for is different than those of men do in United Kingdom. For example, men put more emphasize on the specifications of processor, operating system, 4G connectivity while women inquire more about quality of camera and brand name. A similar trend has been observed among the Indian customers by the author while taking the interviews. Therefore, gender specific product portfolio with specific appearance may be worth to consider.

8.3. Address The Pain Points Where Ara Will Face Challenges

There are certain issues where modular smartphone will face more challenges than the conventional smartphones. For example, more than half of the interviewees have expressed their fondness for slimmer handsets while rest are indifferent with the thickness of mobile phone. As thickness will be a constraint for Ara, existing smartphone makers can leverage on the issue.

8.4. Battery Problem

The previously mentioned report by Charles Arthur [9] also shows nine out of every ten users are concerned about the performance of the battery of their smartphones. Long lasting battery can be the unique selling point in any market. India is no exception in this regard. Almost two third of the respondents in our survey have expressed their dissatisfaction with the service of the batteries of their smartphones. During the aforesaid interview with the author, respondents have expressed their heir feeling that a backup power supplier like power bank is neither convenient to carry nor fashionable to use. Therefore smartphone makers can think about innovative solutions for this problem. For example, integration of power bank within a cover case may be an attractive solution.

However, if Ara becomes a hit, mobile phone manufacturers will obviously enter into module manufacturing. But since Ara provides an open hardware platform, the emergence of

numerous developers may pose tough competition to the established smartphone makers by then.

9. LIMITATIONS

It is assumed that the received responses resemble the voice of the nation to a great extent. But there are three major limitations to the process.

First, due to the usage of convenient sampling technique for data collection, a certain amount of biasness may be injected in the responses as the respondents personally know the interviewer / surveyor.

Second, as shown in Exhibit 3, demographic profiles of the respondents are skewed in terms of age and gender. As two third of the respondents are aged bellow 35 years [Chart 1(b)], opinions of young people got more significance. Similarly, as the sample includes only 30 female respondents, preferences of the female respondents may not have received proper consideration, as 165 out of the total 195 valid respondents are male.

Third, only one of every three respondents was aware about the upcoming product before the interview [Chart 2(b)]. Therefore, they may have been influenced to some extent by the interviewer's perception about the product.

However, investment of enough time and financial resources can eliminate these limitations. A larger number of respondents can also provide better scope of analysis.

10. FUTURE RESEARCH SCOPE

Here are three suggestions that can be very useful for taking this research further:

- As India's cultural diversity plays a major role in the corporate decision-making, region specific information can refine the analysis.

- Report of the pilot project may bring several insights that have not been covered here. Therefore, incorporating those insights may enrich the research work.

- This paper has analyzed the latent demand of modular smartphones in Indian market qualitatively. Quantitative research can be done to extend this qualitative research work.

11. CONCLUSION

The business aspect of the modular smartphone in the Indian market has been found quite promising. Moreover, this open hardware platform can also boost the manufacturing sector in India by encouraging small and medium companies to manufacture modules as the barriers to entry will be low initially. Since the industrial environment is improving and entrepreneurship has become the new buzzword in India, several Indian companies may emerge as significant global player in the upcoming module-manufacturing sector. India's electronics manufacturing industry has a huge opportunity to leverage the early mover's advantage of the potential disruptive innovation.
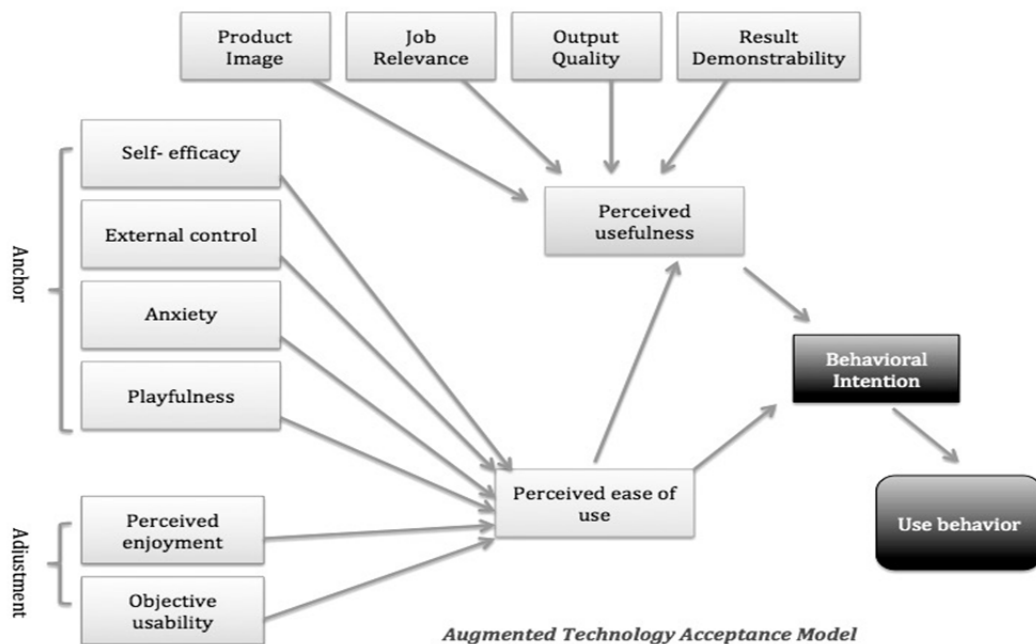
Exhibit 1

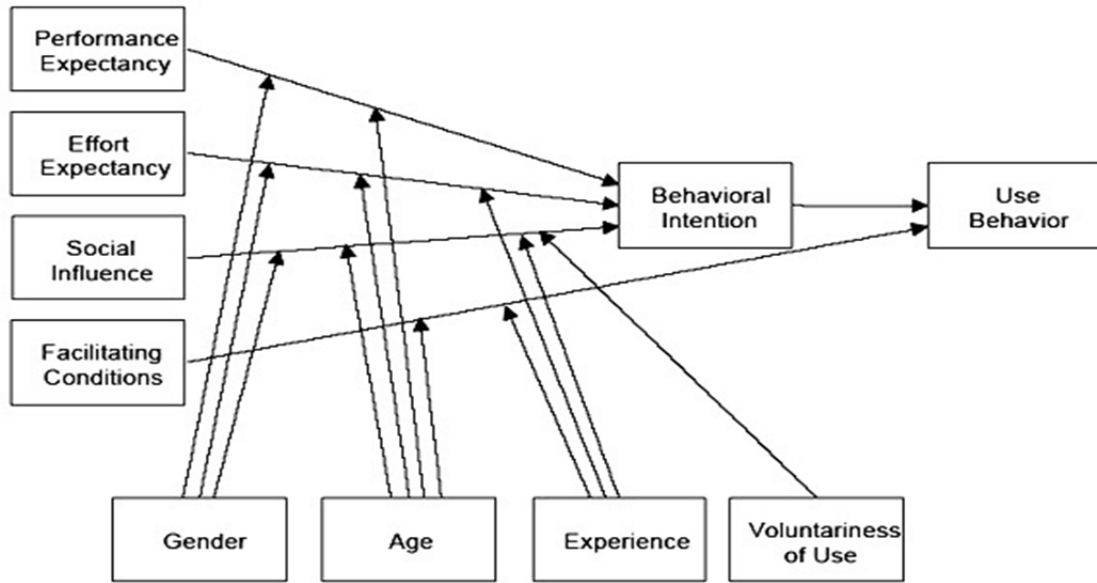**Fig. 1: Augmented version of technology acceptance model [8]**

Fig. 2: Unified theory of acceptance and use of technology [7]Exhibit 3
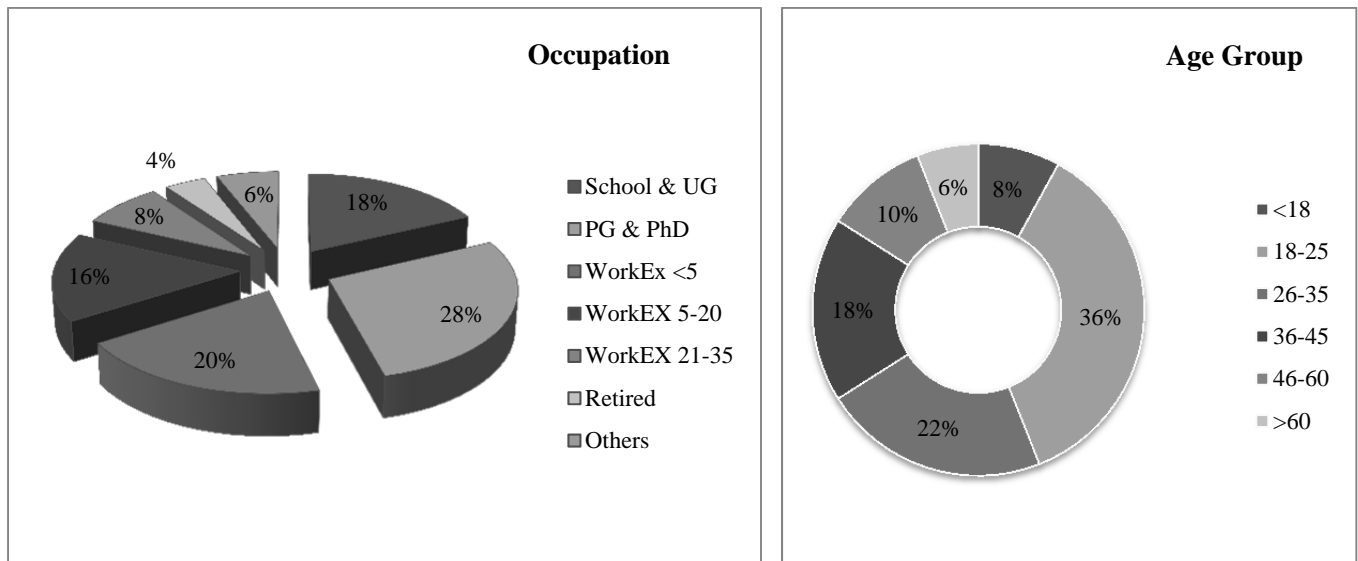

Chart 1: Demographic profile (a) based on occupation, (b) based on age group
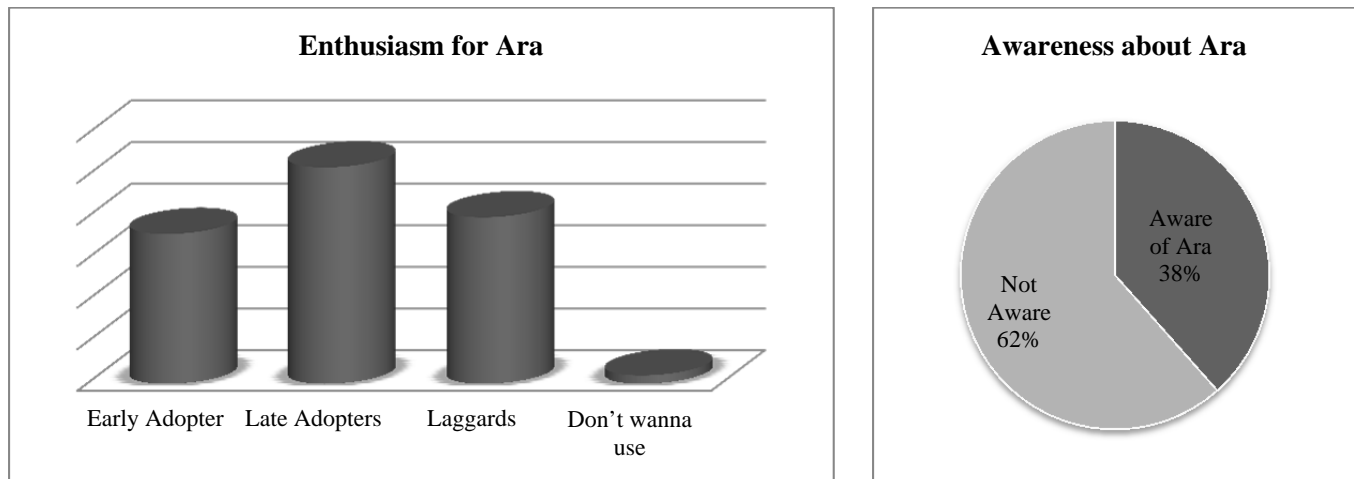
Exhibit 4

Chart 2: Present status of the respondents (a) enthusiasm for ara, (b) awareness about ara

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