# Chapter 10
# Opportunities and Challenges of Augmented Reality Shopping in Emerging Markets


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**Abstract** Augmented reality (AR) is one of the newly emerging technologies that has ability to completely revolutionise the world as we see it and the manner in which the products are sold and purchased. It has a wide range of applications from entertainment and education through to the healthcare sector, architecture and more. The technology began to be used in applications in the 1990s but was first developed in the 1960s. Over the years, especially with the penetration of smartphone devices, AR has seen far higher use in applications. The major advantage of AR is in the field of the shopping experience of online product buyers. In this study, an overview of the field of AR is presented, comprising definitions of AR, a historical overview of AR and the presence of AR in emerging markets and shopping and marketing in emerging markets with the help of AR tools and the applications. This study also discusses the opportunities and the challenges faced by augmented reality in these emerging markets.

**Keywords** Augmented reality · Virtual reality · Emerging markets · Shopping

## 10.1 Introduction

New computer applications are developing rapidly as computing power increases and the size of computers decreases, allowing access to online resources at all times (Abed, Dwivedi, & Williams, 2015). This development has helped the development and spread of novel applications like augmented reality. Through augmented reality (AR), it is possible to incorporate virtual information in the physical environment of an individual in the form of the existing information in the individual's

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surroundings (Brohm, Domurath, Glanz-Chanos, & Grunert, 2017). This process is achieved by software that supplies the real world with objects generated by the computer, which appear in the surroundings just as real objects do. This allows an individual to interact with these objects to gain information, collaborate with other individuals and resolve queries. Through AR, it is possible to create next-generation reality-based interfaces (Alimamy, Deans, & Gnoth, 2017). AR is in fact already in use in laboratories, industries and the consumer markets of the world.

Augmented reality has been employed in many diverse fields, including advertising campaigns, education, video gaming and the arts (Brohm et al., 2017). One of the main applications of the technology is in the field of commerce, where it can be used to develop virtual previews of products so customers may review what they can buy before making purchasing decisions, as in, for example, IKEA's product catalogue (Raska & Richter, 2017). Another example is that of Botta Design, which has taken up AR to allow previews of their Botta 24 model watch by utilising an iOS application. In another project, *National Geographic* utilised augmented reality to bring to life thousands of animal species that have gone extinct, placing them in modern locations such as shopping centres to give people the chance to interact with virtual dinosaurs in familiar contexts. Using the same kinds of ideas and concepts, augmented reality is enriching the experience of shopping.

In this chapter, a detailed introduction to augmented reality has been provided. In the next section, augmented reality is defined before a historical overview of augmented reality is presented along with a description of augmented reality in emerging markets. After this, an overview of shopping and marketing with augmented reality in emerging markets is given, as well as a description of the applications of augmented reality in the commercial context. Finally, opportunities and challenges for augmented reality shopping in emerging markets are explored and conclusions drawn.

## 10.2 Augmented Reality: Definitions

The definition of augmented reality is based on the concept of virtual reality (VR). Through the virtual reality concept, it is possible to create an artificial environment which an individual can explore with the help of technology that stimulates the senses (Sapientnitro: Virtual Reality: Taking an Emerging Technology Mainstream, 2016). Augmented reality is also based on developing an interactive environment, but it aims to add to the existing environment rather than developing a completely artificial environment (Alimamy et al., 2017). Several researchers have defined augmented reality from different perspectives. Though there is conformity among international research communities regarding the different aspects that are part of augmented reality, arrived at after a series of international conferences, there remain differences between researchers in terms of opinion and the nomenclature related to this technology. For the purposes of this study, the definitions provided by (Azuma, 1997; Azuma et al., 2001) are followed, which indicate that AR combines real information with computer-generated information in a real environment in real time,

combining virtual objects with physical ones. AR could also be explained as the broader concept of 'mixed reality', in which simulations predominately take place in the virtual domain and not in the real world (Yim, Chu, & Sauer, 2017).

It has been indicated (Klopfer & Sheldon, 2010) that it is not possible to define AR in a restricted way. The term could be utilised for any technology that purposefully blends real and virtual environments. Thus, AR has been defined (Klopfer & Squire, 2008; p. 205) as 'a situation in which a real world context is dynamically overlaid with coherent location or context-sensitive virtual information'. Thus, augmented reality could provide a technology-mediated immersive user experience, in which virtual and real worlds are blended (Klopfer & Sheldon, 2010) and user engagement and interactions are augmented. It is important to define AR in a broad sense for educators and designers, as it can be created and implemented utilising a wide range of technologies including desktop computers, handheld devices, head-mounted displays, etc. (Brohm et al., 2017): AR is not restricted to any single form of technology. It exploits the affordances that are present in the real world by supplying additional information which is contextual in nature and augments the user's experience of reality (Klopfer & Sheldon, 2010).

In this section, the definitions and concept of AR have been presented. In the following section, a historical overview of the complete technology is provided.

## 10.3 Historical Overview

Though the term 'augmented reality' was first coined in the early 1990s, functional AR systems date back to the 1960s, when a mechanically tracked 3D see-through head-worn display was first developed by Ivan Sutherland and colleagues in 1968. Through this display, it was possible for the user to see information generated by the computer mixed with physical objects like, in this case, the signs present on the walls of the laboratory. Over the following few years, research was carried out which aimed to generate graphical information from computers, and the field of computer graphics flourished (Furness, 1986). In the late 1970s, photorealistic computer-generated images became the main centre for research, and with the advancements that were made in tracking, hopes for the development of the perfect environment for simulation ran high.

Over the last few decades, several works have been produced in the field of AR as a research activity. In 1997, the field was defined (Azuma, 1997) along with explanation of its problems, summarising the advancements that had been made in this technology up to that point. Since then, the growth and progress of AR have been remarkable. Several workshops started to take place in the late 1990s, such as the International Workshop and Symposium on Augmented Reality, the International Symposium on Mixed and Augmented Reality and the Designing Augmented Reality Environments workshop. Further, it was during the late 1990s that well-funded organisations were formed which focused on the development of this technology, like the Mixed Reality Systems Lab (Zhang, Navab, & Liou, 2000).

In this section, a brief historical review of AR has been presented. In the next section, developments that have taken place in AR technology in emerging markets are described.

## 10.4 Augmented Reality in Emerging Markets

In 2016, a global study was conducted regarding evaluation of the interest and awareness of consumers as related to augmented reality, comprising more than 2500 people spread across five different countries. The study indicated that the user base of existing platforms has a high level of interest, comprising predominantly young consumers, suggesting that the younger generation will guide AR adoption. The survey found that 47% of the respondents felt they were very or extremely excited to utilise AR technologies. In emerging economies like India and China, consumers are extremely happy and excited, as 64% and 66% of the respondents expressed their desire to use the technology (Sapientnitro: Virtual Reality: Taking an Emerging Technology Mainstream, 2016). In fact, the democratisation of technologies is expected to grow not just in affluent and mature markets but also in emerging economies where the penetration of the smartphone technologies has been very high (Wilson, 2017).

Early signs of a bright future for this technology can be witnessed in China. The Chinese government is heavily invested in large technology companies, and there has been a dramatic rise in this technology in certain consumer segments (Koytcheva, 2017). A study that took place in 2016 (Virtual Reality Technology in China, 2016) found that AR-related revenues in China grew by 372.2% in the year 2016 to RMB850 million ($136.5 million), reaching a peak of RMB2 billion ($321.1 million) in 2017. Furthermore, shipments of AR and VR devices from China have reached as high as 480,000 units in the year 2016, and this is projected to grow through 2017 and 2018 (Virtual Reality Technology in China, 2016). As the Chinese government is eager to increase domestic consumption and assist the development of home-grown technologies, it is moving fast to develop the domestic AR industry and set the country on the course of those nations that can be considered early adopters of the technology. For this purpose, major players in Chinese industry have scaled up investment in AR technologies, including development of AR hardware, software and platforms upon which AR technology could be installed. According to surveys, young Chinese people, mainly those born in the 1980s and 1990s, are most interested in utilising AR technology (Virtual Reality Technology in China, 2016).

The worldwide revenues from the AR/VR market are assumed to reach $162 billion by the year 2020, as per the findings of the Worldwide Semi-Annual Augmented and Virtual Reality Spending Guide, published by International Data Corp. (IDC). In recent years, AR and VR technology has made developments in different sectors including health care, gaming, education, media and online shopping (Violino, 2016).

This section contained an overview of augmented reality in emerging markets. A brief description of shopping and marketing with augmented reality in emerging markets will be presented in the next section.

## 10.5 Shopping and Marketing with Augmented Reality in Emerging Markets

There has been rapid development in shopping that utilises AR, with huge growth in the markets in terms of advertisements and marketing. However, there are problems faced by the technology as it is still in the early stages of development and regular changes are still being made. In India and China, it has been found that personal and daily use of AR could support routine activities like sending e-mails and communicating through mobile phones (Greenwood et al., 2016). Further, with the help of location-aware overlays, it is possible to provide navigational guidance and allow individuals to store personal information related to specific locations. Furthermore, it is possible to get a unified control interface for the different types of applications that are present in the home. Such personal platforms could have great benefits for direct marketing agencies. Additionally, with the help of this technology, it will be possible for stores to offer virtual coupons to passing consumers, and the development of virtual billboards that advertise products based on personal choices would be easier, and virtual 3D product prototypes could pop up in the consumers' eyewear (Raska & Richter, 2017). Moreover, AR could be built to integrate with the retailer's portal, allowing them to leverage product visualisation, which provides value to shoppers (Greenwood et al., 2016).

This section has given a background in shopping and marketing with augmented reality in emerging markets. An overview of the applications of augmented reality in the commercial context will be presented in the next section.

## 10.6 Applications of Augmented Reality in the Commercial Context

There are a number of applications of augmented reality in the commercial context, some of which can be summarised as follows:

### *10.6.1 Mobile Coupons*

Mobile coupons have recently become a propensity among clients: previously, it was an impractical dream to be able to go to a retail location and have all applicable coupon bargains sent straight to their cellphones. Now, the portable coupon has become an essential instrument. With the improvement of AR innovation, clients are noticeably equipped for getting great local deals around their specific location (Jackson, Angermann, & Meier, 2011).

### *10.6.2 Product Shopping*

AR applications give clients important content that may provide information, advantages and characteristics of a product, as well as data that helps clients compare different products and services and guide them to make the best shopping decisions. For instance, when a purchaser needs to purchase grains, yet there are many brands to browse, he can tap an AR application to receive all relevant information to compare the choices and pick the most suitable (Alkhamisi & Monowar, 2013).

### *10.6.3 Garment Shopping*

Web-based business is considered one strategic use of AR applications, particularly online clothing shopping as online shoppers cannot forecast whether outfits will be suitable for them or not. With AR, buyers can interface with their electronic outfit shopping, overcoming the greatest obstacle they face when choosing outfits. This development would enhance the quality level of this business to new strategic levels (Pereira, Silva, & Alves, 2011).

### *10.6.4 Browsing Through Different Product Reviews*

Many purchasers depend mainly on online social content, such as product ratings, reviews and recommendations before purchasing items. Recent studies on retail business indicated that web-based social content is the primary component buyers depend on before making a purchasing decision. These days, this web-based social content is reachable by PCs distant from the shopping experience itself. A mobile AR app spreads this social content from the PC to the real world by mobile devices, providing clients with item-related information that encourages them to understand the appropriate considerations when making purchasing decisions (Guven et al., 2009).

## 10.7 Opportunities for Augmented Reality Shopping in Emerging Markets

Several factors have been shown to contribute to purchasing decisions, and AR can create three key opportunities that resolve buyer uncertainty in online shopping.

### *10.7.1 Creation of an Engaging Buyer Experience*

With the help of AR technology, it will be possible to overcome the challenges faced by online buyers that help them transform imagination into reality. With this technology, the customer can see how the product will look and feel in their environment (Blázquez, 2014).

### *10.7.2 Modifying or Customising Selections*

By utilising AR technology, it will be possible for shoppers to explore several options and make customised modifications to products in terms of colour and other features. Shoppers will be able to change the colour of the product and apply it in their environment to get a feel for how that product will actually look (Lau, Lee, & Lau, 2014).

### *10.7.3 Visualise or Understand Products and Features*

Augmented reality enables shoppers to understand the working and functioning of complex products with the help of animation. In addition, AR technology is able to make the complete shopping experience personalised and interactive (Pachoulakis & Kapetanakis, 2012).

## 10.8 Challenges Faced by Augmented Reality Shopping in Emerging Markets

Similar to other new technologies, AR faces several challenges in its early adoption period. Some of these challenges are illustrated as follows:

### *10.8.1 Environmental Challenges*

- The first challenge faced by this technology is the environmental challenge, whereby perceptual matters within the environment can cause a problem in the utilisation of this technology (Kruijff, Swan, & Feiner, 2010), such as lighting and weather conditions in outside environments that may affect the localisation quality (Arth & Schmalstieg, 2011).

- The diversity of the colour scheme in the environment can cause major harm to light conditions. There are also challenges presented by hardware and software technologies that are used in handheld display devices, such as colour quality and fidelity (Kruijff et al., 2010).

### *10.8.2 Content Management Challenges*

Most of the present AR systems lack the technique of attaching new content. Generally, a small number of professional domains control these systems. Application developers are the only authorised group to add new content due to the need of programming skills to create a link between data sources and present systems. In AR systems, regular users should be able to add special content without the need for serious technical effort. Furthermore, in these systems, there is a user-created feature that provides an easy way for all users to combine the content they have created from different sources to the same AR view (Kurkovsky, Koshy, Novak, & Szul, 2012).

### *10.8.3 Display Device Challenges*

- Poor camera sensor quality in bad lighting conditions seriously affects the quality of an AR experience. Pictures become fuzzy and colours begin to experience major aberration (Arth & Schmalstieg, 2011).
- Colour fidelity in outside environments is an extremely challenging issue. Changing outside environments significantly affects the visual presentation of AR. In video see-through presentations, both real world and overlays are displayed on similar colour scales (Kruijff et al., 2010).

### *10.8.4 User Challenges*

User concern is one of the challenges of AR. The location of the user is the key element in the utilisation of the AR system (Arth & Schmalstieg, 2011), so user acceptance and adoption of AR in emerging markets could face some challenges surrounding privacy.

## 10.9 Conclusion

Although augmented reality is an important technology that has been around for several years, it is still in its developmental infancy, particularly in emerging markets such as China and India. There are several kinds of AR products that have been

developed and presented in different parts of the world, such as a completely new shopping experience obtained from the layering of 3D spaces, and this supports the broader transitions that are taking place in online shopping. In this study, a complete overview of the field of AR has been presented, comprising definitions of AR, a historical overview of AR and a description of the presence of AR in emerging markets, shopping and marketing in emerging markets with the help of AR tools and the applications that are presented by AR for commercial purposes. Furthermore, this study also presented the opportunities and challenges faced by the AR today.

The field of augmented reality is increasing rapidly with the help of a greater quantity of research that has taken place in this field, and emerging markets such as China and India have an important contribution to make in this field. However, there are also certain challenges that are faced in the adoption of this technology, like those of technical issues and issues related to the availability of content. Thus, it will take some time before AR becomes a normal feature of the shopping experience. When used to its full potential, it can be said that AR will have a huge impact on the way the world operates. In order to enhance understanding of antecedents influencing consumer attitude and behaviour towards AR use, theories and models that are well tried and tested (see, e.g. Dwivedi et al., 2017; Dwivedi, Rana, Jeyaraj, Clement, & Williams, 2017; Rana, Dwivedi, Lal, Williams, & Clement, 2017; Rana, Dwivedi, Williams, & Weerakkody, 2016; Shareef, Dwivedi, Kumar, & Kumar, 2016) in the context of emerging markets (such as India) should be adapted to empirically examine AR-related aspects.

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