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**BACHELOR OF COMMERCE (HONS)**



PROJECT REPORT

ON

**EVOLUTION OF TECHNOLOGY IN SMARTPHONES**

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## **DECLARATION**

I declare that the following documented Project report titled “**EVOLUTION OF TECHNOLOGY IN SMARTPHONES**” is an original and authentic work done by me for the partial fulfilment of **Bachelors of Commerce (Hons) degree program**.

I hereby certify that all the Endeavour put in the fulfilment of the task are genuine and original to the best of my knowledge & I have not submitted it earlier elsewhere.

**SIGNATURE:**

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# **CERTIFICATE**

## **TO WHOM SO EVERY IT MAY CONCERN**

This is to certify that the project work “**EVOLUTION OF TECHNOLOGY IN SMARTPHONES**” made by **ROHIT BANSAL, B.COM (HONS), 40320688817** is an authentic work carried out by him under guidance and supervision of **Miss. PARKHI**.

The project report submitted has been found satisfactory for the partial fulfilment of the degree of Bachelor of Commerce (Hons).

**Project Supervisor**

**Signature**

**Miss. PARKHI**

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# **CHAPTER I**

## **INTRODUCTION**

## 1.1 INTRODUCTION

*"Smartphones" redirects here. For the song, see Trey Songs § 2013–2017: Trigga and Tremaine the Album.*

Smartphones are a class of mobile phones and of multi-purpose mobile computing devices. They are distinguished from feature phones by their stronger hardware capabilities and extensive mobile operating systems, which facilitate wider software, internet (including web browsing over mobile broadband), and multimedia functionality (including music, video, cameras, and gaming), alongside core phone functions such as voice calls and text messaging. Smartphones typically contain a number of metal–oxide–semiconductor (MOS) integrated circuit (IC) chips, include various sensors that can be leveraged by their software (such as a magnetometer, proximity sensors, barometer, gyroscope, or accelerometer), and support wireless communications protocols (such as Bluetooth, Wi-Fi, or satellite navigation).

Early smartphones were marketed primarily towards the enterprise market, attempting to bridge the functionality of standalone personal digital assistant (PDA) devices with support for cellular telephony, but were limited by their bulky form, short battery life, slow analog cellular networks, and the immaturity of wireless data services. These issues were eventually resolved with the exponential scaling and miniaturization of MOS transistors down to sub-micron levels (Moore's law), the improved lithium-ion battery, faster digital mobile data networks (Edholm's law), and more mature software platforms that allowed mobile device ecosystems to develop independently of data providers.

In the 2000s, NTT DoCoMo's i-ode platform, BlackBerry, Nokia's Symbian platform, and Windows Mobile began to gain market traction, with models often featuring QWERTY keyboards or resistive touchscreen input, and emphasizing access to push email and wireless internet. Since the unveiling of the iPhone in 2007, the majority of smartphones have featured thin, slate-like form factors, with large, capacitive screens with support for multi-touch gestures rather than physical keyboards, and offer the ability for users to download or purchase additional applications from a centralized store, and use cloud storage and synchronization, virtual assistants, as well as mobile payment services.

Improved hardware and faster wireless communication (due to standards such as LTE) have bolstered the growth of the smartphone industry. In the third quarter of 2012, one billion smartphones were in use worldwide. Global smartphone sales surpassed the sales figures for feature phones in early 2013.

Most of the mobile phones nowadays are addressed as “smart phone”, as they offer more advanced computing power and connectivity than a contemporary mobile phone. Literately, a smart phone is a handheld computer, as it is powerful enough to deliver various functionalities comparable to a computer

## **TYPES OF SMART PHONE OPERATING SYSTEM**





## **EVOLUTION OF THE MOBILE PHONE**

From simple to smart, mobile phones have transformed dramatically to become information and communication hubs fundamental to modern life.

### **1983 – 1990**

#### **The First Ever Portable Mobile Phone**

In 1983 the world got the first ever portable mobile phone in the shape of the Motorola DynaTAC 8000X. It cost as eye-watering \$4000 USD and was a huge status symbol at the time. Two years later the first mobile phone call on UK soil was made, the then Vodafone Chairman Sir Ernest Harrison, the lucky recipient. In 1989 Motorola followed up the DynaTAC with the 9800X or MicroTAC, it came with a fold down keyboard cover and set the standard for the flip phone form factor seen throughout the 90's.

### **1991 - 1994**

GSM first launched in Europe 1991 with the Orbital TPU 900 first to market, but it wasn't until 1992 that mobiles were no longer restricted to business use. Mass production paved the way for cost-effective consumer handsets with digital displays. Nokia was one of the first to take advantage of this transition, with the Nokia 1011 arriving that year.

### **1995 – 1998**

Although it only offered four colours, the Siemens S10 brought mobile phone displays to life for the first time in 1997. The same year Hagenuk launched the GlobalHandy, the first device without an external aerial. Customisation also kicked off in a big way with Ericsson offering swappable coloured front keyboard panels. The following year Nokia launched a range of 'Xpress-on' interchangeable covers on the 5100 series, making it the first fashion orientated phone.

### **1999 – 2002**

1999 saw Nokia unveil the 7110 which was the first device to take advantage of WAP (a means of accessing information over a mobile wireless network).

A year later Sharp launched the world's very first camera phone, the J-SH04. It was only available in Japan but signalled the start of the public's obsession with phone photography.

However, it wasn't until 2002 and the release of the Sony Ericsson T68i and its clip-on camera, that western market started to take an interest in the camera phone.

### **2003 – 2006**

The implementation of 3G took download speeds up to 2MBS in March 2003 with "3" the first to offer the service in the UK. RIM brought mobile email to the masses with its range of popular BlackBerry devices like the 8100 Pearl. The advent of front facing cameras in 2003 on devices such as the Sony Ericsson Z1010 meant video calling became possible, but not popular.

### **2007 – 2010**

Swiping and scrolling replaced the traditional button method of input. The LG Prada being the first touchscreen in market ahead of the Apple iPhone in May 2007. However, Apple proved to have both the stronger brand and superior knowledge of capacitive touchscreen's potential.

### **2011 – 2014**

Smartphones became increasingly central to modern life, offering much more than just communication features. The UK's first 4G service launched in 11 cities by EE in 2012 taking download speeds up to 12mbps. Voice recognition became common place first with Google Voice before Apple launched Siri into the market. Samsung added a built-in heart rate monitor to their flagship Galaxy S5 to capitalise on growth in mobile health & fitness.

### **2015 - 2018**

The global adoption of 4G vastly improves video streaming and video calling capabilities. Screen sizes continue to grow to maximise the experience of these features, with the iPhone 7 Plus display now 57% larger than the original iPhone from 2007. Mobile payments also emerge with Apple Pay and Android Pay offering users the possibility of buying things with their smartphone.

### **Present Day**

EE launches the UK's first 5G service in 6 cities throughout May 2019. The fifth-generation network promises vastly superior data speeds and reliability, boosting ultra-high-resolution video streaming and mobile gaming. Handset design trends continue to push for an

all-screen experience, with OnePlus introducing the pop-up selfie camera to its flagship 7 Pro device to do away with the notch altogether.

## **1.2 HISTORY**

The development of the smartphone was enabled by several key technological advances. The exponential scaling and miniaturization of MOSFETs (MOS transistors) down to sub-micron levels during the 1990s–2000s (as predicted by Moore's law) made it possible to build portable smart devices such as smartphones, as well as enabling the transition from analogue to faster digital wireless mobile networks (leading to Edholm's law). Other important enabling factors include the lithium-ion battery, an indispensable energy source enabling long battery life, invented in the 1980s and commercialized in 1991, and the development of more mature software platforms that allowed mobile device ecosystems to develop independently of data providers.

In the early 1990s, IBM engineer Frank Canova realised that chip-and-wireless technology was becoming small enough to use in handheld devices. The first commercially available device that could be properly referred to as a "smartphone" began as a prototype called "Angler" developed by Canova in 1992 while at IBM and demonstrated in November of that year at the COMDEX computer industry trade show. A refined version was marketed to consumers in 1994 by BellSouth under the name Simon Personal Communicator. In addition to placing and receiving cellular calls, the touchscreen-equipped Simon could send and receive faxes and emails. It included an address book, calendar, appointment scheduler, calculator, world time clock, and notepad, as well as other visionary mobile applications such as maps, stock reports and news.

The IBM Simon was manufactured by Mitsubishi Electric, which integrated features from its own wireless personal digital assistant (PDA) and cellular radio technologies. It featured a liquid-crystal display (LCD) and PC Card support. The Simon was commercially unsuccessful, particularly due to its bulky form factor and limited battery life, using NiCad batteries rather than the nickel–metal hydride batteries commonly used in mobile phones in the 1990s, or lithium-ion batteries used in modern smartphones.

The term "smart phone" or "smartphone" was not coined until a year after the introduction of the Simon, appearing in print as early as 1995, describing AT&T's Phone Writer Communicator.

## PDA/phone hybrids

Beginning in the mid-late 1990s, many people who had mobile phones carried a separate dedicated PDA device, running early versions of operating systems such as Palm OS, Newton OS, Symbian or Windows CE/Pocket PC. These operating systems would later evolve into early mobile operating systems. Most of the "smartphones" in this era were hybrid devices that combined these existing familiar PDA OSes with basic phone hardware. The results were devices that were bulkier than either dedicated mobile phones or PDAs, but allowed a limited amount of cellular Internet access. PDA and mobile phone manufacturers competed in reducing the size of devices. The bulk of these smartphones combined with their high cost and expensive data plans, plus other drawbacks such as expansion limitations and decreased battery life compared to separate standalone devices, generally limited their popularity to "early adopters" and business users who needed portable connectivity.

In March 1996, Hewlett-Packard released the OmniGo 700LX, a modified HP 200LX palmtop PC with a Nokia 2110 mobile phone piggybacked onto it and ROM-based software to support it. It had a 640×200 resolution CGA compatible four-shade grey-scale LCD screen and could be used to place and receive calls, and to create and receive text messages, emails and faxes. It was also 100% DOS 5.0 compatible, allowing it to run thousands of existing software titles, including early versions of Windows.

In August 1996, Nokia released the Nokia 9000 Communicator, a digital cellular PDA based on the Nokia 2110 with an integrated system based on the PEN/GEOS 3.0 operating system from Geoworks. The two components were attached by a hinge in what became known as a clamshell design, with the display above and a physical QWERTY keyboard below. The PDA provided e-mail; calendar, address book, calculator and notebook applications; text-based Web browsing; and could send and receive faxes. When closed, the device could be used as a digital cellular telephone.

In June 1999 Qualcomm released the "pdQ Smartphone", a CDMA digital PCS smartphone with an integrated Palm PDA and Internet connectivity.<sup>[24]</sup> Subsequent landmark devices included:

- The Ericsson R380 (December 2000) by Ericsson Mobile Communications, the first phone running the operating system later named Symbian (it ran EPOC Release 5, which was renamed Symbian OS at Release 6). It had PDA functionality and limited Web browsing on a resistive touchscreen utilizing a stylus. While it was marketed as a "smartphone", users could not install their own software on the device.

- The Kyocera 6035 (February 2001), a dual-nature device with a separate Palm OS PDA operating system and CDMA mobile phone firmware. It supported limited Web browsing with the PDA software treating the phone hardware as an attached modem.
- The Nokia 9210 Communicator (June 2001), the first phone running Symbian (Release 6) with Nokia's Series 80 platform (v1.0). This was the first Symbian phone platform allowing the installation of additional applications. Like the Nokia 9000 Communicator it's a large clamshell device with a full physical QWERTY keyboard inside.
- Handspring's Treo 180 (2002), the first smartphone that fully integrated the Palm OS on a GSM mobile phone having telephony, SMS messaging and Internet access built into the OS. The 180 model had a thumb-type keyboard and the 180g version had a Graffiti handwriting recognition area, instead.

#### Japanese cell phones

In 1999, Japanese wireless provider NTT DoCoMo launched i-mode, a new mobile internet platform which provided data transmission speeds up to 9.6 kilobits per second, and access web services available through the platform such as online shopping. NTT DoCoMo's i-mode used cHTML, a language which restricted some aspects of traditional HTML in favour of increasing data speed for the devices. Limited functionality, small screens and limited bandwidth allowed for phones to use the slower data speeds available. The rise of I-mode helped NTT DoCoMo accumulate an estimated 40 million subscribers by the end of 2001, and ranked first in market capitalization in Japan and second globally. Japanese cell phones increasingly diverged from global standards and trends to offer other forms of advanced services and smartphone-like functionality that were specifically tailored to the Japanese market, such as mobile payments and shopping, near-field communication (NFC) allowing mobile wallet functionality to replace smart cards for transit fares, loyalty cards, identity cards, event tickets, coupons, money transfer, etc., downloadable content like musical ringtones, games, and comics, and 1seg mobile television. Phones built by Japanese manufacturers used custom firmware, however, and didn't yet feature standardized mobile operating systems designed to cater to third-party application development, so their software and ecosystems were akin to very advanced feature phones. As with other feature phones, additional software and services required partnerships and deals with providers.

The degree of integration between phones and carriers, unique phone features, non-standardized platforms, and tailoring to Japanese culture made it difficult for Japanese

manufacturers to export their phones, especially when demand was so high in Japan that the companies didn't feel the need to look elsewhere for additional profits.

The rise of 3G technology in other markets and non-Japanese phones with powerful standardized smartphone operating systems, app stores, and advanced wireless network capabilities allowed non-Japanese phone manufacturers to finally break in to the Japanese market, gradually adopting Japanese phone features like emoji, mobile payments, NFC, etc. and spreading them to the rest of the world.

### **Early smartphones**

Phones that made effective use of any significant data connectivity were still rare outside Japan until the introduction of the Danger Hiptop in 2002, which saw moderate success among U.S. consumers as the T-Mobile Sidekick. Later, in the mid-2000s, business users in the U.S. started to adopt devices based on Microsoft's Windows Mobile, and then BlackBerry smartphones from Research In Motion. American users popularized the term "Crack Berry" in 2006 due to the BlackBerry's addictive nature. In the U.S., the high cost of data plans and relative rarity of devices with Wi-Fi capabilities that could avoid cellular data network usage kept adoption of smartphones mainly to business professionals and "early adopters."

Outside the U.S. and Japan, Nokia was seeing success with its smartphones based on Symbian, originally developed by Psion for their personal organisers, and it was the most popular smartphone OS in Europe during the middle to late 2000s. Initially, Nokia's Symbian smartphones were focused on business with the Eseries, similar to Windows Mobile and BlackBerry devices at the time. From 2006 onwards, Nokia started producing consumer-focused smartphones, popularized by the entertainment-focused Nseries. Until 2010, Symbian was the world's most widely used smartphone operating system.

Form factor and operating system shifts. The original Apple iPhone: following its introduction the common smartphone form factor shifted to large touchscreen software interfaces without physical keypads

The touchscreen PDA-derived nature of adapted operating systems like Palm OS, the "Pocket PC" versions of what was later Windows Mobile, and the UIQ interface that was originally designed for pen-based PDAs on Symbian OS devices resulted in some early smartphones having stylus-based interfaces. These allowed for virtual keyboards and/or handwriting input, thus also allowing easy entry of Asian characters.

By the mid-2000s, the majority of smartphones had a physical QWERTY keyboard. Most used a "keyboard bar" form factor, like the BlackBerry line, Windows Mobile smartphones, Palm Treos, and some of the Nokia Eseries. A few hid their full physical QWERTY keyboard in a sliding form factor, like the Danger Hiptop line. Some even had only a numeric keypad using T9 text input, like the Nokia Nseries and other models in the Nokia Eseries. Resistive touchscreens with stylus-based interfaces could still be found on a few smartphones, like the Palm Treos, which had dropped their handwriting input after a few early models that were available in versions with Graffiti instead of a keyboard.

The late 2000s and early 2010s saw a shift in smartphone interfaces away from devices with physical keyboards and keypads to ones with large finger-operated capacitive touchscreens.

The first phone of any kind with a large capacitive touchscreen was the LG Prada, announced by LG in December 2006. This was a fashionable feature phone created in collaboration with Italian luxury designer Prada with a 3" 240x400 pixel screen.

In January 2007, Apple Computer introduced the iPhone. It had a 3.5" capacitive touchscreen with twice the common resolution of most smartphone screens at the time, and introduced multi-touch to phones, which allowed gestures such as "pinching" to zoom in or out on photos, maps, and web pages. The iPhone was notable as being the first device of its kind targeted at the mass market to abandon the use of a stylus, keyboard, or keypad typical of contemporary smartphones, instead using a large touchscreen for direct finger input as its main means of interaction.

The iPhone's operating system was also a shift away from previous ones that were adapted from PDAs and feature phones, to one powerful enough to avoid using a limited, stripped down web browser requiring pages specially formatted using technologies such as WML, cHTML, or XHTML that previous phones supported and instead run a version of Apple's Safari browser that could easily render full websites not specifically designed for phones.

Later Apple shipped a software update that gave the iPhone a built-in on-device App Store allowing direct wireless downloads of third-party software. This kind of centralized App Store and free developer tools quickly became the new main paradigm for all smartphone platforms for software development, distribution, discovery, installation, and payment, in place of expensive developer tools that required official approval to use and a dependence on third-party sources providing applications for multiple platforms.

The advantages of a design with software powerful enough to support advanced applications and a large capacitive touchscreen affected the development of another smartphone OS platform, Android, with a more BlackBerry-like prototype device scrapped in favour of a touchscreen device with a slide-out physical keyboard, as Google's engineers thought at the time that a touchscreen could not completely replace a physical keyboard and buttons. Android is based around a modified Linux kernel, again providing more power than mobile operating systems adapted from PDAs and feature phones. The first Android device, the HTC Dream, was released in September 2008, with both a 3.2" capacitive touchscreen and a hardware keyboard that was revealed when the user slid the screen open. By 2010 the majority of Android phones were touchscreen-only.

The iPhone and later touchscreen-only Android devices together popularized the smartphone form factor based on a large capacitive touchscreen as the sole means of interaction, and led to the decline of earlier, keyboard- and keypad-focused platforms. Other smartphone manufacturers soon started projects to replace their existing operating systems with new ones that could support touch interfaces on larger screens and web browsers that could render full web pages. Microsoft, for instance, discontinued Windows Mobile and started a new touchscreen-oriented OS from scratch, called Windows Phone. Nokia abandoned Symbian and partnered with Microsoft to use Windows Phone on its smartphones. Palm replaced their Palm OS with webOS. BlackBerry Limited, formerly known as Research In Motion and known for phones with a full qwerty keyboard below the screen, made a new platform for touchscreen phones based on QNX, BlackBerry 10.

By the mid-2010s, almost all smartphones were touchscreen-only and had discarded legacy mobile operating systems for more recently developed ones that were more capable.

### **Camera advancements**

The Samsung Galaxy Note 10 features three rear-facing camera lenses and a ToF camera (only 10+ versions).

The first commercial camera phone was the Kyocera Visual Phone VP-210, released in Japan in May 1999. It was called a "mobile videophone" at the time, and had an 110,000-pixel front-facing camera. It could send up to two images per second over Japan's Personal Handy-phone System (PHS) cellular network, and store up to 20 JPEG digital images, which could be sent over e-mail. The first mass-market camera phone was the J-SH04, a Sharp J-Phone model sold in Japan in November 2000. It could instantly transmit pictures via cell phone telecommunication.



By the mid-2000s, higher-end cell phones commonly had integrated digital cameras. In 2003 camera phones outsold stand-alone digital cameras, and in 2006 they outsold film and digital stand-alone cameras. Five billion camera phones were sold in five years, and by 2007 more than half of the installed bases of all mobile phones was camera phones. Sales of separate cameras peaked in 2008.

Many early smartphones didn't have cameras at all, and earlier models that had them had low performance and insufficient image and video quality that could not compete with budget pocket cameras and fulfil user's needs. By the beginning of the 2010s almost all smartphones had an integrated digital camera. The decline in sales of stand-alone cameras accelerated due to the increasing use of smartphones with rapidly improving camera technology for casual photography, easier image manipulation, and abilities to directly share photos through the use of apps and web-based services. By 2011, cell phones with integrated cameras were selling hundreds of millions per year. In 2015, digital camera sales were 35.395 million units or only less than a third of digital camera sales numbers at their peak and also slightly less than film camera sold number at their peak.

Contributing to the rise in popularity of smartphones being used over dedicated cameras for photography, smaller pocket cameras have difficulty producing bokeh in images, but nowadays, some smartphones have dual-lens cameras that reproduce the bokeh effect easily, and can even rearrange the level of bokeh after shooting. This works by capturing multiple images with different focus settings, then combining the background of the main image with a macro focus shot.

In 2007 the Nokia N95 was notable as a smartphone that had a 5.0 Megapixel (MP) camera, when most others had cameras with around 3 MP or less than 2 MP. Some specialized feature phones like the LG Viewty, Samsung SGH-G800, and Sony Ericsson K850i, all released later that year, also had 5.0 MP cameras. By 2010 5.0 MP cameras were common; a few smartphones had 8.0 MP cameras and the Nokia N8, Sony Ericsson Satio, and Samsung M8910 Pixon12 feature phone had 12 MP. In 2009 the Samsung Omnia HD was the first phone with 720p video recording. A 14-megapixel smartphone with 3x optical zoom was announced in late 2010. In 2012 Nokia announced the Nokia 808 PureView, featuring a 41-megapixel 1/1.2-inch sensor and a high-resolution f/2.4 Zeiss all-aspherical one-group lens. 1080p video recording on a smartphone was achieved in 2011, and 2160p (4K) video recording in 2013. In 2016 Apple introduced the iPhone 7 Plus, one of the phones to popularize a dual camera setup. The iPhone 7 Plus included a main 12 MP camera along with a 12 MP telephoto camera which allowed for 2x optical zoom and Portrait

Mode (simulated Bokeh). In early 2018 Huawei released a new flagship phone, the Huawei P20 Pro, with one of the first triple camera lens setups. In late 2018, Samsung released a new mid-range smartphone, the Galaxy A9 (2018) with the world's first quad camera setup. The Nokia 9 PureView was released in 2019 featuring a penta-lens camera system. In 2019, Oppo demonstrated an under-display selfie camera, made possible by the use of an OLED display that had a cut-out underneath it, allowing the display to be transparent where the camera is located. This technique is already used for placing proximity and optical fingerprint sensors under the display. The smartphone on which it was demonstrated had no physical buttons, (using capacitive buttons instead), no SIM slot (using eSIM as a replacement), no microSD card slot, no headphone jack, no USB-C, and no speaker or earpiece grilles, relying exclusively on internal storage, wireless charging, 5G, Wi-Fi, and Bluetooth.

### **Display advancements**

In the early 2010s, larger smartphones with screen sizes of at least 5.5 inches diagonal, dubbed "phablets", began to achieve popularity, with the 2011 Samsung Galaxy Note series gaining notably wide adoption. In 2013, Huawei launched the Huawei Mate series, sporting a 6.1-inch HD (1280x720) IPS+ LCD display, which was considered to be quite large at the time.

Some companies began to release smartphones in 2013 incorporating flexible displays to create curved form factors, such as the Samsung Galaxy Round and LG G Flex. By 2014, 1440p displays began to appear on high-end smartphones. In 2015, Sony released the Xperia Z5 Premium, featuring a 4K resolution display, although only images and videos could actually be rendered at that resolution (all other software was shown at 1080p).

New trends for smartphone displays began to emerge in 2017, with both LG and Samsung releasing flagship smartphones (LG G6 and Galaxy S8), utilizing displays with taller aspect ratios than the common 16:9 ratio, and a high screen-to-body ratio, also known as "bezel-less design". These designs allow the display to have a larger diagonal measurement, but with a slimmer width than 16:9 displays with an equivalent screen size.

Another trend popularized in 2017 was having a display that contained a tab-like cut-out at the top-centre—colloquially known as a "notch"—to contain the front-facing camera, and sometimes other sensors typically located along the top bezel of a device. This was introduced for the first time in 2016, by the LG V10. These designs allow for "edge-to-edge" displays that take up nearly the entire height of the device, with little to no bezel along the

top, and sometimes a minimal bottom bezel as well. This design characteristic appeared almost simultaneously on the Sharp Aquos S2 and the Essential Phone, which featured circular tabs for their cameras, followed just a month later by the iPhone X, which used a wider tab to contain a camera and facial scanning system.<sup>l</sup>

Smartphones with foldable displays were theorized as possible once manufacturing costs and production processes were feasible. In November 2018, the start-up company Royal unveiled the first commercially available foldable smartphone, the Royal FlexPai. Also that month, Samsung presented a prototype phone featuring an "Infinity Flex Display" at its developer's conference, with a smaller, outer display on its "cover", and a larger, tablet-sized display when opened. Samsung stated that it also had to develop a new polymer material to coat the display as opposed to glass. Early examples of foldable phones from other manufacturers became the subject of rumours in early 2019; Samsung officially announced the Galaxy Fold, based on the previously-demonstrated prototype, in February 2019 for an originally-scheduled release in late-April.

In 2019, 4.7-inches to 5.5 inches became the industry standard size, with most companies abandoning smaller, under 4.7-inch displays.

Other developments in the 2010s

## **2011**

The first smartphone with a fingerprint reader was the Motorola Atrix 4G in 2011. In September 2013, the iPhone 5S was unveiled as the first smartphone on a major U.S. carrier since the Atrix to feature this technology. Once again, the iPhone popularized this concept.

## **2012**

In 2012, Samsung introduced the Galaxy S3 (GT-i9300) with retrofit table wireless charging, pop-up video playback, 4G-LTE variant (GT-i9305) quad-core processor.

## **2013**

In 2013, Fair phone launched its first *"socially ethical"* smartphone at the London Design Festival to address concerns regarding the sourcing of materials in the manufacturing followed by Shift phone in 2015. In late 2013, QSAAlpha commenced production of a smartphone designed entirely around security, encryption and identity protection.

In October 2013, Motorola Mobility announced Project Ara, a concept for a modular smartphone platform that would allow users to customize and upgrade their phones with add-on modules that attached magnetically to a frame. Ara was retained by Google following its sale of Motorola Mobility to Lenovo, but was shelved in 2016.<sup>l</sup> That year, LG and Motorola

both unveiled smartphones featuring a limited form of modularity for accessories; the LG G5 allowed accessories to be installed via the removal of its battery compartment, while the Moto Z utilizes accessories attached magnetically to the rear of the device.

## **2014**

Microsoft, expanding upon the concept of Motorola's short-lived "WebTop", unveiled functionality for its Windows 10 operating system for phones that allows supported devices to be docked for use with a PC-styled desktop environment.

## **2015**

Samsung and LG used to be the "*last standing*" manufacturers to offer flagship devices with user-replaceable batteries. But in 2015, Samsung succumbed to the minimalism trend set by Apple, introducing the Galaxy S6 without a user-replaceable battery. In addition, Samsung was criticised for pruning long-standing features such as MHL, MicroUSB 3.0, water resistance and MicroSD card support, of which the latter two came back in 2016 with the Galaxy S7 and S7 Edge.

As of 2015, the global median for smartphone ownership was 43%. Statista forecast that 2.87 billion people would own smartphones in 2020.

## **2016**

Major technologies that began to trend in 2016 included a focus on virtual reality and augmented reality experiences catered towards smartphones, the newly introduced USB-C connector, and improving LTE technologies.

## **2018**

In 2018, the first smartphones featuring fingerprint readers embedded within OLED displays were announced, followed in 2019 by an implementation using an ultrasonic sensor on the Samsung Galaxy S10.

## **2019**

In 2019, the majority of smartphones released have more than one camera, are waterproof with IP67 and IP68 ratings, and unlock using facial recognition or fingerprint scanners.

# **HARDWARE**

A typical smartphone contains a number of metal–oxide–semiconductor (MOS) integrated circuit (IC) chips, which in turn contain billions of

tiny MOS field-effect transistors (MOSFETs). A typical smartphone contains the following MOS IC chips.

- Application processor (CMOS system-on-a-chip)
- Flash memory (floating-gate MOS memory)
- Cellular modem (baseband RF CMOS)
- RF transceiver (RF CMOS)
- Phone camera image sensor (CMOS image sensor)
- Power management integrated circuit (power MOSFETs)
- Display driver (LCD or LED driver)
- Wireless communication chips (Wi-Fi, Bluetooth, GPS receiver)
- Sound chip (audio codec and power amplifier)
- Gyroscope
- Capacitive touchscreen controller (ASIC and DSP)
- RF power amplifier (LDMOS)
- A hardware notification LED on some phones

#### Central processing unit

Smartphones have central processing units (CPUs), similar to those in computers, but optimised to operate in low power environments. In smartphones, the CPU is typically integrated in a CMOS (complementary metal–oxide–semiconductor) system-on-a-chip (SoC) application processor.

The performance of mobile CPU depends not only on the clock rate (generally given in multiples of hertz) but also on the memory hierarchy. Because of these challenges, the performance of mobile phone CPUs is often more appropriately given by scores derived from various standardized tests to measure the real effective performance in commonly used applications.

#### **DISPLAY**

One of the main characteristics of smartphones is the screen. Depending on the device's design, the screen fills most or nearly all of the space on a device's front surface. Many smartphone displays have an aspect ratio of 16:9, but taller aspect ratios became more common in 2017.

Screen sizes are measured in diagonal inches. Phones with screens larger than 5.2 inches are often called "phablets". Smartphones with screens over 4.5 inches in size are commonly difficult to use with only a single hand, since most thumbs cannot reach the entire screen surface; they may need to be shifted around in the hand, held in one hand and

manipulated by the other, or used in place with both hands. Due to design advances, some modern smartphones with large screen sizes and "edge-to-edge" designs have compact builds that improve their ergonomics, while the shift to taller aspect ratios have resulted in phones that have larger screen sizes whilst maintaining the ergonomics associated with smaller 16:9 displays.

Liquid-crystal displays (LCDs) and organic light-emitting diode (OLED) displays are the most common. Some displays are integrated with pressure-sensitive digitizers, such as those developed by Wacom and Samsung, and Apple's Force Touch system.

## **SOUND**

Some audio quality enhancing features, such as Voice over LTE and HD Voice have appeared and are often available on newer smartphones. Sound quality can remain a problem due to the design of the phone, the quality of the cellular network and compression algorithms used in long distance calls. Audio quality can be improved using a VoIP application over Wi-Fi. Cell phones have small speakers so that the user can use a speakerphone feature and talk to a person on the phone without holding it to their ear. The small speakers can also be used to listen to digital audio files of music or speech or watch videos with an audio component, without holding the phone close to the ear.

## **BATTERY**

A smartphone typically uses a lithium-ion battery. By the end of 2017, smartphone battery life has become generally adequate; however, earlier smartphone battery life was poor due to the weak batteries that could not handle the significant power requirements of the smartphones' computer systems and colour screens.

Smartphone users purchase additional chargers for use outside the home, at work, and in cars and by buying portable external "battery packs". External battery packs include generic models which are connected to the smartphone with a cable, and custom-made models that "piggyback" onto a smartphone's case. In 2016, Samsung had to recall millions of the Galaxy Note 7 smartphones due to an explosive battery issue. For consumer convenience, wireless charging stations have been introduced in some hotels, bars, and other public spaces.

## **CAMERAS**

Cameras have become standard features of smartphones. As of 2019 phone cameras are now a highly competitive area of differentiation between models, with advertising

campaigns commonly based on a focus on the quality or capabilities of a device's main cameras.

Typically smartphones have at least one main rear-facing camera and a lower-resolution front-facing camera for "selfies" and video chat. Owing to the limited depth available in smartphones for image sensors and optics, rear-facing cameras are often housed in a "bump" that's thicker than the rest of the phone. Since increasingly thin mobile phones have more abundant horizontal space than the depth that is necessary and used in dedicated cameras for better lenses, there's additionally a trend for phone manufacturers to include multiple cameras, with each optimized for a different purpose (telephoto, wide angle, etc.).

Images are usually saved in the JPEG file format; some high-end phones also have RAW image capability.

Modern advanced smartphones have cameras with optical image stabilisation (OIS), larger sensors, bright lenses, and even optical zoom plus RAW images. HDR, "Bokeh mode" with multi lenses and multi-shot night modes are now also familiar. Many new smartphone camera features are being enabled via computational photography image processing and multiple specialized lenses rather than larger sensors and lenses, due to the constrained space available inside phones that are being made as slim as possible.

## **ACCESSORIES**

A wide range of accessories are sold for smartphones, including cases, screen protectors, power charging cables, wireless power stations, USB On-The-Go adapters (for connecting USB drives and or, in some cases, a HDMI cable to an external monitor), add-on batteries, headphones, combined headphone-microphones (which, for example, allow a person to privately conduct calls on the device without holding it to the ear), and Bluetooth-enabled powered speakers that enable users to listen to media from their smartphones wirelessly.

Cases range from relatively inexpensive rubber or soft plastic cases which provide moderate protection from bumps and good protection from scratches to more expensive, heavy-duty cases that combine rubber padding with a hard outer shell. Some cases have a "book"-like form, with a cover that the user opens to use the device; when the cover is closed, it protects the screen. Some "book"-like cases have additional pockets for credit cards, thus enabling people to use them as wallets.

Accessories include products sold by the manufacturer of the smartphone and compatible products made by other manufacturers.

## **SOFTWARE**

### **Mobile operating systems**

A mobile operating system (or mobile OS) is an operating system for phones, tablets, smartwatches, or other mobile devices.

Mobile operating systems combine features of a personal computer operating system with other features useful for mobile or handheld use; usually including, and most of the following considered essential in modern mobile systems; a touchscreen, cellular, Bluetooth, Wi-Fi Protected Access, Wi-Fi, Global Positioning System (GPS) mobile navigation, video- and single-frame picture cameras, speech recognition, voice recorder, music player, near field communication, and infrared blaster. By Q1 2018, over 383 million smartphones were sold with 85.9 percent running Android, 14.1 percent running iOS and a negligible number of smartphones running other OSes. Android alone is more popular than the popular desktop operating system Windows, and in general smartphone use (even without tablets) exceeds desktop use.

Mobile devices with mobile communications abilities (e.g., smartphones) contain two mobile operating systems – the main user-facing software platform is supplemented by a second low-level proprietary real-time operating system which operates the radio and other hardware. Research has shown that these low-level systems may contain a range of security vulnerabilities permitting malicious base stations to gain high levels of control over the mobile device.

## **MOBILE APP**

A mobile app is a computer program designed to run on a mobile device, such as a smartphone. The term "app" is a short-form of the term "software application".

## **APPLICATION STORES**

The introduction of Apple's App Store for the iPhone and iPod Touch in July 2008 popularized manufacturer-hosted online distribution for third-party applications (software and computer programs) focused on a single platform. There are a huge variety of apps, including video games, music products and business tools. Up until that point, smartphone application distribution depended on third-party sources providing applications for multiple platforms, such as Get Jar, Handan go, Hand mark, and Pocket Gear. Following the success of the App Store, other smartphone manufacturers launched application stores, such as Google's Android Market (later renamed to the Google Play Store) and



RIM's BlackBerry App World and Android-related app stores like F-Droid. In February 2014, 93% of mobile developers were targeting smartphones first for mobile app development.

## **SALES**

Since 1996, smartphone shipments have had positive growth. In November 2011, 27% of all photographs created were taken with camera-equipped smartphones. In September 2012, a study concluded that 4 out of 5 smartphone owners use the device to shop online. Global smartphone sales surpassed the sales figures for feature phones in early 2013. Worldwide shipments of smartphones topped 1 billion units in 2013, up 38% from 2012's 725 million, while comprising a 55% share of the mobile phone market in 2013, up from 42% in 2012. In 2013, smartphone sales began to decline for the first time. In Q1 2016 for the first time the shipments dropped by 3 percent year on year. The situation was caused by the maturing China market. A report by NPD shows that fewer than 10% of US citizens have bought \$1,000+ smartphones, as they are too expensive for most people, without introducing particularly innovative features, and amid Huawei, Oppo and Xiaomi introducing products with similar feature sets for lower prices. In 2019, smartphone sales declined by 3.2%, the largest in smartphone history, while China and India were credited with driving most smartphone sales worldwide. It is predicted that widespread adoption of 5G will help drive new smartphone sales.

## **BY MANUFACTURER**

Source	Date	Samsung	Huawei	Apple Inc.	Xiaomi	Oppo	Others
Gartner	Q2 2018	19.3%	13.3%	11.9%	8.8%	7.6%	39.0%
IDC	Q2 2018	21.0%	15.9%	12.1%	9.5%	8.6%	32.9%
Counterpoint Research	Q3 2019	21%	18%	12%	8%	9%	21%

In 2011, Samsung had the highest shipment market share worldwide, followed by Apple. In 2013, Samsung had 31.3% market share, a slight increase from 30.3% in 2012, while Apple was at 15.3%, a decrease from 18.7% in 2012. Huawei, LG and Lenovo were at about 5% each, significantly better than 2012 figures, while others had about 40%, the same as the previous year's figure. Only Apple lost market share, although their shipment volume

still increased by 12.9%; the rest had significant increases in shipment volumes of 36–92%. In Q1 2014, Samsung had a 31% share and Apple had 16%. In Q4 2014, Apple had a 20.4% share and Samsung had 19.9%. In Q2 2016, Samsung had a 22.3% share and Apple had 12.9%. In Q1 2017, IDC reported that Samsung was first placed, with 80 million units, followed by Apple with 50.8 million, Huawei with 34.6 million, Oppo with 25.5 million and Vivo with 22.7 million.<sup>l</sup>

Samsung's mobile business is half the size of Apple's, by revenue. Apple business increased very rapidly in the years 2013 to 2017. Realme, a brand owned by Oppo, is the fastest-growing phone brand worldwide since Q2 2019. In China, Huawei and Honor, a brand owned by Huawei, have 46% of market share combined and posted 66% annual growth as of 2019, amid growing Chinese nationalism. In 2019, Samsung had a 74% market share in 5G smartphones while 5G smartphones had 1% of market share in China.

Research has shown that iPhones are commonly associated with wealth, and that the average iPhone user has 40% more annual income than the average Android user. Women are more likely than men to own an iPhone. Trend Force predicts that foldable phones will start to become popular in 2021.

## **BY OPERATING SYSTEM**

### **USE**

#### **Mobile banking and payment**

In many countries, mobile phones are used to provide mobile banking services, which may include the ability to transfer cash payments by secure SMS text message. Kenya's M-PESA mobile banking service, for example, allows customers of the mobile phone operator Safaricom to hold cash balances which are recorded on their SIM cards. Cash can be deposited or withdrawn from M-PESA accounts at Safaricom retail outlets located throughout the country and can be transferred electronically from person to person and used to pay bills to companies.

Branchless banking has been successful in South Africa and the Philippines. A pilot project in Bali was launched in 2011 by the International Finance Corporation and an Indonesian bank, Bank Mandiri.

Another application of mobile banking technology is Zidisha, a US-based non-profit micro-lending platform that allows residents of developing countries to raise small business loans from Web users worldwide. Zidisha uses mobile banking for loan disbursements and

repayments, transferring funds from lenders in the United States to borrowers in rural Africa who have mobile phones and can use the Internet.

Mobile payments were first trialled in Finland in 1998 when two Coca-Cola vending machines in Espoo were enabled to work with SMS payments. Eventually, the idea spread and in 1999, the Philippines launched the country's first commercial mobile payments systems with mobile operators Globe and Smart.

Some mobile phones can make mobile payments via direct mobile billing schemes, or through contactless payments if the phone and the point of sale support near field communication (NFC). Enabling contactless payments through NFC-equipped mobile phones requires the co-operation of manufacturers, network operators, and retail merchants.

## **FACSIMILE**

Some apps allow for sending and receiving facsimile (Fax), over a smartphone, including facsimile data (composed of raster bi-level graphics) generated directly and digitally from document and image file formats.

## **CONVERGENCE WITH OTHER DEVICES**

The rise in popularity of touchscreen smartphones and mobile apps distributed via app stores along with rapidly advancing network, mobile processor, and storage technologies led to a convergence where separate mobile phones, organizers, and portable media players were replaced by a smartphone as the single device most people carried. Advances in digital camera sensors and on-device image processing software more gradually led to smartphones replacing simpler cameras for photographs and video recording. The built-in GPS capabilities and mapping apps on smartphones largely replaced stand-alone satellite navigation devices, and paper maps became less common. Mobile gaming on smartphones greatly grew in popularity, allowing many people to use them in place of handheld game consoles, and some companies tried creating game console/phone hybrids based on phone hardware and software. People frequently have chosen not to get fixed-line telephone service in favour of smartphones. Music streaming apps and services has grown rapidly in popularity, serving the same use as listening to music stations on a terrestrial or satellite radio. Streaming video services are easily accessed via smartphone apps and can be used in place of watching television. People have often stopped wearing wristwatches in favour of checking the time on their smartphones, and many use the clock features on their phones in place of alarm clocks.

Additionally, in many lesser technologically developed regions smartphones are people's first and only means of Internet access due to their portability with personal computers being relatively uncommon outside of business use. The cameras on smartphones can be used to photograph documents and send them via email or messaging in place of using fax (facsimile) machines. Payment apps and services on smartphones allow people to make less use of wallets, purses, credit and debit cards, and cash. Mobile banking apps can allow people to deposit checks simply by photographing them, eliminating the need to take the physical check to an ATM or teller. Guide book apps can take the place of paper travel and restaurant/business guides, museum brochures, and dedicated audio guide equipment.

## **CRITICISM AND ISSUES**

### **SOCIAL IMPACTS**

In 2012, University of Southern California study found that unprotected adolescent sexual activity was more common among owners of smartphones. A study conducted by the Rensselaer Polytechnic Institute's (RPI) Lighting Research Center (LRC) concluded that smartphones, or any backlit devices, can seriously affect sleep cycles. Some persons might become psychologically attached to smartphones resulting in anxiety when separated from the devices. A "smombie" (a combination of "smartphone" and "zombie") is a walking person using a smartphone and not paying attention as they walk, possibly risking an accident in the process, an increasing social phenomenon. The issue of slow-moving smartphone users led to the temporary creation of a "mobile lane" for walking in Chongqing, China. The issue of distracted smartphone users led the city of Augsburg, Germany to embed pedestrian traffic lights in the pavement.

### **WHILE DRIVING**

Mobile phone use while driving—including calling, text messaging, playing media, web browsing, gaming, using mapping apps or operating other phone features—is common but controversial, since it is widely considered dangerous due to what is known as distracted driving. Being distracted while operating a motor vehicle has been shown to increase the risk of accidents. In September 2010, the US National Highway Traffic Safety Administration (NHTSA) reported that 995 people were killed by drivers distracted by phones. In March 2011 a US insurance company, State Farm Insurance, announced the results of a study which showed 19% of drivers surveyed accessed the Internet on a

smartphone while driving. Many jurisdictions prohibit the use of mobile phones while driving. In Egypt, Israel, Japan, Portugal and Singapore, both handheld and hands-free calling on a mobile phone (which uses a speakerphone) is banned. In other countries including the UK and France and in many US states, only the use of calling on handheld phones is banned, while hands-free use is permitted.

A 2011 study reported that over 90% of college students surveyed text (initiate, reply or read) while driving. The scientific literature on the danger of driving while sending a text message from a mobile phone, or texting while driving, is limited. A simulation study at the University of Utah found a six fold increase in distraction-related accidents when texting. Due to the complexity of smartphones that began to grow more after, this has introduced additional difficulties for law enforcement officials when attempting to distinguish one usage from another in drivers using their devices. This is more apparent in countries which ban both handheld and hands-free usage, rather than those which ban handheld use only, as officials cannot easily tell which function of the phone is being used simply by looking at the driver. This can lead to drivers being stopped for using their device illegally for a call when, in fact, they were using the device legally, for example, when using the phone's incorporated controls for car stereo, GPS or satnav.

## **HYPOTHESIS**

- Since this time world is facing a world pandemic and is under a strict lockdown public might be using their phones more than usual which might result in excess of internet data consumption
- Sellers now provide additional discounts on mobile exchange online and offline which give enough benefits for the customers while purchasing new smartphones.

## **CHAPTER 2**

### **RESEARCH METHODOLOGY**

## **2.1 RESEARCH OBJECTIVE OF THE RESEARCH**

### **1. Primary Objective**

- a. To study about the evolution in the mobile phones.
- b. To understand and draw a map of the journey by smartphones over time.

### **2. Secondary Objective**

- a. To identify the customer attitude towards smart phone.
- b. To analyse the usage of features, software, and applications of Smart phone.
- c. To know the customer satisfaction of the smart phones

## **2.2 RESEARCH METHODOLOGY**

The research was conducted from January 2020 to April 2020. The research includes meeting with retailers, distributors and consumers. It includes preparation of the questionnaire to be answered by people for knowing the awareness and understanding of consumers and agents towards smartphones in multiple areas of India. The views of the above parties were recorded in the research as per the questionnaire made.

## **2.3 RESEARCH DESIGN**

### **• Descriptive research**

Descriptive research includes surveys and facts findings enquiries of different kinds. The major purpose of Descriptive research is the description of the state of affairs, as it exists at present. It provides the data about the population or universe being studied.

Descriptive research is used when the objective is to provide a systematic description that is as factual as accurate possible.

### **Sources of data**

For the study I have collected both Primary as well as the Secondary Data.

- Primary data is collected from Survey i.e., Questionnaire.
- Secondary data is collected from browsing internet from various websites and from the data published by the organization.
- Also few projects are studied for the reference of structure and project design.

## **2.4 DATA COLLECTION**

Data collection is the process of gathering and measuring information on targeted variables in an established system, which then enables one to answer relevant questions and evaluate outcomes. Data collection is a component of research in all fields of study including physical and social sciences, humanities, and business. While methods vary by discipline, the emphasis on ensuring accurate and honest collection remains the same. The goal for all data collection is to capture quality evidence that allows analysis to lead to the formulation of convincing and credible answers to the questions that have been posed.

### **TYPES OF DATA**

**1) PRIMARY DATA** – refers to the data that the investigator collects for the very first time. This type of data has not been collected either by this or any other investigator before. A primary data will provide the investigator with the most reliable first-hand information about the respondents. The investigator would have a clear idea about the terminologies used, the statistical units employed, the research methodology and the size of the sample. Primary data may either be internal or external to the organization.

**2) SECONDARY DATA** – refers to the data that the investigator collects from another source. Past investigators or agents collect data required for their study. The investigator is the first researcher or statistician to collect this data. Moreover, the investigator does not have a clear idea about the intricacies of the data. There may be ambiguity in terms of the sample size and sample technique. There may also be unreliability with respect to the accuracy of the data.

### **METHODS OF PRIMARY DATA COLLECTION:**

#### **A) DIRECT PERSONAL INVESTIGATION**

Consists of the collection of data by the investigator in a direct manner. The investigator (or researcher) is responsible for personally approaching a respondent and investigating the research and gather appropriate information. In other words, the researcher himself enters the field and solicits data that he requires to take the research forward. Thus, this method of data collection ensures first-hand information. This data is all the more reliable for an intensive research. But in an extensive research, this data is inadequate and



proves to be unreliable. This method of collection of data is time-consuming. Hence, it tends to get handicapped when there is lack of time resource. However, the greatest demerit is that this method is very subjective in nature and is not suitable for objective based extensive researches.

## **B) INDIRECT ORAL INTERVIEW**

Consists of the collection of data by the investigator in an indirect manner. The investigator (or enumerator) approaches (either by telephonic interviews) an indirect respondent who possesses the appropriate information for the research. Thus, this method of data collection ensures first-hand information because the interviewers can cross-question for the right and appropriate information.

## **C) MAILED QUESTIONNAIRE**

Consists of mailing a set or series of questions related to the research. The respondent answers the questionnaire and forwards it back to the investigator after marking his/her responses. This method of collection of data has proven to be time-saving. It is also a very cost-efficient manner of collecting the required data. An investigator who has the access to the internet and an email account can undertake this method of data collection. The researcher can only investigate those respondents who also have access to the internet and an email account. This remains the only major restriction of this method.

## **D) SCHEDULES**

Scheduling involves a face to face situation with the respondents. In this method of collecting data, the interviewer questions the respondent according to the questions mentioned in a form. This form is known as a schedule. This is different than a questionnaire. A questionnaire is personally filled by the respondents and the interviewer may or may not be physically present. Whereas, the schedule is filled by the enumerator or interviewer after asking the respondent his/her answer to a specific question. And in scheduling method of collecting data, the interviewer or enumerator is physically present.

## **E) LOCAL AGENCIES**

In this method, the information is not directly or indirectly collected by either the interviewer or the enumerator. Instead, the interviewer hires or employs a local agency to work for him/her and help in gathering appropriate information. These local agents are often

known as correspondents as well. Correspondents are only responsible for gathering accurate and reliable information. They work according to their preference and adopt different methods to do so.

## **SECONDARY DATA – SOURCES OF DATA**

### **a) PUBLISHED SOURCES**

There are many national organizations, international agencies and official publications that collect various statistical data. They collect data related to business, commerce, trade, prices, economy, productions, services, industries, currency and foreign affairs. They also collect information related to various (internal and external) socio-economic phenomena and publishes them. These publications contain statistical reports of various kinds. Central Government Official Publication, Publications of Research Institutions, Committee Reports and International Publications are some published sources of secondary data.

### **b) UNPUBLISHED SOURCES**

Some statistical data are not always a part of publications. Such data are stored by institutions private firms. Researchers often make use of these unpublished data in order to make their researches all the more original.

## **2.5 SAMPLING DESIGN**

### **POPULATION/UNIVERSE**

Population/Universe is the entire pool from which a statistical sample is drawn. A population may refer to an entire group of people, objects, events, hospital visits, or measurements. A population can thus be said to be an aggregate observation of subjects grouped together by a common feature.

In this project population is limited to the boundary of UTTRAKHAND, UTTERPRADESH, DELHI NCR AND CAPITAL AREA OF INDIA i.e. DELHI.

### **SAMPLE UNIT**

The term sampling unit refers to a singular value within a sample database. For example, if you were conducting research using a sample of university students, a single university student would be a sampling unit.

Here 103 different sample units were analysed for the project due to limited sources and public contacts.

## **SAMPLE SIZE**

The term sampling unit refers to a singular value within a sample database. For example, if you were conducting research using a sample of university students, a single university student would be a sampling unit.

Another example of a sampling unit could be if you were conducting online research with 50 households, one household would be a singular sampling unit.

## **SAMPLE AREA**

Area sampling is a method of sampling used when no complete frame of reference is available. The total area under investigation is divided into small sub-areas which are sampled at random or according to a restricted process (stratification of sampling). Each of the chosen sub-areas is then fully inspected and enumerated, and may form the basis for further sampling if desired.

## **2.6 SAMPLING INSTRUMENTS (QUESTIONNAIRE)**

### **NO. OF QUESTIONS**

To make a qualitative questionnaire there must be a limited number of questions to maintain the interest of the respondents. Also the questions asked must be only about the topic of the research.

In my project 13 different questions are asked from the respondents from which 10 regarding the topic and 3 about the general information about the respondents.

### **TYPES OF QUESTIONS**

- Multiple Choice Questions

Open up a conversation with this question. These are good survey questions to get more meaningful answers from as people have the opportunity to give you more feedback through a text box. If you're looking for a yes/no answer—you'll need to use a closed-end question.

- Demographic Questions

Demographic survey questions are a mix of different forms of questions. It's up to you whether you want to use a dropdown here or an open-ended question with them. They all talk about things which can be seen as a bit touchy, so take heed.

- Likert Scale Questions

Likert scale questions are good survey questions for finding out what people think about certain things. Generally, they come in 5, 7, or 9-point scales and you've probably filled one out before.

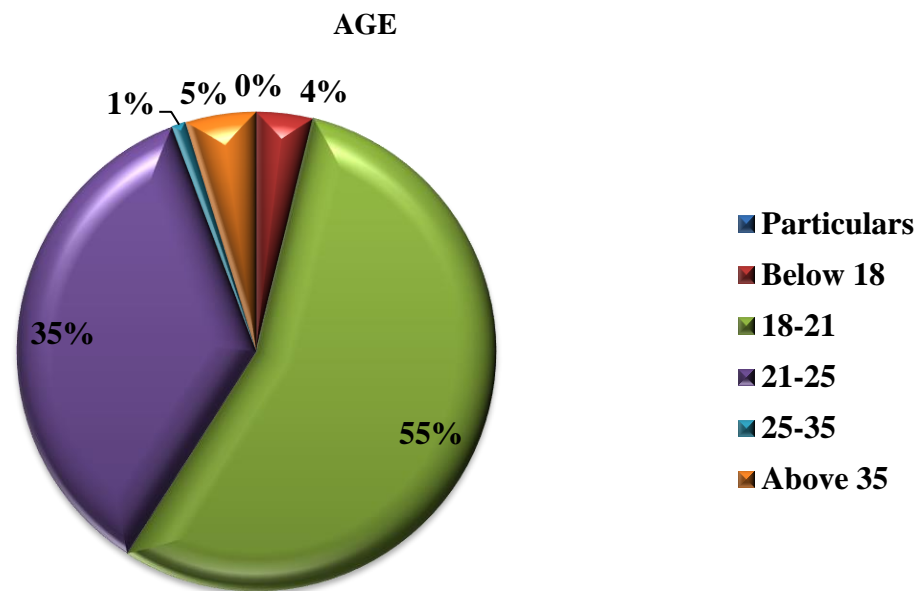
**CHAPTER 3**  
**DATA PROCESSING, ANALYSIS & INTERPRETATION)**

### **3.1 DATA PROCESSING**

#### **Q1. AGE**

This table represents the age of respondents.

Particulars	No. of respondents	Percentage
Below 18	4	4%
18-21	58	55%
21-25	37	35%
25-35	1	1%
Above 35	5	5%
TOTAL	105	100%



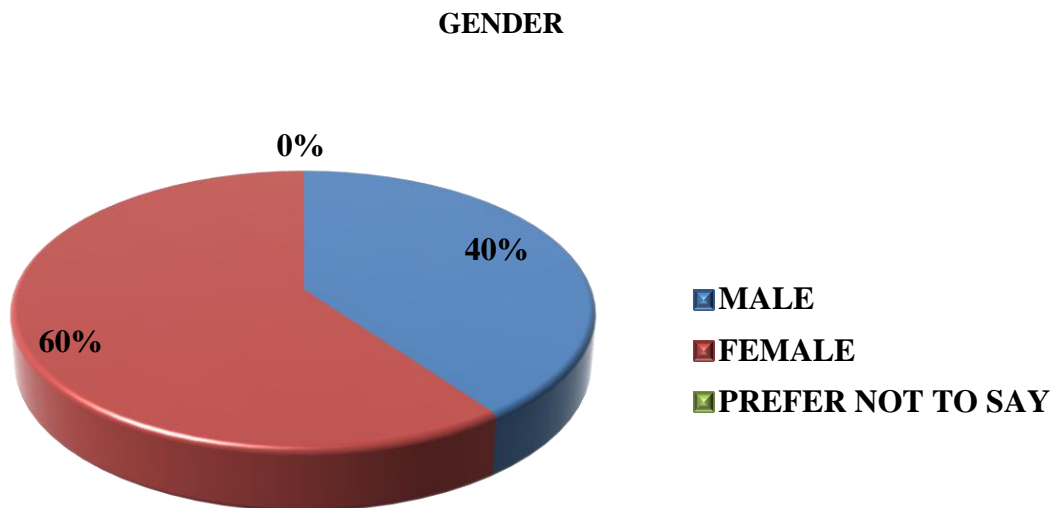
**Fig. 3.1**

#### **INTREPRATATION**

Responses are been filled and studies for the age category of 18-21 and 21-25 mostly but for a broader and overall analysis respondents from other age categories are also been taken

## Q2. GENDER.

Particulars	No. of respondents	Percentage
MALE	42	40%
FEMALE	63	60%
PREFER NOT TO SAY	0	0%
TOTAL	105	100



**Fig. 3.2**

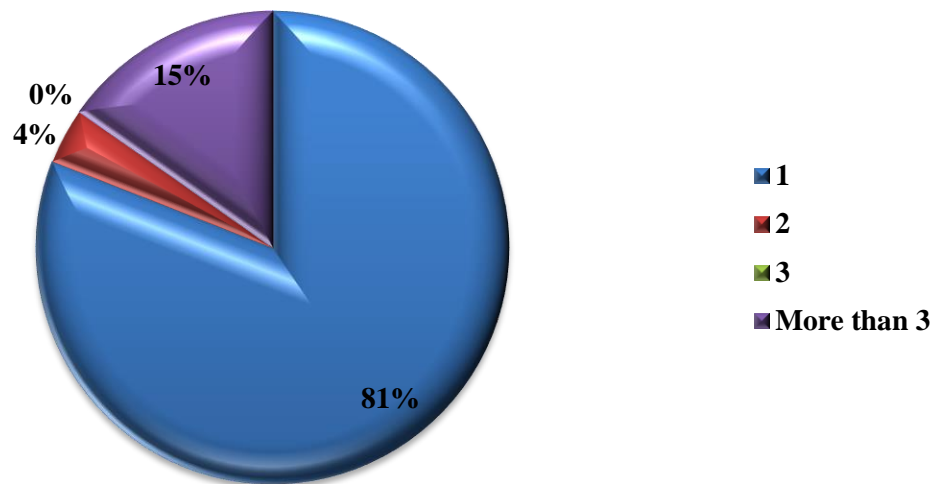
## **INTREPRATATION**

Among the respondents number of female respondents is more than male.

### Q3. HOW MANY SMARTPHONES DO YOU OWN?

Particulars	No. of Respondents	Percentage
1	85	80.95%
2	4	3.81%
3	0	0%
More than 3	16	15.24%
TOTAL	105	100

### HOW MANY SMARTPHONES DO YOU OWN?



**Fig.3.3**

### **INTREPRATATION**

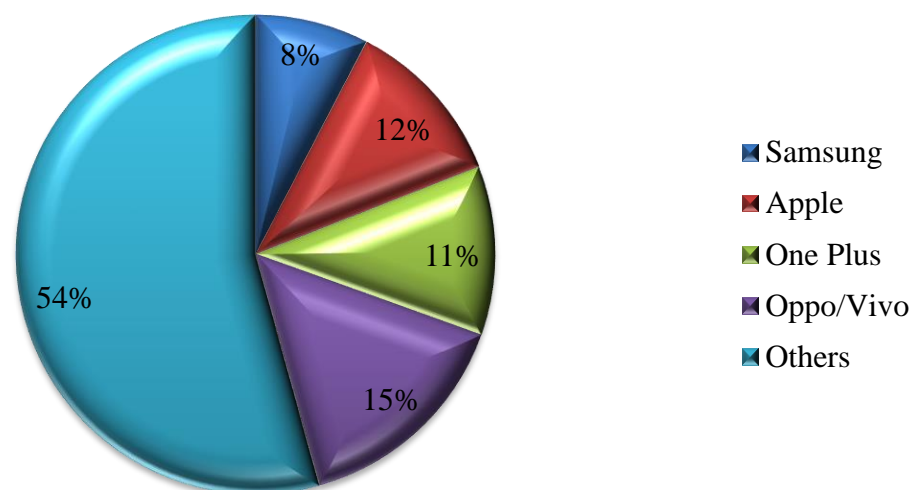
Among the 105 respondents according to the survey more than 80% use only 1 smartphone where as more than 15% use more than 3 smartphones. More than 3% of the sample population own 2 smartphones.



#### Q4. WHAT BRAND PHONE DO YOU USE?

Particulars	No. of Respondents	Percentage
Samsung	8	7.6
Apple	12	11.4
One Plus	12	11.4
Oppo/Vivo	16	15.2
Others	57	54.4
TOTAL	105	100

#### WHAT BRAND PHONE DO YOU USE?



**Fig 3.4**

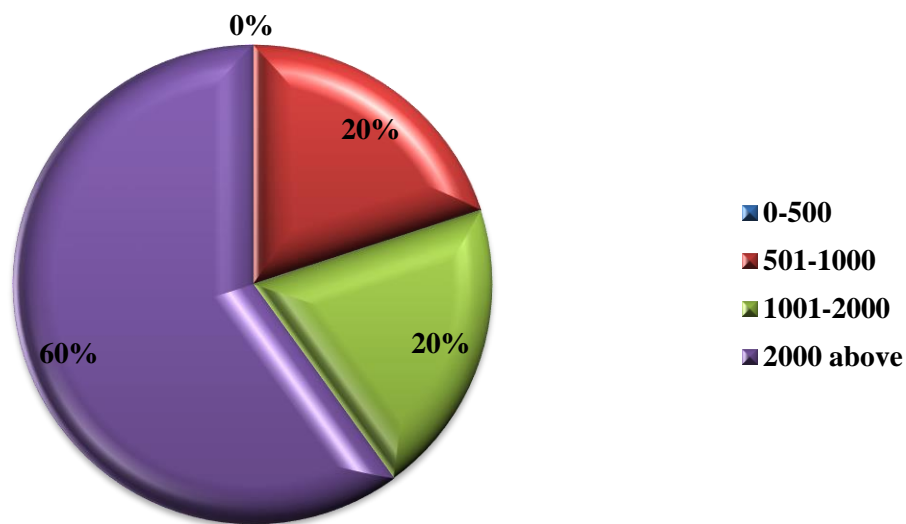
#### **INTREPRATATION**

In response to the above question most percentage of the respondents answered Redmi/MI (since we didn't had this option the went for others) but from the other brands Oppo/Vivo had the lead followed by Apple and One plus together.

#### Q5. WHAT IS YOUR YEARLY BUDGET ON SMARTPHONES?

Particulars	No. of responses	Percentage
0-500	0	0%
501-1000	21	20%
1001-2000	21	20%
2000 above	63	60%
TOTAL	105	100%

#### WHAT IS YOUR YEARLY BUDGET ON SMARTPHONES



**Fig 3.5**

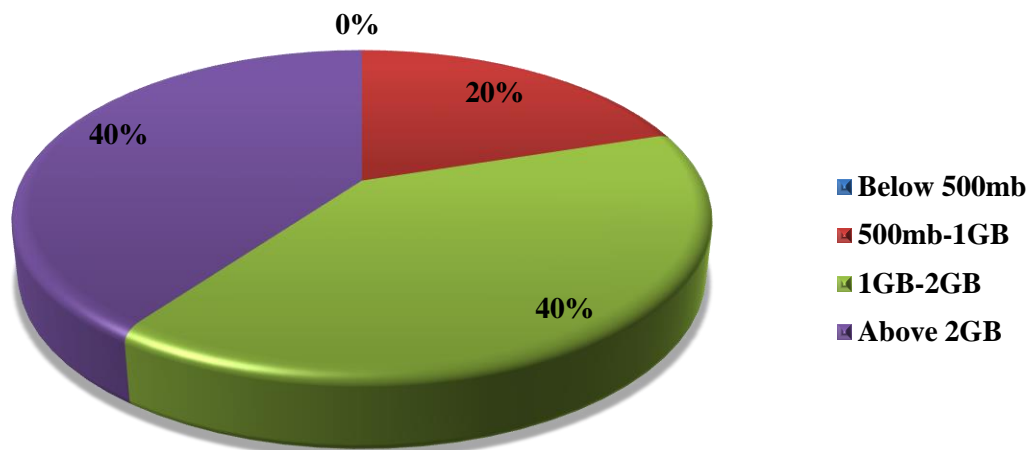
#### **INTREPRATATION**

It is understood in the world of speed and technology every individual demands a high speed and quality facilities and many options in there smartphones hence 60% of the respondent's yearly budget on smartphones rises over 2,000 but still 20% respondents

#### Q6. HOW MUCH PER DAY DATA YOU USE ON YOUR SMARTPHONE?

Particulars	No. of Responses	Percentage
Below 500mb	0	0%
500MB-1GB	21	20%
1GB-2GB	42	40%
Above 2GB	42	40%
TOTAL	105	100

#### HOW MUCH PER DAY DATA YOU USE ON YOUR SMARTPHONE



**Fig 3.6**

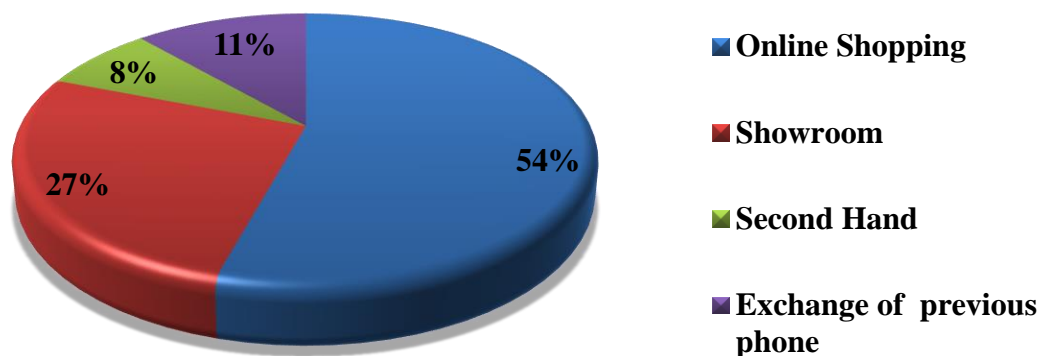
#### **INTREPRATATION**

As growing requirements and scope on internet/Online platforms the data consumption or requirements also increases hence resulting the above results in data collection. 40% of the respondents, 20% of respondents use data between 1GB-2GB and the remaining 20% consume 500MB-1GB data every day.

### Q7. HOW DO YOU PREFER PURCHASING YOUR PHONE?

Particulars	No. of Responses	Percentage
Online Shopping	57	54.4
Showroom	28	26.6
Second Hand	8	7.6
Exchange of previous phone	12	11.4
TOTAL	105	100

### HOW DO YOU PREFER PURCHASING YOUR PHONE



**Fig 3.7**

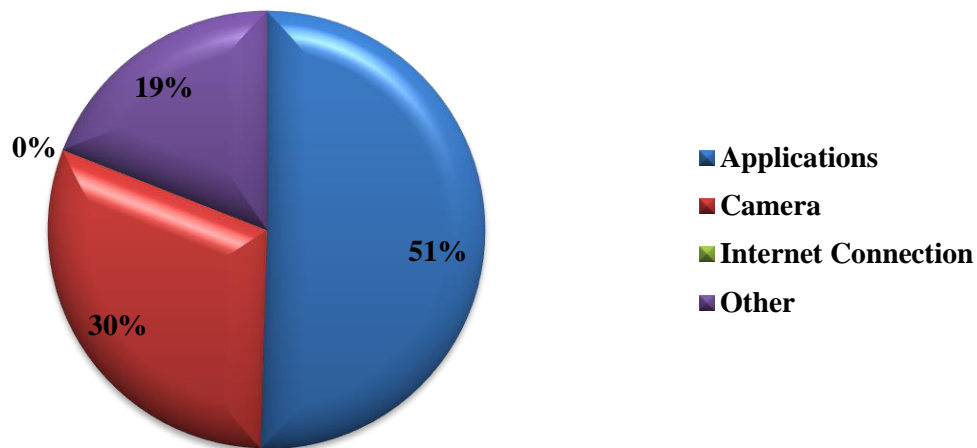
### **INTREPRATATION**

E-commerce or trade made a huge transformation in the market. For smartphones also according to the data collected more than half the respondents prefer purchasing smartphones online through various websites. More than 26% respondents prefer purchasing in showroom and 11.4% respondents prefer exchanging their old smartphones in replace with new smartphone and only 7.6% of the respondents prefer purchasing 2<sup>nd</sup> hand smartphones.

**Q8. WHAT IS THE MAIN FEATURE THAT ATTRACTS YOU WHILE DECIDING ON A SMARTPHONE?**

Particulars	No. of Responses	Percentage
Applications	53	50.48
Camera	32	30.48
Internet Connection	0	0
Other	20	19.04
TOTAL	105	100

**WHAT IS THE MAIN FEATURE THAT ATTRACTS YOU WHILE DECIDING ON A SMARTPHONE**



**Fig 3.8**

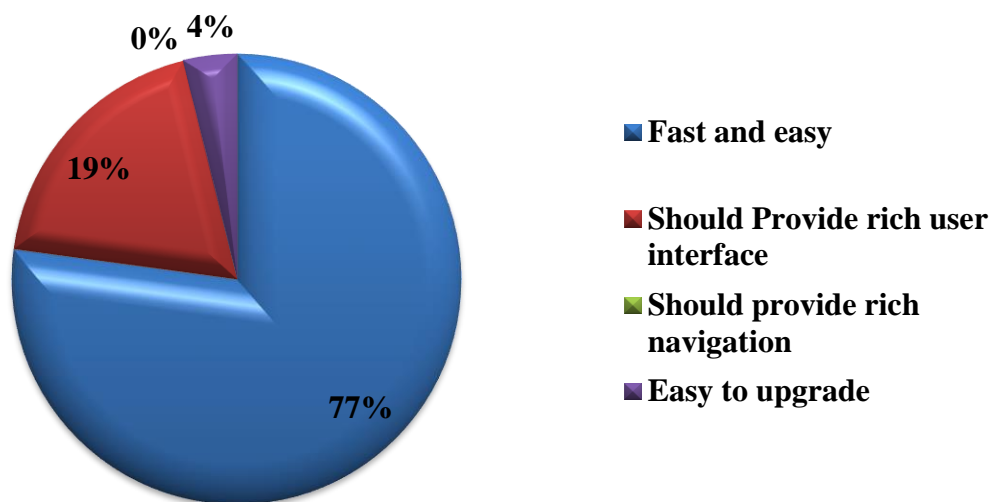
**INTREPRATATION**

For more than half the respondents the applications in the smartphone effects their choice of smartphone whereas 30.48% respondents consider camera as the main feature which effect the choice of smartphone. 19.04% respondents have other features effecting their choice of smartphone like battery, hardware specs. and processor.

### Q9. WHAT DO YOU EXPECT FROM AN OPERATING SYSTEM OF SMARTPHONES?

Particulars	No. of Respondents	Percentage
Fast and easy	81	76.9
Should Provide rich user interface	20	19.2
Should provide rich navigation	0	0
Easy to upgrade	4	3.9
TOTAL	105	100

### WHAT DO YOU EXPECT FROM AN OPERATION SYSTEM OF SMARTPHONES



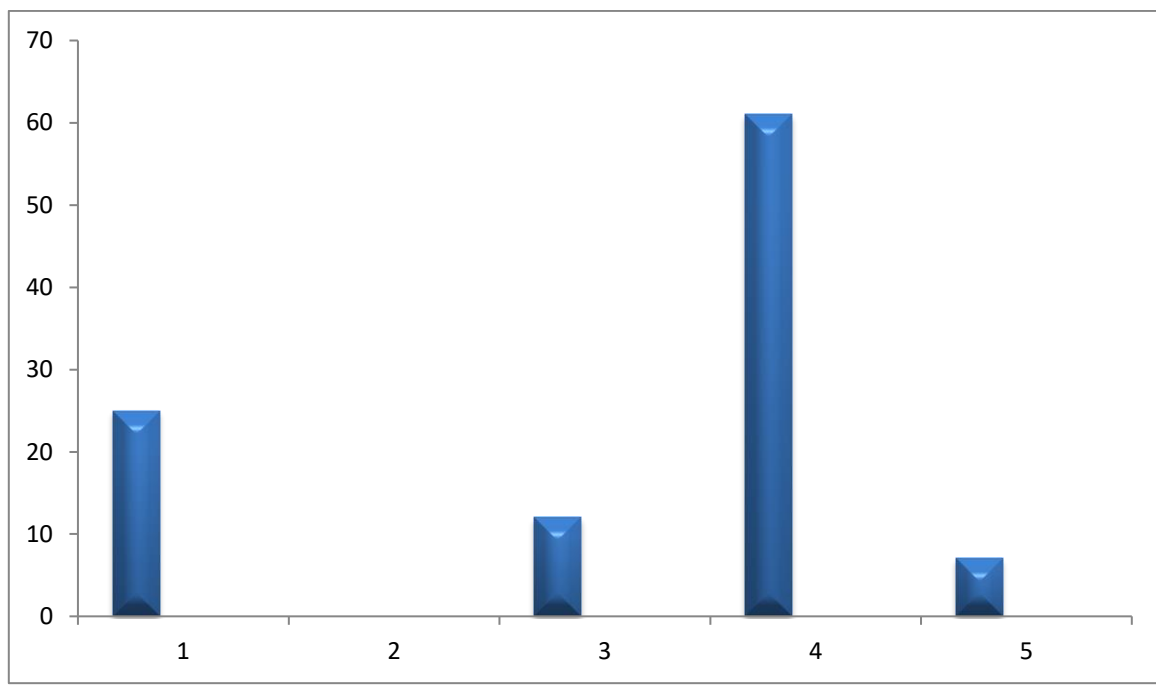
**Fig 3.9**

### **INTREPRATATION**

Major portion of the respondents expect fast and easy operating system where the device becomes more user friendly and handy to use. 19.2% of the respondents expect a rich user interface providing a classic look to the device and remaining 3.9% respondents expect operating systems which are easy to upgrade.

**Q10. HOW IS YOUR SATISFACTION WITH YOUR CURRENT OPERATION PLATFORM/SYSTEM?**

Particulars	No. of Responses	Percentage
1	25	23.8
2	0	0
3	12	11.5
4	61	57.7
5	7	7
TOTAL	105	100



**Fig 3.10**

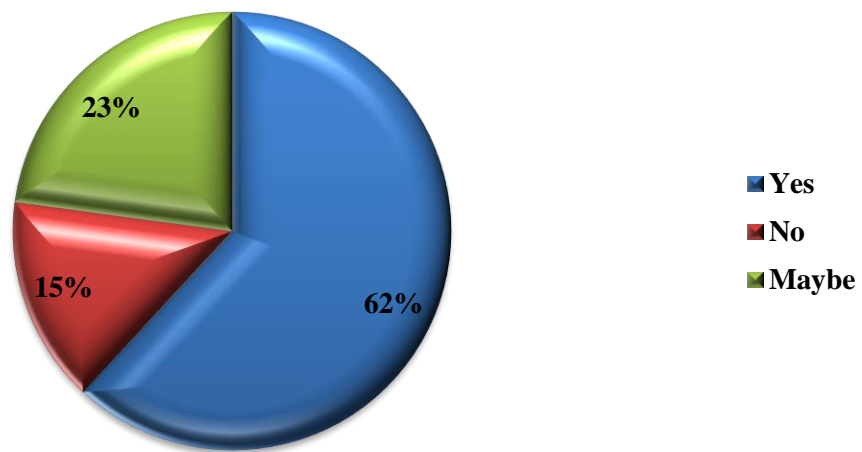
**INTREPRATATION**

7% of the respondents are totally satisfied with their smartphones 57.7% respondents might be facing some minor issues on their device, 11.5% respondents have an average opinion about their smartphone and 23.8% respondents are not very impressed with smartphone(s) they use.

**Q11. DOES BRAND NAME INFLUENCE YOUR DECISION MAKING IN PURCHASING?**

Particulars	No. of Responses	Percentage
Yes	65	61.5
No	16	15.4
Maybe	24	23.1
TOTAL	105	100

**DOES BRAND NAME INFLUENCE YOUR DECISION MAKING IN PURCHASING**



**Fig 3.11**

**INTREPRATATION**

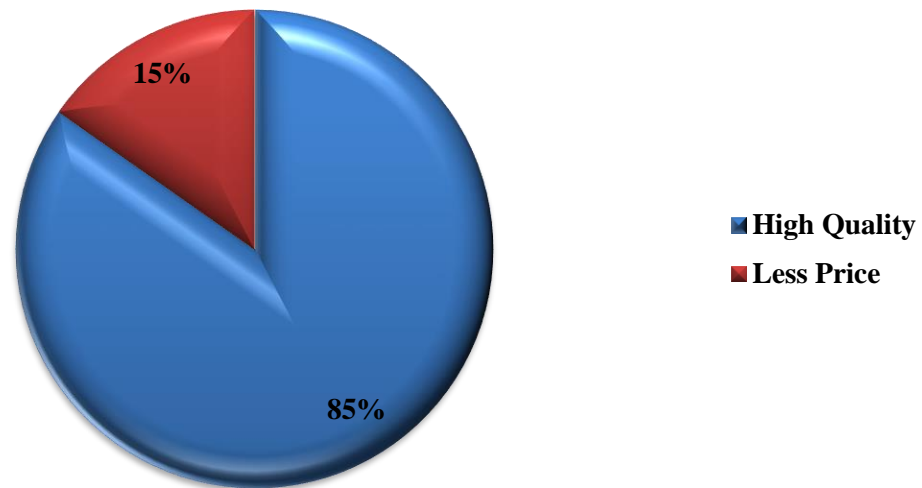
61.5% respondents believe that brand name does effect in their decision while purchasing a smartphone, 15.4% respondents does not have the brand name at a priority on their requirements on the smartphone they use.



**Q12. WHICH ONE DO YOU CONSIDER AS THE MOST IMPORTANT POINT WHEN PURCHASING A SMARTPHONE?**

Particulars	No. of Responses	Percentage
High Quality	89	84.6
Less Price	16	15.4
TOTAL	105	100

**WHICH ONE DO YOU CONSIDER AS THE MOST IMPORTANT POINT WHEN PURCHASING A SMARTPHONE**



**Fig 3.12**

**INTREPRATATION**

For 84.6% respondent's quality of the device is more concerned issue than price whereas 15.4% respondents consider reasonable price over high quality.

## 3.2 ANALYSIS OF THE PROBLEM

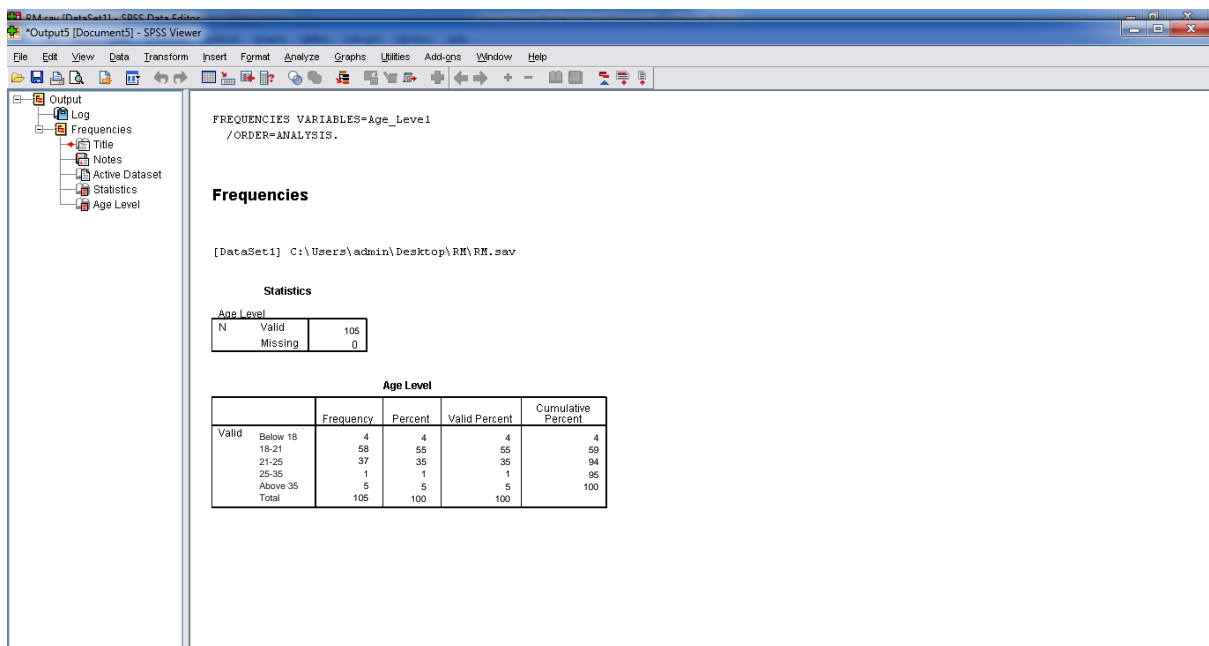
### 1. Descriptive Statistics

#### a. Frequency

Steps to check frequency:-

- Analysis > Discriptive Statistics > Frequencies

### AGE



SPSS Viewer window showing the output for the command: `FREQUENCIES VARIABLES=Age_Level /ORDER=ANALYSIS.`

**Frequencies**

[DataSet1] C:\Users\admin\Desktop\RM\RM.sav

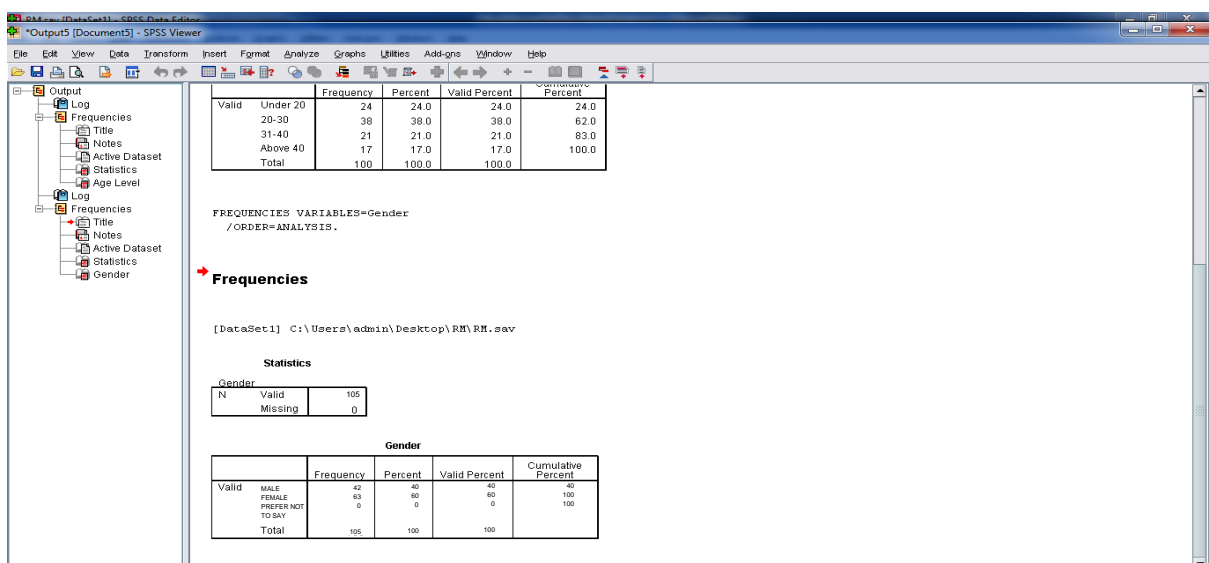
**Statistics**

Age Level	
N	Valid 105
	Missing 0

**Age Level**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
Below 18	4	4	4	4
18-21	58	55	55	59
21-25	37	35	35	94
25-35	1	1	1	95
Above 35	5	5	5	100
Total	105	100	100	

### GENDER



SPSS Viewer window showing the output for the command: `FREQUENCIES VARIABLES=Gender /ORDER=ANALYSIS.`

**Frequencies**

[DataSet1] C:\Users\admin\Desktop\RM\RM.sav

**Statistics**

Gender	
N	Valid 105
	Missing 0

**Gender**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
Under 20	24	24.0	24.0	24.0
20-30	38	38.0	38.0	62.0
31-40	21	21.0	21.0	83.0
Above 40	17	17.0	17.0	100.0
Total	100	100.0	100.0	

## HOW MANY SMARTPHONES DO YOU OWN?

SPSS Viewer window showing the output of a frequency analysis for the variable 'Age\_Level'.

**Output**

- Log
- Frequencies
- Statistics
- Age Level

**FREQUENCIES VARIABLES=Age\_Level**  
/ORDER=ANALYSIS.

**Frequencies**

[DataSet1] C:\Users\admin\Desktop\RM\RM.sav

**Statistics**

HOW MANY SMARTPHONES DO YOU OWN?

N	Valid	Missing
	105	0

**HOW MANY SMARTPHONES DO YOU OWN?**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1	85	80.95	81	81
2	4	3.81	4	85
3	0	0	0	85
More than 3	16	15.24	15	100
Total	105	100	100	

## WHAT BRAND PHONE DO YOU USE?

SPSS Viewer window showing the output of a frequency analysis for the variable 'Individual\_Service'.

**Output**

- Log
- rerequencies
- Notes
- Active Dataset
- Statistics
- When you are shopping on F
- og
- rerequencies
- Notes
- Active Dataset
- Statistics
- What kind of products do you
- og
- rerequencies
- Notes
- Active Dataset
- Statistics
- On the whole, the satisfactor
- og
- rerequencies
- Notes
- Active Dataset
- Statistics
- Do you think our distribution
- og
- rerequencies
- Notes
- Active Dataset
- Statistics
- Do you think the individual se

**FREQUENCIES VARIABLES=Individual\_Service**  
/ORDER=ANALYSIS.

**Frequencies**

[DataSet1] C:\Users\admin\Desktop\RM\RM.sav

**Statistics**

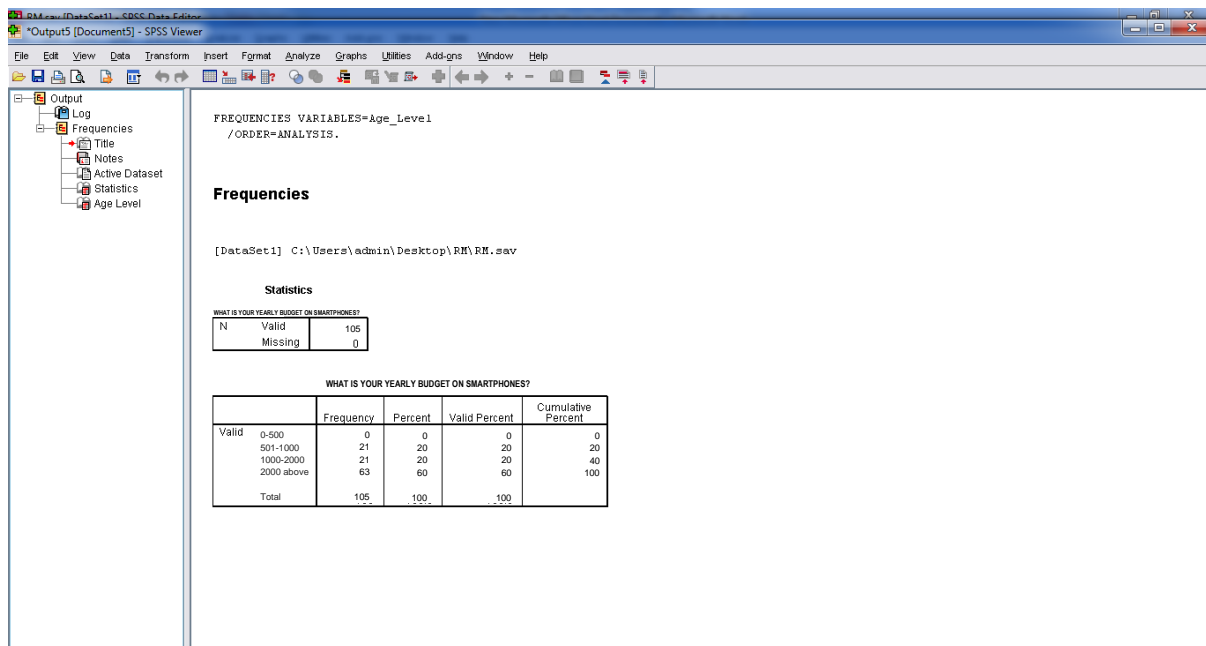
WHAT BRAND PHONE DO YOU USE?

N	Valid	Missing
	100	0

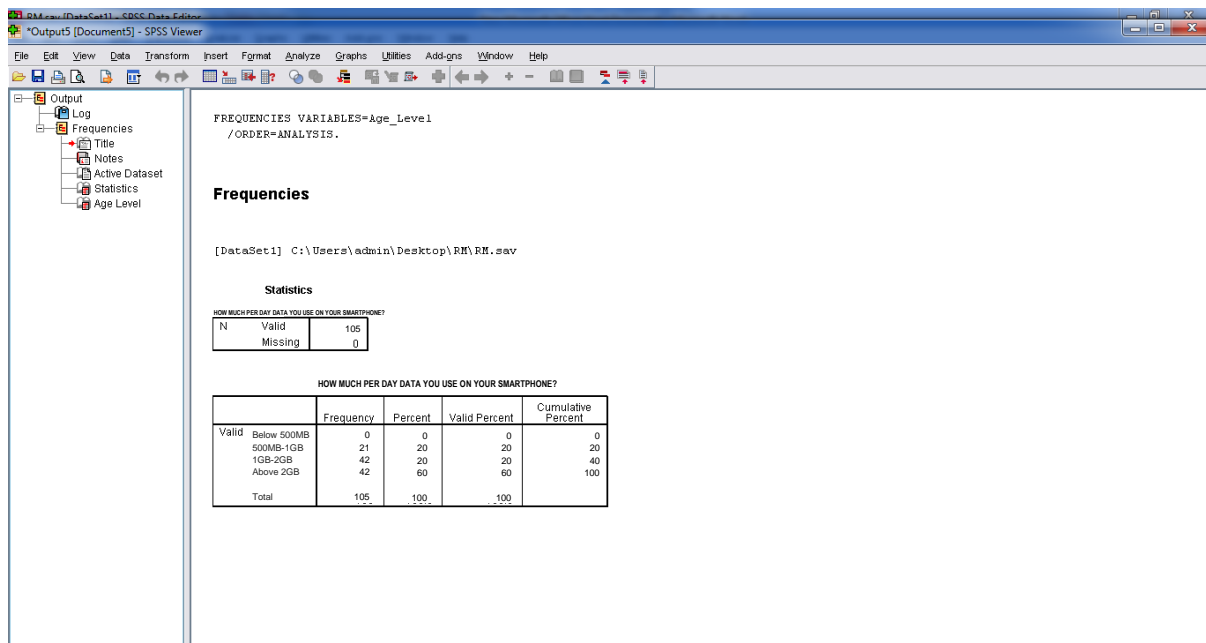
**WHAT BRAND PHONE DO YOU USE?**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid SAMSUNG	8	7.6	8	8
APPLE	12	11.4	11	19
ONE PLUS	12	11.4	11	30
OPPO/VIVO	16	15.2	15	45
OTHERS	57	54.4	55	100
Total	105	100		

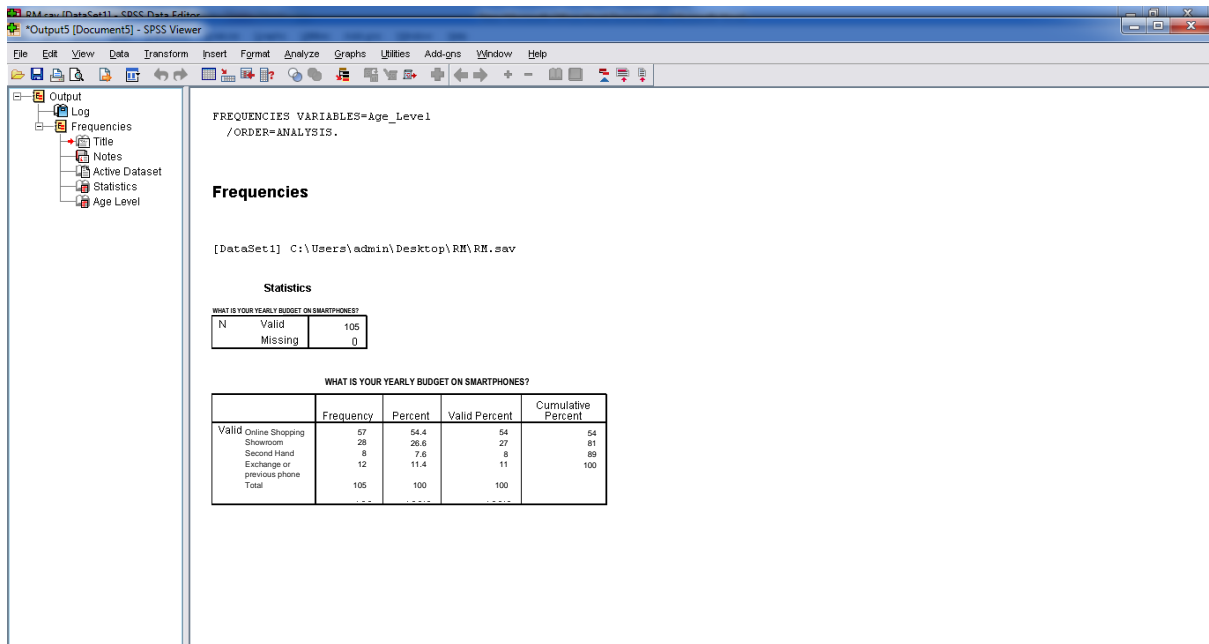
## WHAT IS YOUR YEARLY BUDGET ON SMARTPHONES?



## HOW MUCH PER DAY DATA YOU USE ON YOUR SMARTPHONE?



## HOW DO YOU PREFER PURCHASING YOUR PHONE?



SPSS Viewer window showing the output of a frequency analysis. The command is: `FREQUENCIES VARIABLES=Age_Level /ORDER=ANALYSIS.`

**Frequencies**

[DataSet1] C:\Users\admin\Desktop\RM\RM.sav

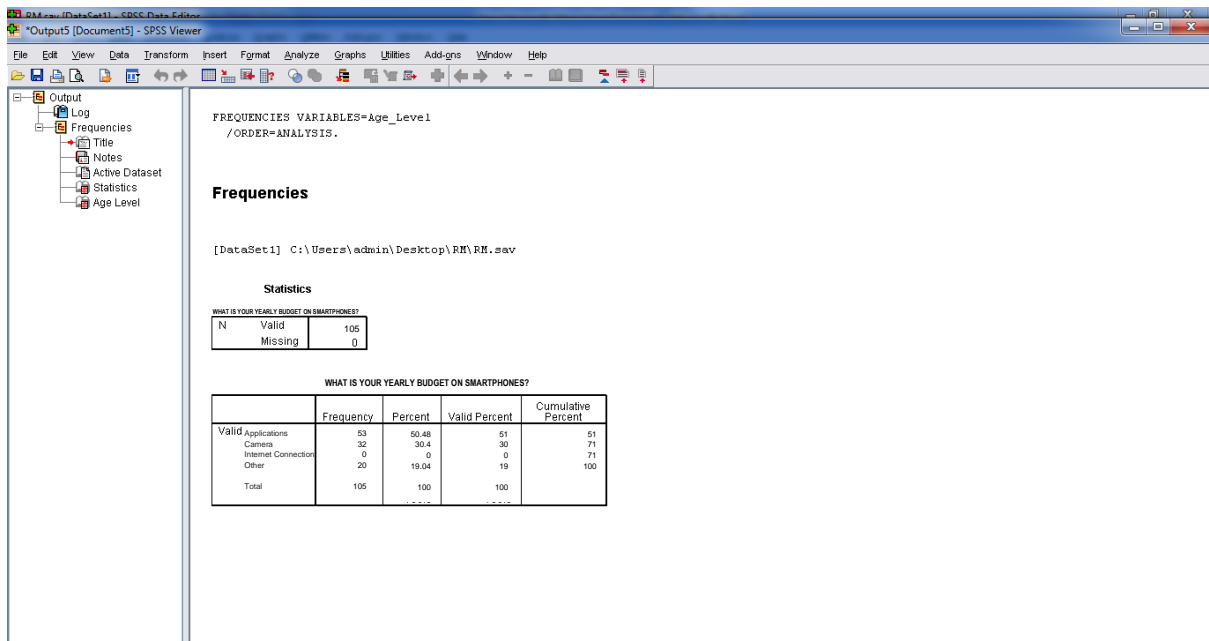
**Statistics**

WHAT IS YOUR YEARLY BUDGET ON SMARTPHONES?		
N	Valid	105
	Missing	0

WHAT IS YOUR YEARLY BUDGET ON SMARTPHONES?				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Online Shopping	57	54.4	54	54
Showroom	28	26.6	27	81
Second Hand	8	7.6	8	89
Exchange or previous phone	12	11.4	11	100
Total	105	100	100	

## WHAT IS THE MAIN FEATURE THAT ATTRACTS YOU WHILE DECIDING ON A SMARTPHONE



SPSS Viewer window showing the output of a frequency analysis. The command is: `FREQUENCIES VARIABLES=Age_Level /ORDER=ANALYSIS.`

**Frequencies**

[DataSet1] C:\Users\admin\Desktop\RM\RM.sav

**Statistics**

WHAT IS YOUR YEARLY BUDGET ON SMARTPHONES?		
N	Valid	105
	Missing	0

WHAT IS YOUR YEARLY BUDGET ON SMARTPHONES?				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Applications	53	50.48	51	51
Camera	32	30.4	30	71
Internet Connection	0	0	0	71
Other	20	19.04	19	100
Total	105	100	100	

## WHAT DO YOU EXPECT FROM AN OPERATING SYSTEM OF SMARTPHONES?

SPSS Viewer window showing the output of a frequency analysis. The left sidebar shows the 'Output' tree with 'Frequencies' selected. The main window displays the following information:

**FREQUENCIES VARIABLES=Age\_Level**  
/ORDER=ANALYSIS.

**Frequencies**

[DataSet1] C:\Users\admin\Desktop\RM\RM.sav

**Statistics**

WHAT DO YOU EXPECT FROM AN OPERATING SYSTEM OF SMARTPHONES?		
N	Valid	105
	Missing	0

WHAT DO YOU EXPECT FROM AN OPERATING SYSTEM OF SMARTPHONES?				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid Fast and easy	81	76.9	77	77
Should provide rich user interface	20	19.2	19	96
Should provide rich navigation	0	0	0	0
Easy to upgrade	3.9	3.9	4	100
Total	105	100	100	

## HOW IS YOUR SATISFACTION WITH YOUR CURRENT OPERATION PLATFORM/SYSTEM?

SPSS Viewer window showing the output of a frequency analysis. The left sidebar shows the 'Output' tree with 'Frequencies' selected. The main window displays the following information:

**FREQUENCIES VARIABLES=Age\_Level**  
/ORDER=ANALYSIS.

**Frequencies**

[DataSet1] C:\Users\admin\Desktop\RM\RM.sav

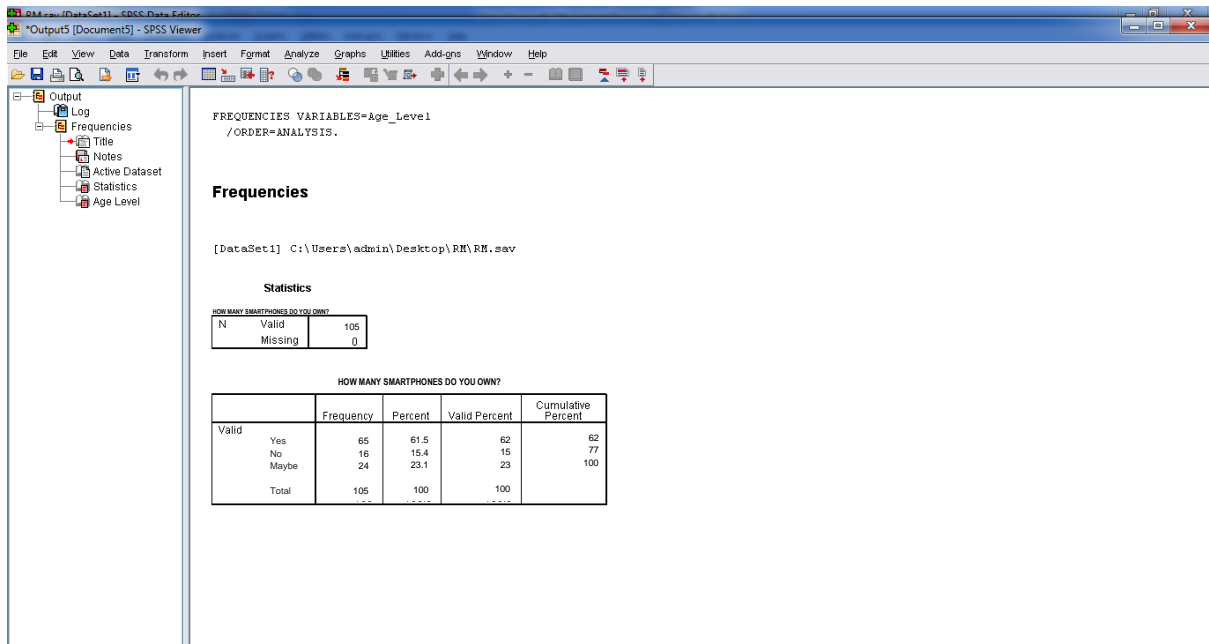
**Statistics**

HOW MANY SMARTPHONES DO YOU OWN?		
N	Valid	105
	Missing	0

HOW MANY SMARTPHONES DO YOU OWN?				
	Frequency	Percent	Valid Percent	Cumulative Percent
Valid 1	25	23.8	24	24
2	0	0	0	24
3	12	11.4	11	35
4	61	57.7	58	93
5	7	7	7	100
Total	105	100	100	

## DOES BRAND NAME INFLUENCE YOUR DECISION MAKING IN PUCHASING?



SPSS Viewer window showing the output of a frequency analysis for the variable 'HOW MANY SMARTPHONES DO YOU OWN?'. The output includes a summary table and a detailed frequency table.

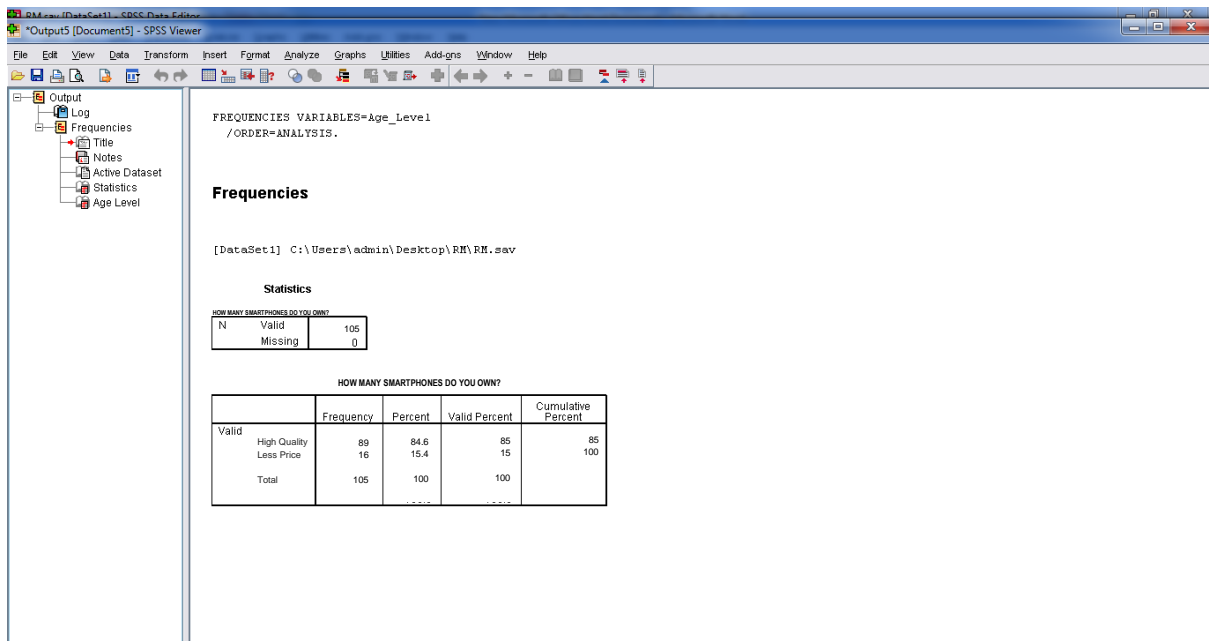
**Statistics**

HOW MANY SMARTPHONES DO YOU OWN?	
N	Valid 105
	Missing 0

**HOW MANY SMARTPHONES DO YOU OWN?**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
Yes	65	61.5	62	62
No	16	15.4	15	77
Maybe	24	23.1	23	100
Total	105	100		

## WHICH ONE DO YOU CONSIDER AS THE MOST IMPORTANT POINT WHEN PURCHASING A SMARTPHONE?



SPSS Viewer window showing the output of a frequency analysis for the variable 'WHICH ONE DO YOU CONSIDER AS THE MOST IMPORTANT POINT WHEN PURCHASING A SMARTPHONE?'. The output includes a summary table and a detailed frequency table.

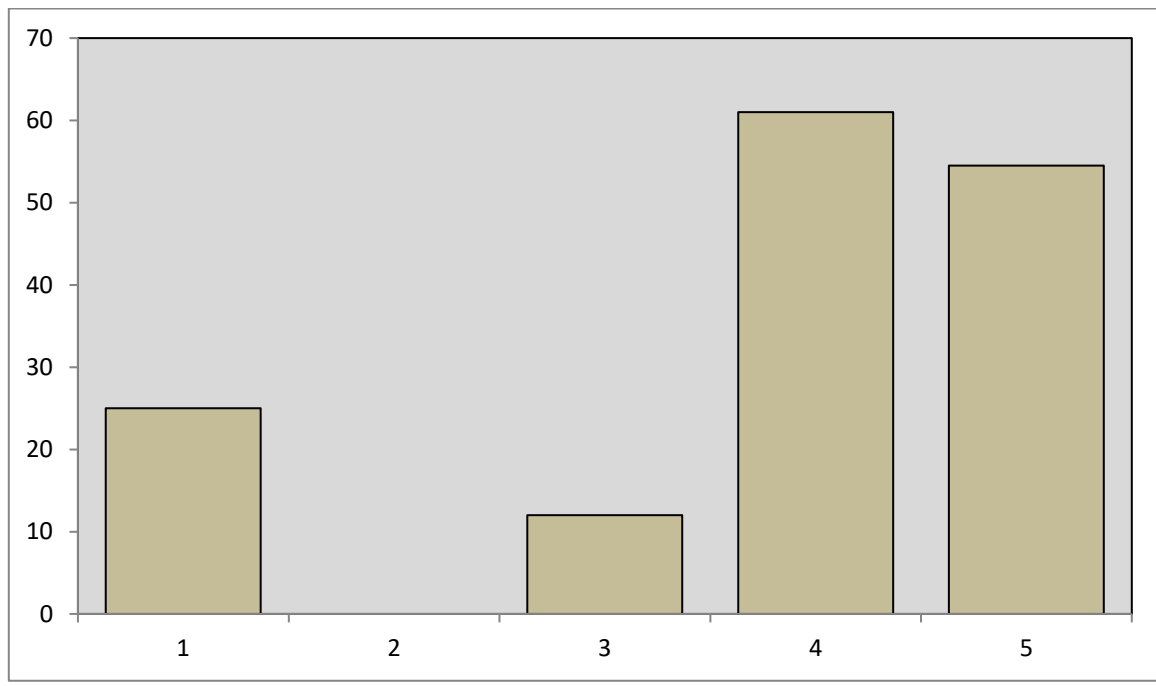
**Statistics**

WHICH ONE DO YOU CONSIDER AS THE MOST IMPORTANT POINT WHEN PURCHASING A SMARTPHONE?	
N	Valid 105
	Missing 0

**WHICH ONE DO YOU CONSIDER AS THE MOST IMPORTANT POINT WHEN PURCHASING A SMARTPHONE?**

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid				
High Quality	89	84.6	85	85
Less Price	16	15.4	15	100
Total	105	100		

## DESCRIPTIVE STATISTICS



## CROSSTABS

SPSS Viewer - \*Output2 [Document2] - SPSS Viewer

File Edit View Data Transform Insert Format Analyze Graphs Utilities Add-ons Window Help

Crosstabs

[DataSet1] C:\Users\admin\Desktop\RM\RM.sav

**Case Processing Summary**

	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Age Level * How often do you use Flipkart	105	100.0%	0	.0%	105	100.0%

**Age Level \* How often do you use Flipkart Crosstabulation**

Count		How much per day data you use on your smartphone?				Total
		Below 500MB	500MB-1GB	1GB-2GB	Above 2GB	
Age	Below 18	0	1	2	1	4
	18-21	0	14	8	36	58
	21-25	0	5	6	26	37
	25-35	0	0	1	0	1
	Above 35	0	1	4	0	5
Total		0	21	21	63	105



# T-TEST

SPSS Viewer - \*Output4 [Document4]

File Edit View Data Transform Insert Format Analyze Graphs Utilities Add-ons Window Help

Yes No Maybe

Do you think the product classification of Flipkart is reasonable

T-TEST  
 /TESTVAL=0  
 /MISSING=ANALYSIS  
 /VARIABLES=Frequent\_access  
 /CRITERIA=CI(.9500).

**T-Test**

[DataSet1] C:\Users\admin\Desktop\RM\RM.sav

**One-Sample Statistics**

	N	Mean	Std. Deviation	Std. Error Mean
How much per day data you use on your smartphone?	100	3.3300	.72551	.07255

**One-Sample Test**

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
How much per day data you use on your smartphone?	45.899	99	.000	3.33000	3.1860	3.4740

SPSS Processor is ready.

## **4 FINDINGS**

In the current running world the elder group in the sample area still are not used to the smartphones as they seem to face issues in using and feel not so friendly to use or in other words they don't feel smartphones much handy for them. This issue raised as the older generation does not need latest technology on such regular basis, at that age most of the tech needs are fixed according to their need and wants. Evolution of smartphones made it easy for majority of the age categories but yet the most elderly users have fixed needs and wants.

Through the time smartphone have evolved and upgraded at a rapid rate and many new and advanced features have been introduced since the day and still continuing to develop further features to make human race easy and more efficient.

Majority of the smartphone users prefer using a single smartphone but some officials have to use more than 1 as to fulfil their office and personal needs. Many companies provide a smartphone to their employees for the office and professional use hence respondents have more than 1 smartphone.

When asked personally many users were using the Redmi/MI smartphones as they feel Redmi/MI provides advanced features in low price. But for other respondents Oppo/Vivo was prime choice followed by Apple and One Plus on 2<sup>nd</sup> preference and Samsung on 3<sup>rd</sup>.

Lately the telecom companies have raised their recharge plans due to many factors which effected the yearly budget of smartphone users and hence our result showing at least 60% of the respondents with a yearly budget on smartphones more than 2,000.

The research was done during the period of the pandemic of COVID-19 (Coronavirus), every respondent is following the lockdown declared by the government which might be reason for our response to the per day data usage question. 80% of the respondents use data more than 1GB per day(40% between 1GB and 2Gb, 40% above 2GB).

The results to question 7 shows the growth of e-commerce in the world as more than half of the respondents prefer using online purchase but still 26.6% respondents prefer showrooms and 11.4% respondents prefer exchanging old smartphone for new which does benefits them in the form of discount.

The smartphone applications attract the customers most according to the survey but camera features is still close enough with 30.48% of respondents

## **5. LIMITATIONS**

- The scope of the project is limited to selected regions of INDIA hence taking these responses to study the behaviour of entire nation might be difficult.
- For the project only 105 respondents have been studied according to their response to the questionnaire. Due to many factors it was difficult to study more respondents.
- Even after such growth and development in the IT sector of the nation there are regions where smartphones are not considered as a handy device. People struggle to adapt the technology and advancement of the technology.
- Since many people are still not in contact with the rapid changing and growing world they have to hustle to catch-up with the advance technologies and developed devices/features of smartphones.
- Since many respondents of elder age category face difficulty using advanced feature smartphone they skipped the questionnaire.

## **6. CONCLUSION**

Hereby I conclude from the research that;

- Before purchasing a smartphone the brand name does effect the decision of the customer hence the companies should focus on gaining public trust and effective marketing techniques also.
- Majority of the respondents gave 4/5 rating to the operating platform/system they use which shows that the development of smartphones is heading to a correct direction but also considering the 23.8% of the responses which are not satisfied which the operating platform/system the tech system in smartphones still need many changes and new features.
- Public expectation from the smartphone operating system has more towards fast and easy usage but there are noticeable interests on rich user interface and rich navigation.

Summarizing the conclusion by me on the basis of the research done above, the evolution of technology in the smartphone have an impressive speed but there is still many factors and new advanced features which humans have to launch in the tech market and help in easy and efficient human life.

## **7. SUGGESTIONS & RECOMMENDATIONS**

- For future development companies need to focus more on application development also as in this research it was concluded that customers prefer development of applications on 1<sup>st</sup> priority.
- Samsung needs to improve its marketing strategies and device features to make an effective product to increase public trust and product demand.
- Telecom companies need to make more handy devices for old age category users as while doing the survey it was noticed as those users were un-aware of many key features of the smartphones they were using and hence faced difficulty using them.
- At this point of the market major part of the smartphone users have a open budget for smartphones and related expenses hence the telecom companies can make the best use it by introducing attractive schemes and advanced features in the coming devices.

## **8. BIBLIOGRAPHY AND WEBLOGRAPHY**

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## **9. ANNEXURE**

### **EVOLUTION OF TECHNOLOGY ON SMARTPHONES**

1. Name \*

Your answer

2. Age \*

- ☐ Below 18
- ☐ 19-21
- ☐ 21-25
- ☐ 25-35
- ☐ Above 35

3. Gender \*

- ☐ Female
- ☐ Male
- ☐ Prefer not to say

4. How many Smartphones do you own? \*

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ More than 3

5. What brand phone do you use? \*

- ☐ Samsung
- ☐ Apple
- ☐ One Plus
- ☐ Oppo/Vivo
- ☐ Other:

6. What is your yearly budget on smartphones(in Rupees) \*

- 0-500
  - 501-1000
  - 1001-2000
  - 2000 above
  
- 7. How much per day data you use on your smartphone \*
- Below 500mn
  - 500MB - 1GB
  - 1GB - 2GB
  - Above 2GB
  
- 8. How do you prefer purchasing your phone? \*
- Online shopping
  - Showroom
  - Second Hand
  - Exchange of previous phone
  - Other:
  
- 9. What is the main feature that attracts you while deciding on a smartphone? \*
- Applications
  - Camera
  - Internet connection
  - Other:
  
- 10. What do you expect from an operating system of smartphones? \*
- Fast and easy
  - Should provide rich user interface
  - Should provide rich navigation
  - Easy to upgrade
  - Other: