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"How can radical innovation bring back product competition in a stagnating smartphone industry?"

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ABSTRACT

The aim of this thesis is to investigate and analyse the smartphone industry and the company, HTC, within this industry, in the hopes of finding a radical innovation that could generate product competition, in this stagnating industry.

This bachelor thesis is divided into two parts where one of them is performing an analysis and the second is developing a product concept. During the first part, information will be collected and analysed from literature papers, as well as two professionals from the multinational company Thomson Reuters. The second part deals with all of the ideation and realisation of a product concept, based on the information that were analysed during the first part. Additionally, the marketing of the product concept will be made in order to make sure that the product could be diffused well if it were made. After all of this, a user testing made under semi-structured interviews was realised in order to gain some insights to how people feel about this radical innovation and if they have any suggestions to improve this one.

The researches have led to the conclusion that radical innovation is one of the only way to bring back product competition in this industry, due to the fact that an incremental innovation cannot impress the potential users, who have grown accustomed to the technology, making them harder to impress. Nevertheless, this radical innovation must be useful and interesting enough for the user to actually make a difference.

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INTRODUCTION

The topic of this case study is to solve a problem in an important industry which is the smartphone industry. Its importance is not only present in terms of economic reasons, but also in terms of technological advancements. Indeed, in years prior to 2016, smartphone companies took risks and wanted to differentiate themselves by bringing unique designs and unique features into their high-end devices. All of this made for an exciting industry with high product competition. People were buying and people were interested, more than ever, in what companies had to offer. Though, in 2016 marks the first time that the smartphone market has gone flat, and this is mostly due to the lack of innovation and lack of creativity that the smartphone manufacturers put when designing their newest flagships. This lack of exciting products was not only noticed by consumers but also by professionals working with or on the smartphone industry, stating that this industry is nowadays "a bit boring".

Therefore, the goal of this thesis is to see whether it is possible to bring back product competition within the smartphone industry. In order to do this, it is needed to first gain insight on both the smartphone industry as a whole, as well as a specific company from it, HTC, in the hopes of bringing back product competition thanks to a feasible product concept. This product concept will be made as if HTC were the ones manufacturing the product, giving sense to the product concept, as well as give guidance to the project. Accompanying the product concept will be a marketing plan according to HTC's resources, in order to ensure the best diffusion of the product, which will help in giving excitement towards the mentioned industry.

Why HTC? HTC has always been an innovation driven company, and their numerous awards in this sector can prove it. Having a solid market share from 2009 to 2012, HTC has not managed to make as big of an impact on the industry since, due to marketing deficiency, leaving Apple and Samsung to dominate the market. Their position in the market as well as their innovation-driven strategy is the perfect combination to create an effective product concept that will hopefully bring back product competition in the smartphone industry.

For ensuring optimal results and making the project clear, the progress will be split into two parts. The first part will deal with all of the literature research necessary to understand the smartphone industry as well as the smartphone company HTC. Several business models will be introduced in the industry analysis, helping with the understanding of HTC's position as well as where the future of the smartphone lies, hence, where HTC's resources should head towards. The second part of the thesis will be everything related to the development of the product with the research on potential customers and the steps to achieve the most exciting product. Finally, the thesis ends with the evaluation of the product, as in if the potential consumers are in fact excited about such a product and if the goal of the thesis was achieved. It is also the section where time is taken to reflect on the thesis, as see how it would have been possible to make the process simpler and better.

PART I - ANALYSIS

INDUSTRY LEVEL

The smartphone industry is one of the fastest growing industry ever to exist, and is most likely one of the most important industries, with a product that people cannot live without nowadays. With the smartphone sales stagnating for the first time since its introduction in 2007, an analysis to why that is will be made, as well as an analysis of what can help bring back increasing smartphone sales will also be made. All of this will help the answering the research question: How can radical innovation bring back product competition in a stagnating smartphone industry?

1. WHAT IS A SMARTPHONE?

A smartphone is a complex device capable of many great things. As they are getting more powerful and more efficient, their uses go beyond the device alone as they are able to control (to some extent) external devices wirelessly, such as cars for example (more on this later). Therefore, it is important to get a clear idea of what a smartphone is, what it can do and its limits.

A smartphone is essentially a mobile phone with computer like features. Smartphones are considered to be an extended version of a PDA [1] (Personal Digital Assistant), combining PDA functionalities with cellular capabilities, such as cellular calling, texting and data. Nowadays, smartphones go deeper into the computer features, thanks to their considerable increase in processing power. Although the term PDA is no longer relevant, they basically have the same features as they are both able to run a bunch of useful apps (clock, calculator, camera to name a few), as well as being able to connect to the internet allowing for browsing the web, viewing and replying to emails. All of this is done in a mobile package that one can put in his pocket.

In this mobile package, multiple components can be found [2]. The main ones are the processor, called a CPU (Central Processing Unit) acting as the brain of the device, processing all of the information needed in order to perform a task. Associated with the processor is the GPU which is the Graphics Processing Unit, which handles any types of graphic processing, such as 3D modelling or lighting that will be shown on screen. GPU's are mostly used when playing games which is filled with 3D objects and animations. GPUs perform these intensive tasks so that the CPU doesn't need to take care of these. Another component associated with the CPU is the RAM (Random Access Memory) which is a form of data storage for storing frequently used program instruction, allowing for the increase in speed of the system and the decrease of work from the processor. All of these information are either processed in the background, without the user knowing, or shown on the device's display.

Nowadays flagships phones usually have a screen between 4.7 inches to 6.2 inches, with resolutions of either 1080p (1080x1920) or Quad HD (1440x2560). The resolution of a screen is the number of pixels that the screen has: the more pixels, the sharper the images on the screen is. Although having a high resolution screen is great, it does not necessarily result in better screen quality as other factors come into account in regards to screen quality (brightness and type of screen to name a few). Another important element in the smartphone is the battery. The battery is the source of power of the device, which allows for the device to be used without a power plug. The CPU, GPU and screen greatly impacts the battery if not optimised well. Furthermore, all smartphones nowadays have front and rear facing cameras for taking pictures and videos. Finally, smartphones nowadays have all of the essential wireless connectivity such as Wi-Fi, Bluetooth, cellular connection (up to 4G), GPS, NFC and many more.

On the software side of things, smartphones all are ran under a specific Operating System (OS). For most phones, this OS is Android, whereas the iPhone runs under IOS. An OS is a software system that manages all of the hardware inside of the smartphone and provides the services necessary to run programs or apps [3]. The operating system also accounts for the User Interface (UI) of the product, as well as the User Experience (UX). When looking at Android phones, most of the manufacturers decide to use their own altered version of Android, shaping the UI and UX to their liking.

Now that all of the main specifications of a smartphone has been mentioned, we can now look at the history of the smartphone with the evolution that goes with, starting from way back, in the 1990s.

2. HISTORY

For a big part of the population it's hard to imagine a world without this one device that wakes us up in the morning and that allows users to listen to music with, play games, read emails, watch videos and many more, while being able to sit right into the user's pockets [4]. Of course, this one device, the smartphone, was not always present. In fact, in the 1970s, such a device that could combine both telephony and computing was only a concept by researchers. It was only two decades later, in the early 1990s that this concept became true, with companies like Nokia with their Nokia 1011 (1992) and IBM with the IBM Simon (1994), bringing out mobile phones with a few (limited) computer capabilities on the market. The Nokia 1011 which came out two years prior to the IBM device, was much more limited, could only display two lines of black and white text, and had only an address book as a computer functionality. Though, the IBM Simon had much more PDA (Personal Digital Assistant) like capabilities, with several computer functionalities implemented, such as an address book (up to 99 personal contacts), a calendar, a calculator, a world time clock and the ability to view and answer emails thanks to cellular connectivity. Although this was not the first PDA, which was the Apple Newton MessagePad in

1993, it was definitely the most impressive one at the time. The first PDA, the Apple Newton, came with Newton OS 1.x, which came with handwriting recognition. This software had some trouble reading the users handwriting. Palm on the other hand, at the time, had a much better handwriting recognition with their Palm Pilot 1000 and 5000 which wowed the crowd [5]. They became very popular thanks to their low price and their ability to "HotSync" with computers through serial cable. Palm later dropped the "Pilot" name due to a law suit from the pen brand "Pilot". Their PDA's were then renamed the Palms, which were still popular devices at the end of the 90s and early 2000s.

During the second half of the 1990s, companies saw the potential in this market and started to join the industry [4]. Qualcomm, IBM, Nokia, Palm, Ericsson and Blackberry were some of the more famous brands in this industry, and used many different operating systems, such as BlackBerry OS (Blackberry), Windows Mobile OS (which later led to Windows Phone), Palm OS, Symbian OS (Nokia) and many more. In the late 1990s and early 2000s, Blackberry started to affirm themselves as a leader in the smartphone industry and increased their popularity in the US over the years. Success was mainly towards enterprise customers, as their secured emails and full-feature miniature keyboard made it interesting for businessmen often on the go, who have to reply to emails quickly everywhere. The introduction of the 3G network in the early 2000s helped smartphone manufacturers, as data speeds were greatly increased which made browsing the web, retrieving and sending emails much faster.

Although these devices could be considered as smartphones, their limited capabilities and speed didn't allow for them to become a "fully general-purpose mobile computing device". This device came in 2007, with the release of the anticipated Apple iPhone by Apple's CEO and Co-founder (at the time) Steve Jobs. This device set a new standards on what a true smartphone could and should be, thanks to their innovative full touchscreen design, the inclusion of 3rd party developed apps thanks to their AppStore (in 2008), a powerful and new mobile operating System called IOS, as well as all the connectivity and hardware features needed to really make this a smartphone (WIFI, GPS, GSM/GPRS/EDGE, Bluetooth, a 2.0 megapixel camera and more). It then inspired Google to compete with this device, thanks to the introduction of the first phone based on Google's open-platform operating system, the HTC Dream under Android OS, which came out in late 2008 [6]. The rise of Android came with the idea of an operating system that was free and open to all [7]. This means that anyone is allowed to use and/or modify any part of Android's code. With this, carriers and manufacturers could both benefit from such a system, where the manufacturer is able to use freely an operating system and a carrier is able to modify its code to add certain functionalities. Android grew strong with big OEMs (Original Equipment Manufacturer) like Motorola, Sony Ericsson (now Sony), LG, Samsung, and many more joining the Android community. Though, in 2016, Google joined the other manufacturers and made their first in-house device called the Google Pixel. This phone had a big impact on the Android community, as it delivers a pure Android experience and shows to the public what Google thinks a "pure Android smartphone" should be like.

Back in the years from 2007 to 2012, multiple operating systems were still used somewhat equally, with OSs like Symbian OS, BlackBerry OS and Windows Phone OS still present. As of today, a lot of the firms have failed to make it in the smartphone industry, and are either struggling to get back up (Nokia, BlackBerry) or have discontinued their products (Windows Phone). These "slowly dying" companies such as Nokia and Blackberry have decided to make their last attempt in this industry, by using a slightly altered version of the Android OS. As a result, the smartphone industry has become a duopoly industry on the operating system's level, with only IOS and Android clearly dominating the industry. Though, while IOS from Apple remains closed and exclusive to the iPhone, Android has spread to many companies from all over the world, and is the most popular OS in the world, with around 87% of the population using Android and around 12.5% using IOS [8].

3. IMPACT ON THE WORLD

The smartphone has been one of the quickest technological and economical advancements in any industry ever. Back in 2007, a lot of the population never considered buying a smartphone. This was especially true for women, as smartphones were more targeted towards businessmen. Though, as time went on, smartphones grew in popularity thanks to their many features and apps that were both useful and entertaining. The adoption of smartphones have gotten to the point where people have completely changed their behaviour due to these devices.

In 2016, the number of smartphone users has surpassed the 2 billion user mark, and it is found that roughly 2 million smartphones are newly activated daily [9]. Furthermore, it is estimated that by 2020, a total of 6 billion users will be reached, accounting for more than 70% of the population. While the Western smartphone market is slowing down, the emerging market isn't. With more and more budget phones available to the public, it is estimated that countries like India, China and Africa will have increasing numbers in terms of smartphone sales as the years go by. Though, sales are not the only number that is increasing. Indeed, over the years, as smartphones got better with more functionalities and better apps, addiction towards them is also on the rise.

In fact, not only did women adopt smartphones with a 64% increase in adoption from 2010 to 2012, but in that last year, around 51% of mothers admitted that they were addicted to their smartphones, consuming media such as videos, Facebook, Instagram and Twitter on a daily basis [9]. Furthermore, smartphone usage between women and men are completely different, as women will "more likely share, take picture and play games on their devices, while men usually watch videos and read the news more frequently", as taken from mobilebusinessinsights.com [11].

When it comes to the youth, kids have gotten so used to phones and tablets that more of them know how to work a smartphone than can tie their shoes. Another interesting number is that teenagers from the age of 13 to 17 receive and send around 4000 messages monthly, which accounts for roughly 150 texts a day. This

means that young users nowadays do not call one another, but instead text, mostly by the usage of social messaging platforms such as WhatsApp, Facebook messenger and others.

In fact, social media is a big part of why people use their smartphones. It was estimated that the average smartphone owner spends around two hours (a bit less) daily on social media apps daily. In fact, social media mobile applications are the apps that people spend the most time according to research. In figure 1 below, it can be seen that 29% of time spent on a mobile app is spent on social media, with Facebook being the most used mobile application [64]. The mobile applications usage have also increased thanks to the increase in speed, quality and cost reduction of mobile connection, which is predicted to increase year by year. In fact, according to a report made by GSMA, it is predicted by that 2020, the average user in America will consume 22Gb of monthly mobile data, and the average European user will consume 12Gb monthly. [73]

FIGURE 1: TIME SPENT BY USER IN THE APP ACCORDING TO CATEGORY

Furthermore, with the consumption of digital media increasing, users are consistently switching between apps, to the point where, on a daily basis, the average user will open 28 apps and will check his/her smartphone at least 46 times a day. In fact, more than half of those owning a smartphone will immediately check their device after being awake. This is also due to the fact that most smartphone owners use their smartphone as an alarm clock [11]. In addition to all of this, it is worth mentioning that the majority of growth in digital media comes from mobile device, which as a result, nowadays, people use more their smartphones than their desktop/laptop, making computers their secondary device.

With all of the applications available to users and all of the different uses that smartphone has, the smartphone have disrupted many industries. Smartphones are so capable devices packing so much technology, that communication and media is not the only industries that have been disrupted (daily newspapers, pocket digital

cameras, physical books, MP3 devices, GPS devices and many more), but also payment methods, such as money transfer or payments (Android pay and Apple pay), television, with video streaming services available on smartphones (Netflix, Amazon Prime Videos, and many more) and potentially many more, such as the laptop industry and the whole identity of people. This means that passports, identity cards and driver's licences will all be made accessible on the smartphone, resulting in the end of one device that will carry everyone's identity, payments, keys, media systems and even people's working tools. [72]

4. Dominant design

Any given industry usually follows the same cycle. This cycle was given by James Utterback in 1978 and is called the Product Life Cycle. In this cycle, Utterback states that three distinctive phases could be found: the fluid phase, the transition phase and finally the specific phase [11]. Utterback states that by the time an industry reaches the specific phase, a dominant design, which is a design widely and distinctively adopted by many manufacturers (more on this in this chapter), should rise within the industry. Therefore, it will be seen in which phase the smartphone industry is located at and whether or not a dominant design has risen in the industry.

In the beginning, during the fluid phase, the market is shared with a lot of different companies, all working on increasing their market share and creating a strong brand name. With this, competition is fierce and companies release multiple handsets a year with radical innovation on board in the hopes of getting the attention of a large percentage of consumers [12]. Radical innovation is a term that differs in its definition. Though, one aspect of the definition that is recurrent is that a radical innovation is an innovation that differs distinctively from any existing products, and as a result has a significant impact on a market, both technologically and economically [74]. An example of a radical innovation was the first iPhone released in 2007, disrupting the simple phones' industry, as well as many other industries (MP3, PDA's to name a few).

The transitional phase is characterised by the concentration of the industry as the lowest performing firms are pushed out of the market. Indeed, companies work on improving their internal innovation and product capabilities, by using incremental innovation over their previous devices. Incremental innovation, as opposed to radical innovation, is when the innovation is only an upgrade compared to its predecessor, making the innovations more discrete. Usually, incremental innovation helps in the diffusion of radical innovations [74]. The biggest example of this is with the "S" version of the iPhone (Eg: iPhone 4S) which doesn't change the design, but only upgrades its internals (processor, RAM, screen and many more) to give a better performing product. In this phase, it is also possible for companies to bring out new products using radical innovation, if they think that it could launch a new line of products. Although sometimes this strategy could not work, like the HTC Evo 3D, it is possible that the taking this sort of risk pays off, like Samsung did with their Galaxy Note line up, which came out in 2012.

When coming into the final phase, the specific phase, a widely accepted product line by the consumers can become a dominant design, where a product's architecture will become imitated and improved on by at least most of the companies that are remaining in the industry. A dominant design, as defined by Utterback, is "a single architecture that establishes dominance in a product category" [12]. As the industry reaches maturity, it becomes less about innovation, but more about the business aspects, such as reducing manufacturing costs as well as research and development costs, since all, or nearly, of the innovation in their devices are incremental innovations.

At that moment, product design becomes standardised between companies, to the point where the differences between competing versions of the product are so small, that the design of the product does not constitute a source of competitive advantage. As a result, the emergence of a dominant design greatly impacts the market shares of the companies within the industry. An example for with was in the computer industry, where the emergence of a dominant design came under the term "Wintel" in the late 1990s, which is the combination of Microsoft's "Windows Operating System" and Intel's processors [71]. During the emergence of a dominant design, large companies generally focus on competing with others in terms of price while smaller companies focus on market niches.

Within the phone industry, the product life cycle can be noticed, as Graze Cecere explains it in his paper "Is there a dominant design in the smartphone industry?" alongside Nicoletta Correcher and Ricardo David Battaglia [12]. In his paper he analyses the smartphone industry by applying the Product life cycle by Utterback in order to answer his research question.

With this, Cecere states firstly that there is an empirical evidence that shows that there is an emergence of a dominant design, at least in regards to hardware features of phones. Indeed, Cecere explains that while only 30% of smartphones had a touch screen in 2007, this number has risen up to 95% in 2012, and has kept growing since. This increase in hardware feature also accounts for others such as 3G connection (35% of smartphone had it in 2006, while in 2012 90% of smartphones had it) or even the 3.5mm headphone jack (less than 10% in 2006, 95% in 2012). Cecere also mentions that the weight of the smartphones have all become very similar, suggesting that the "degree of differentiation in relation to hardware features is being reduced".

Though, Cecere in his paper, released in 2014, concludes that the emergence of a dominant design cannot be concluded, as the software features on smartphones are still too different from one another, as well as the rise of new handsets released which greatly increased since 2007 due to new companies trying to take a piece of market share in the smartphone industry. Though, as of 2016, it seems that the emergence of a dominant design has finally risen. Indeed, in an article by Owen Williams from thenextweb.com [14], this journalist states that "smartphones are just boring slabs" where "all those crazy choices and designs converged into one design, produced by many". In this article, he explains that the phones performances are too similar for them to be compared, as all flagship phones are very powerful and capable, and all have great hardware that makes it nearly indistinguishable to decide a clear winner (for example, in the camera department, no clear winner could be

found between the Samsung Galaxy S6, the iPhone 6 and the LG G4, it all depends on preferences). Williams goes on saying that launch events will lose their appeal, as people will not be as interested as they once was. In a discussion with the global head of applied innovation at Thomson Reuters, this "inexcitement" was confirmed as he himself is not impressed with what smartphones have to offer these days, stating that the smartphone industry is "a bit boring these days". Although, both the article and the professional from Thomson Reuters agree that the future of the smartphone industry will head towards software innovations, and that this sector is where manufacturers could really differentiate themselves and offer unique experiences.

It is worth mentioning that, according to McDermott and O'Connor's paper, radical innovation is "critical to the long-term success of firms". Indeed, in this paper, McDermott and O'Connor explains that, while incremental innovation helps in the diffusion of radical innovation, an incremental innovation cannot be made possible without the introduction of a radical innovation. This means that on the long term, it is crucial for companies to release radical innovations, as these "provide the foundation upon which future generations of products are manufactured". Within the smartphone industry, a proper radical innovation hasn't been noticed in at least a couple of years. As a result the incremental innovations are not as powerful as they all rely on innovations that were introduced a few years back. [75]

5. INNOVATION AND ITS DIFFUSION

Smartphones are high-tech products which consistently try to innovate, especially when it comes to flagship phones. Since the introduction of the iPhone back in 2007, the smartphone and the technology inside of it has evolved so much. Almost every aspect of the device has seen a fundamental upgrade, with a new innovative technology that just came out of the R&D department. In order to make the most innovative smartphone concept, all of these innovations must be researched and analysed upon.

All of the upcoming phones in the paper were checked on the website gsmarena.com [15]

DESIGN
As the design of the device needs to be practical, aesthetically pleasing, nice to the touch and durable, it is a feature that manufacturers can not overlook. In this department, huge innovations have been made, raging all the way from the materials used, going from "cheap looking" plastic to using strong aluminium with different manufacturing techniques, all the way to useful features such as waterproofing or even "indestructible phones" [16]. Back in 2010, nearly all phones, as different as they were, used some sort of plastic, that, as practical as it was for networking purposes, made the phone seem cheap and not durable. In that same year, the iPhone 4 made a big impact design wise with the use of glass and metal for a more premium feel. Later on, in 2013, HTC understood the importance of premium quality materials, and revolutionised the smartphone design pattern using an all-around metal phone in their HTC One. This design was copied by many companies as the

material choice and design was really appealing. In addition to that, with this device, they standardise the use of stereo front facing speakers for several years. During that same year, Sony introduced a Waterproof smartphone with IP57 rating (water resistant up to one meter and thirty minutes) which also became a standard feature later on. Fast-forward to 2016 where Xiaomi released a "bezel-less phone" to show off their technological prowess. Although not very practical, this device shows a tremendous amount of innovation on the technology side, with a considerable aesthetic innovation. On top of that, this phone uses a ceramic back which helps with the durability, as claimed by Xiaomi. An evolution of the smartphone design over the years can be found in APPENDIX A.

SCREEN

In terms of hardware, big improvements can be witnessed. Probably the biggest one is the screen, in terms of both resolution and quality. The first iPhone which came out roughly 10 years prior to this paper, had a screen resolution of only 320x480, on a display size of 3.5", giving it a total of 163ppi (Pixels Per Inches). Although at the time this was revolutionary, companies understood that the screen being the main interaction between the smartphone and its user, needed a bigger and better screen. In the year of 2010, most screen were between 3.5" to 4" with a resolution of either 480x800 or, for the iPhone 4, 640x960 (giving it a 330ppi pixel density). In the year of 2012, with the introduction of the Samsung Galaxy Note, the term "Phablet" (Hybrid of a "Tablet" and a "Phone") came into place, thanks to their massive 5.3" display, with a resolution of 800x1200 (with a smaller pixel density of 285ppi). Although a lot of people thought that 5.3" was "way too big for a phone", it got a lot of attention, forcing the other manufacturers to make phones with bigger screen. Shortly after, in 2013, the average screen size for a phone was 4.5" it 4.7", with a full HD screen, meaning a 1080p display (1080px1920). In that same year, the first Ultra HD (resolution of 1440x2550) phone was introduced by Vivo with their Xplay3S, which came with a massive 6" display, giving it a huge 490ppi. Although from 2014 to until now, manufacturers equip their smartphone with Ultra HD displays (except for the iPhone still using 1080p displays), in 2015, Sony unveiled the first ever 4K smartphone, having a massive screen resolution of 2160x3840, giving it the biggest pixel density ever on a smartphone of around 806ppi. In 2015, the introduction of the first dual curved screen came to the market, with the Samsung Galaxy S6 Edge, following from their single curved screen from the 2014 Galaxy Note Edge. Furthermore, nowadays screens are brighter, more colour accurate than before, using Super AMOLED or Super LCD capacitive touchscreens, and being more resistant with a protective glass embedded on top of the screen called Gorilla Glass from Corning.

CAMERA

The camera is the second area where companies managed to drastically innovate. At the start of the industry, camera phones were of bad quality, going only up to 2 MP (Megapixels) and taking videos were not possible. As time went on, camera quality got better, filming was made possible and a front facing camera for skype calls or taking selfies was introduced. In 2011, the first 3D dual- camera setup was unveiled with the HTC Evo 3D [17]. In 2012, Google thought that camera innovation should

not only come from the hardware, but also the software, by introducing Photosphere, which essentially means that the user can take 360-degree all around panorama photo, so that the picture could become more immersive. Furthermore, filters and effects became increasingly popular in the camera app. In that same year, Nokia brought out the PureView 808, a 41MP smartphone camera, the highest megapixel resolution camera at this point. On the other hand, HTC, in 2013, suggested that, instead of going towards more megapixel, cameras should focus on bigger megapixels in order to capture more light. As a result, in the same year, HTC unveiled the first "UltraPixel" camera, which uses 2 micrometers pixels, instead of the competition's 1.4 micrometers [18]. This increase in pixel size lead to the new pixel size standard of 1.55 micrometer pixels nowadays. Camera quality got a huge upgrade on the front facing camera as well thanks to the "selfie madness" which begun around 2012/2013. Companies put a lot more attention in the front facing camera, with even developing some new products that mainly focuses on the front facing "selfie" camera, like the HTC Desire Eye (13MP front facing camera) and the Lumia 730 "selfie phone". Camera quality also increased thanks to tools that helped stabilise the phone and/or help with focusing, such as IR-Laser focusing or OIS (Optical Image stabilisation). In 2016, HTC were the first to introduce both front and back OIS-equipped smartphone with their 2016 flagship the HTC 10. In 2016, LG also introduced an interesting dual-camera setup on their LG G5, with one main camera having a standard 78° angle of view, and a secondary one having a bigger 135° angle of view. Also during that year, Huawei teamed up with Leica to also give a dual-camera setup, but instead of having the secondary camera use a wider angle, the secondary camera was a monochromatic camera allowing to capture more details, as well as true black and white photos. Finally another dual-camera setup that was introduced in that year was the iPhone 7 plus's one, which enables for a two times optical zoom, allowing for a bigger depth of field, perfect for blurring out background images.

NETWORK

The cellular network allowed for some major improvements in world communication came from a long way. When the first generation, named 1G, cellular connection came out in the 1980s, although revolutionary, it was very limited in what it could do [19]. This technology introduced the mobile voice services, which allowed for the communication between two individuals, as long as they were not too close to one another to avoid interferences, and supported only one user per channel. Furthermore, since it was analogue, it large and heavy, used a tremendous amount of power and was very cost ineffective. It was then replaced around a decade later, when 2G came into place. 2G was a much bigger improvement over its predecessor, using digital, it had more voice capability and was able to send simple data (below 0.5 Mbps) such as texts and emails. At the start of the 2000s, 3G was introduced. With better data speeds (around 63 Mbps), it allowed users to be connected to the internet and give them a nice user experience. 3G connectivity helped smartphones grow in popularity, as they had a lot of functions that were internet-based. In the 2010s, 4G hit the market with more data capacity reaching a maximum data rate of 300 Mbps, support for more channels which results to the support of more users and low latencies, improving user experience. 5G is supposed to be hitting the market in

the early 2020s, following the tradition of a cellular upgrade every decade, which will be an overall upgrade over 4G and reaching data speeds 10 to 100 times than today's 4G, with even less latency. In June 2016, speeds such as up to 10 Gbps were achieved in the lab, which is promising for when 5G will come out in the 2020s, at least in terms of speeds.

SECURITY

Smartphones are the devices most susceptible to being stolen, both in terms of digital theft, as well as hardware theft. As of 2011, smartphones are the most stolen type of property, surpassing even hard currency [9]. Although passwords to unlock the device were already present from the start, many users did not want to use them as they are too cumbersome and takes too long each time. In 2013, Apple made the fingerprint scanner, becoming a standard on midrange to flagship devices [15]. Only using a press on a button and an unlocking rate of less than one second the adoption rate drastically increased compared to the traditional password to unlock. In 2016, Samsung introduced another alternative, the Iris scanner which requires even less effort, as all you need to do is look at your phone. Going deeper into security, a completely secure smartphone called the Blackphone was released in 2014 with a special operating system called Silent OS (based on Android), which promised "privacy without compromise" [20]. For the more mainstream market, Android and IOS update their phones regularly upgrading their respective security patch, making sure that every piece of information is encrypted from the start. Furthermore, BlackBerry making Android phones since 2015 also promises a completely secure mobile experience, thanks to their DTEK software embedded into their every smartphone [21].

SOFTWARE

Software is as important, if not more, when it comes to the user experience of the phone. A phone that doesn't have any software features, or just lags will not do well. In both these cases, the smartphones software has come from far and will be going even further. Big software improvements for both IOS and android came in the stability department, aesthetics and feel of the OS, but also in feature. Tests on the failure rate of the operating system have been conducted to see how stable on OS is. In 2010, the failure rate of IOS was of 2.1 within the first 12 months (meaning that the phone would crash about 2.1% of the whole time of us under 12 months) while most Android phone's failure rate was of around 6.7% (Motorola and HTC were the more stable phones with 2.3% and 3.7% failure rate respectively. Nowadays, the failure rate of IOS is slightly about 1% while the one of Android is just below that same 1% with 0.75% [22, 23]. Feature wise, both of these operating systems included voice assistants, Siri for Apple which came in 2011 and Google Now for Android which came a year later, which gradually became better at recognising speech, but also transitioned into becoming personal assistants under app form, coming with some AI features, such as knowing where and when you are going to go to give you traffic updates and so on.

THE FUTURE OF SMARTPHONES

Smartphones manufacturers all have big plans and different strategies when it comes to the future of smartphone technology. Some believes that the future is virtual reality (such as HTC or Samsung) or augmented reality (Apple, Google) and some believe in making phones modular (Motorola), allowing your phone to be a loud speaker or even a project, thanks to accessories that you can attach directly on the phone. Another possible direction where the smartphone industry could head towards is the near bezel-less display phones, as it was witnessed with the Xiaomi Mi Mix in late 2016 [15]. This always to witness more content on a bigger screen (this device features a 6.4" screen), while still having a reasonably small footprint. With having such big displays while still keeping the portable phone factor of the smartphone, the smartphone industry is overtaking more and more the tablet industry, dying year by year, as seen on the graph below (figure 2), with sales going down since 2013.
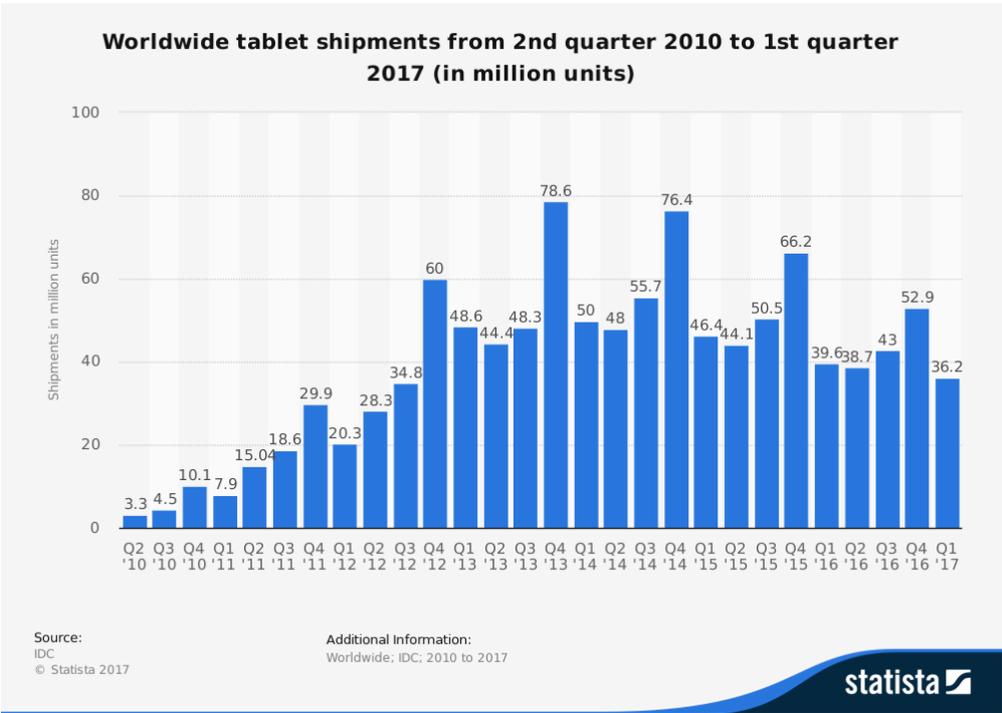
FIGURE 2: TABLET SALES OVER THE YEARS [24]

Though, in a discussion with a professional in the mobile industry, he qualifies VR and AR as "a neat trick that people are going to be wowed by it, but I don't see it as mainstream technology". He believes that these technologies are good in other sectors such as education and science, but will not add any value to the smartphone industry. This goes against the opinion of the head of mobile Business of Thomson Reuters, who does believe that AR could be a really big innovation in the future. Indeed, although the head of mobile business is also against VR as it's "too heavy on the brain and the eyes, and also the fact that you can't see where you are going", he claims that the conditions are not applicable to AR, and the information one could extract out of AR is enormous, much bigger than VR for example. Furthermore, the

last professional suggested that when AR will be coupled with AI, it will be really interesting. The example the professional gave was "when walking in the streets of an unfamiliar city and you start to get hungry, you can ask for a place to eat and the AR device will be able to show you all the relevant information towards food in a useful way".

This professional believes that the future of the smartphone industry will not come from any hardware add-ons, but more in the software and services department. When asked what he believes to be the future of tech should head towards, the reply was that "Smartphones are now rectangular pieces of glass that all kind of look the same, so where are you going to differentiate? […] Now, nobody notices the difference between a 10 megapixels camera and a 12 megapixels camera, so the only thing you can start to innovate on, in my mind, is software and services: the capabilities of things that the device can do for you and the way the device will radically change the things we do. As an example: Voice assistants such as Siri, Google assistant and Amazon echo, they are pretty cool as they give us a preview of how we can interact using voice. But the real big breakthrough for me is the replacement of the wallets that we carry. They (smartphones) are going to be the instruments of our money, identity and of basically how we get things done. An example for this is cars, as now smartphones are the key to our self-driving cars, but also in hotels, where we can now use our smartphones as hotel keys thanks to the NFC chip on our phone. The phone is going to be the gateway for everything that we do". Both professionals believe that the future will come be able to simplify everything that humans do, and that we will only need to carry one device for basically everything. This means that the smartphone will be in the centre of the tech universe, including everything from homes, being able to control lights and shutters, as well as all home appliances, all the way to cars, and the replacement of laptops. In fact, both of the professionals that were interviewed believe that the smartphone will disrupt the laptop industry, once they find out a way to expand the screen to a larger one (for now, for example, Windows Continuum could do this task).

One of the areas where both Thomson Reuters employees believe will have a huge impact on the future of technology is AI, with companies such as Apple and Google which are currently experiencing on this technology by putting a lot of resources into this sector. All of the companies working on AI have this shared belief that smartphones in the future will be able to learn from everything that we do and predict what we are going to do next, hence giving us the information before we even ask for it. Furthermore, it is hoped that the voice assistants in the phone will be intelligent enough to have a proper conversation with the human, as if the device was in fact another human being, understanding exactly what the user wants, as well as what the human means, reading his or her emotions.

All of these services will be accompanied by The Cloud, as all of our data will be stored on there. Nowadays, all, or at least more businesses are shifting towards the use of Cloud solutions thanks to Amazon Web Services (AWS) or Microsoft's Cloud computing solution, to store all data as the costs are decreased compared to having their own servers, and all data is directly backed-up, meaning that all data is secured, even in case of accident.

DIFFUSION OF INNOVATION

According to Rogers, "diffusion is the process by which an innovation is communicated through certain channels over time among the members of a social system" [25]. Therefore, Rogers states that there are four elements in the diffusion of an innovation: 1) an innovation 2) communication through certain channels 3) Over time 4) thanks to a social system. Rogers describes diffusion as a "special type of communication in which the messages are concerned with a new idea". Although one would think that great innovations would diffuse quicker thanks to an increase of communication around the innovation, it is most often not the case. In fact, Rogers claims that most innovations diffuse at "a surprisingly low rate". Therefore, what makes an innovations diffuse quicker? Rogers states that there are five qualities that determine the success of an innovation.

1) Relative advantage

This is the degree to which the innovation is perceived by the focus group as better than the innovation that precedes it. The new innovation must have economic, social, convenience or satisfactory advantages compared to previous versions of that innovation. The greater the relative advantage is perceived, the more likely the innovation will be adopted quickly. In fact, this is one of the reasons why the smartphone got adopted this quickly as it killed the need for other cumbersome product such as a calculator, a separate camera, a flashlight and many more. The smartphone was and still is a device that managed to combine utilities from other devices, making it a product with one of the best relative advantage to date. In terms of the smartphones themselves, unlike at the start of the industry back in 2007, nowadays, most flagship smartphones are similar in terms of functionalities that no real relative advantages could be found between one device compared to another. It mostly falls down to preferences.

2) Compatibility with existing values and practices

This is the degree to which an innovation goes with the values, practices and needs of the potential users. If an idea is already widely adopted, the new one will be adopted quicker if it doesn't change the way people used the previous innovation (E.g.: backwards compatibility). In order to accommodate for this, both Android and IOS have a transfer tool to get all the users data from their old device to the new, no matter what OS they were using previously (easy to go from Android to IOS or vice-versa). Furthermore, all iPhones use the same lightning port, meaning that most of the accessories (except for phone cases) will be usable on the new iPhone that users upgraded to. This is the same for Android devices, as now, all Android devices use a USB type-C port that is also being used by laptops additionally.

3) Simplicity and ease of use

This is the degree to which an innovation is perceived as being easy to use or simple to learn. If an innovation takes less time to learn then it is more likely to spread rapidly. This was and remains one of Apple's main strength in the smartphone industry, as their software was the easiest to use back in 2007, and to some people, still is the easiest OS to operate. Apple understood that the phones at that time were

too complicated and only made for a niche of people. When Android was launched 2 years later, its main complaint was that it was too complicated for most people. Google then made huge efforts to simplify the OS, and succeeded at doing so. With the combination of more choices and affordable price, Android rapidly became the most popular mobile operating system in the world.

4) The ability to try before using

This is the degree to which an innovation can be experienced (on a limited basis) before use. This trial reinsures the user who might have been considering using it. Within the smartphone industry, these trials were made thanks to electronic shops (MediaMarkt, Darty and so on), as well manufacturers' personal shops (Apple Store, Samsung Store). In fact, one of Apple's main advantage compared to Android is their Apple Stores which are widely popular and users have the ability to try out every single one of their products. Furthermore, in these store, there is also the possibility to talk to a professional if an error occurs with the product, giving the user even more confidence towards the brand.

5) Observable results

If an innovation is successful, positive feedbacks and results will come back from it. These positive results will reinsure the potential users and allow for a quicker adoption of the innovation. Usually, the results are observable thanks to word-of-mouth communication, as well as reviews online on a product or a certain technology. These reviews are made either by consumers who really enjoy the product, or by reviewers online (tech-websites or YouTubers). Smartphone companies hand-out their products before the original release date so that these reviewers could use the phone before everyone else and give their experience with the device. They do this in order to confirm or reinsure potential buyers that their products are great and that these potential users will be satisfied with their new product.

According to Everett Rogers, these five qualities determine between 49 and 87 percent of the variation in the adoption of new products.

Marketing, as well as trust, is also a decisive factor when it comes to adoption. While marketing is good to spread the idea, trust is what will make people adopt it or not. Ideas given by people that one knows-and-trusts or even a professional in this field (for example a doctor recommending a specific medicine) will be more likely to be adopted, than if a random stranger tries to persuade someone is adopting a certain innovation. Furthermore, the willingness for one to adopt or resist an innovation also determines the rate of adoption of an innovation. Rogers explains that there are five types of people when it comes to the adoption of an innovation (as shown in figure 3): Innovators, early adopters, early majority, late majority and laggards.
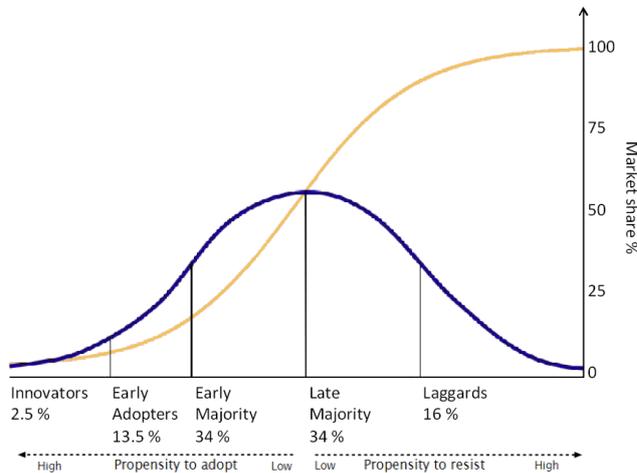
FIGURE 3: DIFFUSION OF INNOVATION GIVEN BY ROGERS.

6. COMPETITION

PORTER'S FIVE FORCES MODEL

The five forces that Porter gives is a great tool to analyse the industry. Though, it is only powerful if the forces in this model are understood correctly, meaning that indicators are there to explain the forces. In Robert Grants "Contemporary strategy analysis" [26] he explains what the structural determinants of these five forces are, by showing the strength of each of the competitive forces that are found in the model. These can be seen in figure 4 just below.
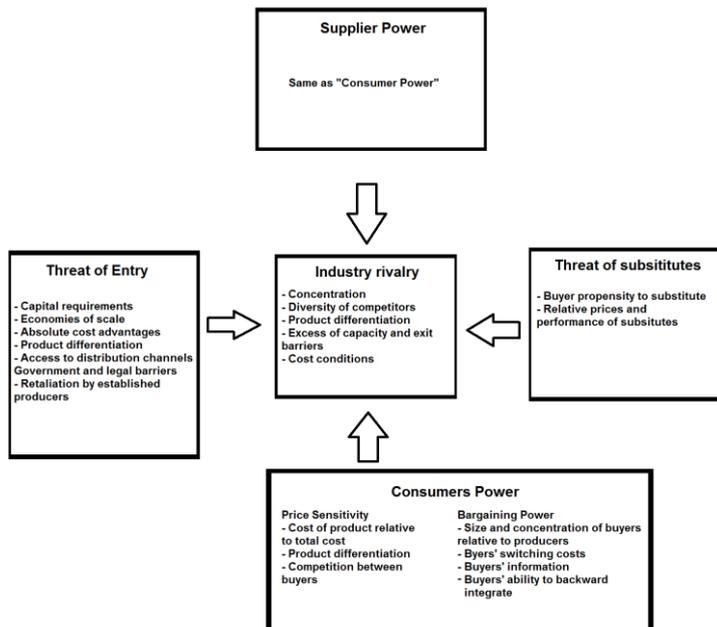
FIGURE 4: INDICATORS OF PORTER'S FIVE FORCES MODEL

Thanks to these indicators, it is possible to determine precisely whether the forces are low, mid or high. With this, it will be possible to discover the opportunities and threats that the smartphone industry has.

IN THE SMARTPHONE INDUSTRY

Bargaining power of customers - High

Using the indicators given by Robert Grant, it can be said that consumers have a huge power on the smartphone industry. First of all, the competition between buyers is huge. Smartphones are a very personal device, and one will judge another according to what device this person has. Between IOS and Android there is a huge battle, with iPhone owners saying that Android users are either geeks are cheap people, whereas Android users say that iPhone owners a pretentious and know nothing about technology as their device is overpriced. Furthermore, the smartphone is one of the biggest market, with many companies offering different features. Recently, there has been a rise of Chinese smartphone manufacturers in the Western side of the world, meaning that consumers have a lot of solid choice for a relatively cheap price. With all this, manufacturers recently have made it extremely easy for users to switch from one device to another. This is also true when going to a device on another platform (Android to IOS and vice-versa).This means that when switching to the other OS, all of the data will be transferred within minutes.

Bargaining power of suppliers - Mid

For the most important components, manufacturers made long term deals with suppliers (Qualcomm, Google, Corning, and much more), in order to limit the power of suppliers. Apple has had some problems with their suppliers, as some of their suppliers, such as screens, processors and batteries are rival companies (LG, Samsung), resulting in them putting more pressure on Apple by upping the prices of the components. On the Android side, all OEMs rely on Google's software Android which is free of charge. Though, if Google decides to put a price on their software, OEM's would need to either yield under Google's pressure, or find another alternative. Though, it is very unlikely that situation occurs, as according to one of the professionals, licensing software is what lead to the fall of the Symbian OS

Threat of new entrants - Mid

New companies are entering the smartphone industry every year. With Android being free for all, it is easy for companies to jump on board this rewarding industry. Companies that are present in other industries, some of which are not even related to this one, try to pierce into the market. Companies in the camera, display or even construction industry, such as Sharp or CAT, have made at least one attempt to creating a smartphone under Android, showing off their respective industries' technology (Sharp developed a bezel-less display, CAT created an "indestructible" smartphone for workers). Though, many of these companies fail to make any real breakthrough in the smartphone industry, either by not having big access to distribution channel, or by not making radically different products, or even by targeting a too small niche of people (such as CAT), making them quit completely the

smartphone industry, or satisfy themselves with the small amount of market that they manage to grab. For a new entrant in the industry to make it, their product must be radically different than any other in the market, as well as have certain deals (cheaper price, by a product get a free other product, to name a few).

Threat of substitute products - Low

Although manufacturers brought out some products that was believed to grab some of the market share from smartphones, such as tablets, smartphones have too big of an impact on people's life to be replaced thanks to their portability, capabilities and their screen that is large enough to view content on. As a matter of fact, most products or technologies related to the smartphone are complementing this industry, potentially boosting devices. These products include smartwatches, virtual reality and augmented reality headsets. Furthermore, the smartphone is such a complete device that people have no wish to substitute it with another, all of what people want is to be able to connect to all devices around thanks to the Internet of Things (IoT).

Rivalry within the industry - High

The smartphone industry is highly competitive. Indeed, it might be one of the most competitive industries, if not the most competitive. Companies spend millions on research & development and marketing to grab as much market share as they possibly can. With so many companies producing good quality smartphones, one mistake from a company can make them lose a numerous amount of customers to another company. Furthermore, the rise of Chinese manufacturers coming with cheaper priced phones whilst still ensuring good quality created even more rivalry, as manufacturers with premium price needed to find innovations that would justify the high price of their device. In addition to all this, the different price range within the industry means that product differentiation is high, meaning that one could chose exactly the device that fits to his/her needs.

With all of this said about the smartphone industry, these researches and analysis will help in the realisation of the project. Though, before the development of the product concept can be started, in order to give a better focus to the project, it is important to look into further details a specific company within this industry: the HTC Corporation.

COMPANY LEVEL – HTC

The industry level analysis helped in getting a better understanding of the industry, as well as see what potential this industry still has if it continues to grow as it once did. Nevertheless, in order to give better guidance towards the realisation of this project, which is generating product competition in the smartphone industry thanks to radical innovation, the product concept will be made under HTC's branding, utilising their resources. Though, before this could happen, it is crucial to analyse this company in order to understand its evolution and its placement within the industry, as well as gaining knowledge on what technology could be used to achieve the goal of this project.

1. HISTORY AND EVOLUTION

HTC is a Taiwanese tech company founded in 1997 by Cher Wang and Peter Chou [27, 28]. HTC originally started off as an ODM (Original Design Manufacturer), designing and manufacturing devices such as phones and tablets under another brand name, and then also became a OEM (Original Equipment Manufacturer) creating designs under their own brand name. In 1998, HTC designed some of the world's first touch and wireless handheld PDAs [29]. Later, in 2002, HTC created the first Microsoft-powered smartphone code-named "Merlin". Following their partnership with Microsoft, they later on, in 2005, created the first 3G Microsoft phone. A year later, they were the first company to bring out a phone with an integrated GPS. While their partnership continued with Microsoft, in 2008, after concluding a deal with Google, HTC created the first Android phone the HTC Dream, consolidating their role as an OEM. From then on, HTC brought out many devices under their own brand name such as the HTC Hero (2009), the HTC Desire (2010), the HTC Legend (2010), as well as bringing the first phone under Google's name, the Google Nexus One (2010). With the coming of the HTC Hero, they brought out their own Android overlay called HTC Sense, to simplify the use of smartphones and make the software more intuitive. With so many devices released in 2010 (a total of 12 devices) HTC pushed to promote their phones, creating the slogan "Quietly Brilliant" and the "YOU" campaign, which was HTC's first global advertising campaign, promoting the focus on the customer [30]. Also in that year, HTC managed to deliver the first 4G smartphone in the US with the HTC Evo 4G. Finishing off that year, HTC became one of the launch manufacturers of Windows phone 7 with their HTC HD7, HTC Mozart and HTC Trophy, alongside Samsung, LG and Dell. During that year, HTC was ranked 31st most innovative company in the world, thanks to all of these devices and industry firsts [29]. With 2010 being a good year for HTC, both in terms of sales and innovations, 2011 was accompanied with some rewards and acquisition to help them grow even more. With HTC's market value surpassing the one of Nokia's making them the third most highly valued smartphone company in the world (behind Apple a Samsung), HTC came in 98th place in Interband's list of Best Global Brands

rankings, and valued it at $3.6 billion. In terms of acquisitions, HTC became the majority owner of S3 Graphics and acquired Dashwire for $18.5M [31]. Furthermore, a strategic partnership was made between Beats Electronics and HTC, which involved in acquiring 51% of Beats' shares [32].

With the rise of the two giants Samsung and Apple, HTC lost much of its market share in the U.S. In addition to that, a management restructuring was made, making them lose $40M in the process, as well as reselling 25% of its shares to beats [33]. In the first quartile of 2013, HTC's year-to-year profit dropped by 98.1%, making it the smallest-ever profit for the company [34]. During that year, HTC made an attempt to bring back their profit with the HTC One (M7) which won numerous awards including Best Smartphone of the year during the Global Mobile Awards and many more highlighting its design and innovations. Although one of the most awarded smartphones ever, the HTC One did not manage to bring HTC's profit back up as in Q3 of 2013 HTC posted a net loss of $101.3million [35]. Analysists claim that the lack of sales of the HTC One came from the ineffectiveness of HTC's marketing effort at that time [41]. The successor to the HTC One, the HTC One M8, managed on the other hand to help boost up the sales, shortly upon its release in March 2014, it became the company's fastest growth since October 2011. During that year, Google chose HTC to make its Nexus 9 tablet, consolidating Google's and HTC's partnership. On March 1st 2015, HTC unveiled the Vive, a virtual reality (VR) headset in collaboration with Valve Corporation [36]. Though, sales in terms of smartphones declined with the HTC One M9 being a critical and sales disappointment, as well as Samsung and Apple increasing in popularity. Having a lot of focus on virtual reality, HTC launched "Viveport", a VR app store focused on non-game VR experiences [37]. Also during that year, Peter Chou, HTC's CEO since 2005 stepped down and was replaced by co-founder Cher Wang [38]. In 2016, HTC unveiled its 10th flagship smartphones called the HTC 10 which was received by critics but did not manage to sell as well as HTC hoped to. When the phone was revisited by certain popular reviewers such as Mr Mobile and Android Authority it was named "The best 2016 smartphone that people weren't buying" [39, 40]. HTC saw year-to-year sales decline every month in 2016 apart for the month of September.

2. CORPORATE STRATEGY

SWOT ANALYSIS

Having won numerous awards for most innovative product, and being ranked in the top 100 most innovative companies in the world, HTC is undoubtedly an innovation driven company. Being aware that innovation falls as one of their main strength, they manage to create innovative products that are critically acclaimed by reviewers and tech journalists. Though, even with these critically acclaimed products sales are not on the rise, and this is due to some of their weaknesses, where one of the biggest is marketing. Though, with having on board the most popular OS in the world, Android, they could potentially take advantage of this popularity to increase their sales if they manage to take the rise of cheap quality Android phones seriously and understand

how big this threat is. With all of this said, HTC has many more Strength, Weaknesses, Opportunities and Threats that will be looked and analysed thanks to a SWOT analysis.

Strength

- Strong R&D department
- Aggressive innovation with multiple awards and recognitions
- High end phones are praised by reviewers
- Wide range of diverse products (vast range of product portfolio)
- Strong impact in VR (HTC Vive) which is considered to be a strong technology for the future
- Has complete control over its supply chain
- Partnership with Valve for VR
- Close google partnership could help them get back up (Google has a lot of resources)

Weaknesses

- Unaggressive marketing
- Too similar products when it comes to high end phones
- Declining brand awareness over mainstream consumers
- Financial issues
- Problems in company structuring (restructuring in 2012 and 2016)
- Patent wars: HTC paid Apple and Nokia

Opportunities

- Android is the most popular OS on the market
- Market is stagnating in terms of sales and innovation
- Markets becoming interesting in emerging countries

Threats

- Strong competition from Apple and Samsung, with better marketing budget
- Cheap phones are increasing in terms of quality (OnePlus, Motorola)
- Chinese manufacturers are increasing in popularity in western market, creating good phones for a cheaper price
- Google could put pressure on OEMs by licensing Android
- Consumer are more and more demanding

FIGURE 5: HTC SWOT ANALYSIS

Analysis

HTC has for a long time relied on their innovations to create brand awareness, allowing them to save money on marketing. Though, with the strong competition from Apple and Samsung since 2012, HTC's brand awareness has declined to the point where only tech enthusiasts and reviewers have a clear idea of what HTC is releasing these days. Overshadowed by Samsung's and Apple's marketing budget of respectively $363 million and $351 million, in the U.S only in 2013, HTC has a hard time to compete with their marketing budget, which in 2013 in the U.S was just shy of $76 million, with only $1.5 million spend in the last quartile of that year, compared to Apple's massive $128 million marketing budget in that same period [41]. In 2013, HTC's flagship smartphone won numerous awards with one of them being the "2013 Smartphone of the year award" ahead of both Apple's iPhone 5S and Samsung's Galaxy S4. Their lack of marketing made the HTC One "completely overshadowed by its rivals", as explained by CNET. With number reaching a critical point for HTC, if HTC doesn't overcome this weakness in regards to marketing, the end for HTC would be sooner rather than later.

Another problem HTC has to face is the rising of cheap Android smartphones that are increasing in both quality and popularity. The famous tech reviewer MKBHD regularly states that "Good phones are becoming cheap and cheap phones are getting good" [42]. With smartphones like the OnePlus 3T coming in about 300€ less than any other high end flagship while still having the same specifications and functionalities as them. Though, their reduced price means that sacrifices need to be made, and usually these sacrifices come in the camera department, as well as the screen department. Nevertheless, a not-selling-well company like HTC should still be careful of being replaced by one of these companies which are increasing in popularity. Indeed, Chinese manufacturers such as OnePlus or Huawei have increased in popularity during the last couple of year, to the point where Huawei is the 3rd company in terms of market share in the U.S and Europe behind each time Samsung and Apple, a place HTC occupied in 2012 before going down drastically. By the beginning of 2016, their market share is barely non-existent, not even going above the 2% mark worldwide [43].

Though, their reoccurring strength of innovative features in their devices, HTC has had more often than not critically acclaimed devices and highly awarded devices, especially in the "Most innovative device" field [44]. This strength is important for HTC's survival, but not unique as other companies such as Samsung and LG are also very innovative. Though, with the consumers demanding more and more in terms of quality, critically acclaimed smartphones could be helpful to gain the customer's attention. HTC has a uniqueness compared to other OEM's and this uniqueness comes from its ODM capabilities making them have complete control over their supply chain, as well as their close relationship with Google which is stronger than any other company at the moment, thanks to their shared software patents [45]. This relationship could help HTC in terms of software, but mostly in terms of resources and marketing, which is something HTC desperately needs. Another advantage that HTC has over its competitors is the VR experience that comes with the HTC Vive. Although not the only phone manufacturer with a VR headset, the HTC Vive is the only standalone VR headset with a dedicated app store, meaning that it doesn't really on smartphones, and could help them in recognition considering how well received the HTC Vive is in the 3D modelling world, as well as linking this device to their smartphones, creating a unique experience. This is a big and unique opportunity for HTC, as virtual reality could be "the next best thing" when it comes to technology.

SUBSIDIARIES

Since 2004, HTC owns Dopod International Corporation, a Taiwanese manufacturing of communications and related equipment company.

In 2011, HTC finalised the acquisition of S3 graphics, an American computer graphics company, by becoming the majority owner. HTC acquired S3 graphics for $300 million. Also in that year, HTC acquired Dashwire, a mobile-web connected service (known as Cloud services) company [31].

VERTICAL INTEGRATION

According to Business dictionary a vertical integration is when a company has the entire control over the entire manufacturing process, from raw goods to the end consumer. This integration can move forward (forward vertical integration) which is oriented toward the end consumer, or move backwards (backwards vertical integration), oriented towards raw materials and goods production [46].

If a company opts for a forward integration, it means that they control the distribution centres and retailers where the products are sold. In the other case, if they opt for a backwards integration, they control at least part of the supplies necessary in order to produce the device. Of course, a company can opt for both forwards and backwards integration called a balanced integration, reducing costs of production and shipments in the end.

As HTC was originally founded as an ODM, their integration is based on the backwards integration, as they control their entire supply chain. This control allows HTC to reduce manufacturing costs, as well as have a smaller amount of pressure from external suppliers.

HORIZONTAL INTEGRATION

Once again, according to Business dictionary, a horizontal integration, as opposed to the vertical one, is when a company decides to merge or make an acquisition of another company in certain business activities that are at the same level of the value chain [47].

Within its years of activities, HTC has acquired multiple companies, where only three of them still belongs to them: Dopod international, Dashwire and S3 graphics, to boost respectively communication hardware, Cloud Services and their graphics sector in smartphones. Other companies that HTC acquired or merged with, such as Beats Electronics, fell through.

PARTNERSHIPS

For this section, all of the information is used from HTC's website in the "partners" section [48]

Google – HTC has a close and long term partnership with Google, owner of the Android operating system. This partnership is stronger than most, starting already since 2009, when Google asked HTC to build the first Android phone, the HTC Dream. Google then asked HTC to build the first Nexus phone called the HTC Nexus One, which is essentially what Google thinks a phones hardware should resemble when using Google's pure Android software experience. This phone was also made to promote the manufacturing brand HTC, as it was HTC's brand name that was put on the phone, not Google. HTC was called once again to manufacture the first Google Pixel phone in 2016, which is the first phone released under Google's name. Their partnership also extends to the software department, as Google approached HTC in 2015 seeking help into building a more reliable, simple and intuitive OS for

the Android operating system. With all of this, it can be said that HTC's partnership is stronger than any other Android OEMs, which could be beneficial to HTC's survival.

Qualcomm – HTC also has partnerships with Qualcomm providing them with certain components such as the processor and Wi-Fi modules.

Fitbit – Having released a couple of fitness devices themselves, HTC wants to appeal to the sport enthusiast. A partnership was made with Fitbit was made in 2014, where HTC would have Fitbit's mobile app directly installed, and would help the user track their basic activity.

Corning – The display is the main interaction between the user and the device, it is then essential to protect it. For a few years now, HTC have been partners with Corning, a protective glass company to ensure that the screen won't scratch or shatter.

Pioneer – One of the main features of the HTC One released in 2013 was its ability to produce great audio. HTC then partnered with Pioneer to promote its seriousness towards audio.

Yamaha – HTC also partnered with Yamaha to promote their audio capabilities that they produce in their phones.

Volkswagen – Having a Car software feature that makes your phone more car-friendly by simplifying its layout and functionalities, HTC partnered with Volkswagen which will mimic HTC's software on their dashboard when an HTC phone is connected to the car.

THE 4 E'S OF HTC'S CORPORATE STRATEGY

These are based on the slides from LinkedIn, addressing the 4 E's of corporate strategy [49].

Extend

HTC is extending its business into another technological business: Virtual Reality. With the coming of the HTC Vive, a virtual reality headset developed in partnership with Valve. HTC is taking VR really seriously, considering that it is a promising future technology in many educative and medicinal fields. Furthermore, VR could be interesting for a smartphone company as VR and smartphones are linked, as it was shown by Google or even Samsung.

Expand

HTC is still in the smartphone race, bringing out at least a new flagship phone in 2017 code named the HTC U 11. With this phone, the "U" campaign will be launched, expanding from the "YOU" that HTC released back in 2011. Aside from HTC's upcoming 2017 flagship as well as the HTC Vive, no other products expansion was given by HTC.

Exit

HTC said to be dropping the low-end smartphone market in 2017 as the reward from low-end phones is not high enough. This is due to the profit margins being too low. HTC instead prefers focus on mid to high-end smartphones that generates more profit per device sold, all in the hopes of making profits in 2017.

Enhance

HTC will enhance the HTC Vive with more applications coming for the device. It will also keep updating their latest devices, such as the HTC 10, with the newest version of Android coming in 2017 as well as the newest version of their in-house software overlay HTC Sense.

A CHANGE IN FOCUS

When Cher Wang was appointed as new CEO of HTC, the focus of the company slightly changed. Of course, HTC is still building smartphones with a new flagship coming out in 2017, but Virtual Reality seems to be of big importance as well to the company. Cher Wang explains that for her "VR is more important than smartphones" as "VR is the future as it could change the way people view medical practises, science and even education" according to her [50].

SUPPLY LINE

HTC has complete control over its supply line when it comes to manufacturing their own smartphones. Furthermore, with Google making their own product line since 2016 called the Google Pixel, HTC has become the official smartphone supplier of Google, manufacturing the device and branding it under Google's name, instead of their owns [51]. This means that HTC are now back in the ODM business, and receives money from both their own product line and Google's. Google having a lot of resources, HTC could potentially benefit a lot from this new situation if the Google Pixel product line manages to grab the attention from consumers.

3. BUSINESS STRATEGY

TARGETING GROUP

With the rise of quality budget phones, HTC's target group has switched. Although HTC started with the targeting of high-end devices back in 2010, they quickly saw the potential in developing countries and started to introduce more affordable phones, while still keeping their high-end devices. Nevertheless, starting from 2015, HTC decided to drop the focus put on affordable phones and push the high-end market, hoping to make bigger profits from them [52]. As a result, HTC is targeting the High-end consumers with at least basic knowledge on smartphones. This regroups innovators (reviewers, developers, and tech enthusiasts), early adopters and early

majority according to Roger's diffusion of innovation [25] (see figure 3 in Section 5 of industry research). HTC is also targeting the youth by making good looking, well performing smartphones without putting a premium price on the device with their A9 series [53].

PATENTS AND FUTURE TECHNOLOGY

HTC is an innovation-driven company with many technological resources, with having numerous current technologies, as well as numerous promising technologies to come. For the sake of the next phase, the ideation phase in Part II of this project, it is important to analyse properly what HTC can offer for now and for the near future. Indeed, not all patents and ideas are achievable in the next couple of years, as well as not all of them promise to ensure a quality product that customers would enjoy. For this, the research of every technology that HTC has will made, as well as an analysis of all of the patents owned by HTC, where only the most promising ones will be presented here. These promising ones will be chosen based on their title, if they could potentially be useful in at least one of the technologies mentioned in the "Future of technology" section, in Part I of the project. All of the patents, released in either 2017 or 2016, were found using "freshpatents.com" [68

- HTC Boomsound: Since 2013, HTC has renamed their speakers HTC Boomsound, which combines stereo speakers (originally front facing) and ensures an enhanced sound experience on the phone's speakers.
- "Multi-focal length range image capturing device" under USPTO Patent Application n° 20170171437: This is an invention which relates to an image capturing device having the ability to change the range of the focal length. HTC explains that is could be useful for medical devices, but could also have uses in AR as well.
- "Method of protecting power receiver and related wireless charging device" under USPTO Patent Application n°20170046541: HTC is working on the battery technology for phones, where more secure and faster wireless charging is one of the aspects that they are working on.
- "Image capturing apparatus and method for obtaining depth information of field thereof" under USPTO Patent Application n°20160292873: HTC is working on the use of two cameras, one primary and one auxiliary camera, in order to capture depth of field. This is useful in everyday photography for portraits for example (blurring out the background) as well as for AR, allowing the device know the dimensions of the object in real life, as well as knowing how close of far that object is.
- "Test apparatus and pressurizing assembly thereof" under USPTO Patent Application n°20170003307: HTC have teased that they will use pressure sensitive sensors in their future devices (starting from 2017) which allows for additional software functions when pressure is applied on the sides of the device. This patents confirms the feasibility of this technology. HTC named this technology "Edge Sense".
- "User interface adjusting method and apparatus using the same" under USPTO Patent Application n°20160246491: HTC wants to make it easier to

customise every aspect of the smartphones user interface, including the layout, the style, the font and the colour palette to name a few.
- "Display module" under USPTO Patent Application n°20160231774: This is a system which uses a different display module than most, meaning that the display has rounded corners, making the display more resistant and less prominent to breaking.

All of these technologies are HTC owned technologies and are ready to be used. While most technologies have already been implemented in a product before, the pressure function that HTC named "Edge Sense" will be a first in the smartphone industry. Thus, this could potentially be an interesting innovation that could help in creating product competition.

MARKETING MIX

Price

At product launch, HTC's pricing is very high since the demand is at its peak, as is with most smartphone manufacturers. When the sales figure drop later on, HTC is flexible with the price, and usually offer some kind of deal (this year, with HTC's 20th anniversary, a lot of deals will be made for most of their products). Furthermore, in the US only, HTC offers a deal where if you trade in your old HTC smartphone, you could get a new one for a good price, to show that they care about their loyal customers. This is partly thanks to better manufacturing and better management process, which has helped in cutting down the costs of manufacturing, giving the ability for HTC to provide various discounts to the public.

Place

For a few years now, HTC have sold their devices globally. They have various deals in more than eighty countries in the world, as well as at least one hundred and eighty five mobile operators which help distribute the devices. Furthermore, they sell their products in retail shops such as MediaMarkt, and in some developing countries, HTC sell their products in either malls or separate outlets that have experienced personnel in sales and can provide quality service [54]. HTC also sell their products online on their own website htc.com, as well as other shopping websites such as Amazon.

Product

HTC started out as design manufacturer (ODM), but later also became an equipment manufacturer (OEM), manufacturing their own devices under Android and Windows Phone. Now, they dropped Windows Phone to only focus on Android thanks to their high popularity. HTC have their own product lines all using Android with their own skin on top called Sense. Their new product line will be called HTC U, with the HTC U Play and U Ultra to be released in March 2017, and their successor to the HTC 10 will be the HTC U11 expected in May 2017.

2016 HTC Products [15]:

- HTC 10
- HTC 10 Evo
- HTC 10 Lifestyle
- HTC A9S
- HTC Desire 10 Pro
- HTC Desire 530, 625, 628, 630, 650, 728 Ultra, 830, 825

Promotion

HTC started off their promotional campaign in 2009 with their highly successful "Quietly Brilliant" slogan, as well as their "YOU" advertising campaign. From 2009 to 2011, HTC became a sponsor for a cycling team named "HTC – Highroad Cycling Team". A year later, they became the official UEFA Europa league and Champions League sponsor, with a contract duration of three years [30, 54]. In 2013, HTC dropped the "Quietly Brilliant" slogan as they didn't want to be "quiet" anymore. To prove their point, a two year contract with Robert Downey Jr was made a few months later. Though, HTC decided not to renew Robert Downey Jr's contract once over in 2015 [55]. From 2013 to 2015, HTC's flagship line was called the "One" series, trying to simplify its lines of products. As the HTC One M9 was a critical and sales disaster, they were forced to change their image, and decided to name their new product the HTC 10, as it was their 10th flagship smartphone since their debut in 2008.

4. PROBLEMS AND RECOMMENDATION

INDUSTRY IS HIGHLY COMPETITIVE

The SWOT analysis as well as Porter's five forces model shows us that the smartphone industry is highly competitive, especially from the two giants Samsung and Apple who are turning it into a duopoly industry. This competitive aspect comes from both the technological prowess that both these companies manage to put in their smartphones, as well as their marketing quality and budget which grabs a lot of attention from the consumers. This competition is powered by the impact smartphones have on the world and the money it brings. With HTC being so big back in 2010, they underestimated the competitiveness of this industry and were "too soft" on certain aspects that will be discussed further down in the paper. Their lack of competition compared to other companies greatly affected their brand awareness, as people don't even know what smartphones HTC are making, which as a consequence, has a negative impact on their sales.

The person in charge of the head of mobile business at Thomson Reuters has been working for more than 15 years in the mobile department and explained what goes through a consumer's mind when purchasing a smartphone. With Apple taking 90% of the profit of the smartphone industry, a lot of consumers are willing to pay a large amount of money for such a product. Though, when it comes to Android, many of the

consumers don't know what phone they want to purchase, meaning that when they walk into a store, all they know is what features they require and the price they are willing to pay for such a device. This means that when shopping for a device, these people will only get the phone that fits their requirements and could get a good deal out of it, not looking necessarily at the technical capabilities. This is a huge problem for HTC as, even if their devices are technologically advanced, a lot of people overlook their devices because they are too expensive for them. This professional gave an example, where he said "People are going to gravitate towards what the easiest and the cheapest […], you look at VHS versus Beta, Beta was the superior format but VHS won because it was cheaper and easier to use" and commented on HTC on this, saying "To put it back to HTC, people are not going to be drawn necessarily towards the technically superior solution, they are going to be drawn towards what fits what they want at the price they are willing to pay […] and how it fits their workflow".

MARKETING

One of the aspects where HTC was too passive on is marketing. CNET's article "Here's why HTC is losing the smartphone war" perfectly highlights HTC's sales problem with HTC not putting enough resources into their marketing [41]. Looking at their direct competitors Samsung and Apple, their marketing budget for 2013 were of $363 million for Samsung and $350.9 million for Apple, which is a lot more compared to HTC's $75.8 million budget. Surprisingly, Samsung's marketing budget is 463.8% higher than HTC's one. This problem explains why HTC's sales have not been doing well in the last few years, as all of their products are overshadowed by their rival's one, understanding the importance of marketing properly their products. HTC's lack of marketing comes from their strategy focused on innovation, which they believed would receive enough attention from the critics and tech journalists that it would manage to grab the attention from the mainstream consumers. Though, looking at 2013 again, HTC released one of the most innovative and rewarded smartphone with their industry changing HTC One, but with their shy marketing budget ($75.8 million compared to Samsung's $363 million) during that year, HTC's sales were disappointing. For indication, after one month of availability, 5 million HTC Ones were shipped, while for the same period Samsung managed to ship 10 million Samsung Galaxy S4 devices and Apple sold 5 million iPhone 5s within 3 days of availability [41].

HTC's marketing problem also goes further than their budget, as it also expands to their marketing strategy. Indeed, HTC uses Product-focused marketing which only appeals to the high-tech community when they are trying to simplify everything by using one name "HTC One" for multiple devices (just as cars do) in order to appeal more to the mainstream market.

With all of this said, it seems that HTC believes that the smartphone market is still at the growth phase of the product life cycle (therefore the transition phase), while this market is in fact in the saturation phase (specific phase). If this is the case, all of

HTC's marketing strategies are not fit for the current situation and needs to be modified to fit this current situation.

FINANCIAL SITUATION

With disappointing sales over the last few years (since 2012), HTC are having a hard time financial-wise. After posting their biggest quarterly loss ever in Q2 of 2015, HTC's stock price plunged to the lowest it has been in a decade, at just $1.99 per share [56]. During that quarter alone, HTC's quarterly loss elevated up to $252.7 million. In 2016, even with their well-received VR headset, the HTC Vive, HTC did not manage to make profit in 2016. With their revenue in decline in 2016, they did though manage to limit their operating loss in 2016 thanks to a 34% cost reduction over the year [57]. Though, their quarterly loss means that HTC has to be selective with their budget, meaning they probably will not spend much on their marketing, which could potentially be the solution to their problem.

RECOMMENDATIONS

Better target group

HTC needs to focus on profit instead of market share. Low-end products are good when it comes to market share, but doesn't produce enough profit as the margin between the manufacturing cost and the retail price is too small. For HTC's sake, they should quite this market all together and focus on their high-end segment only, where with the money saved from quitting the low-end market, could put it to could use such as in their R&D department, or best, their marketing department. Sony who has also had hard time financially in the last couple of years, losing money from their smartphones, only focus on the high-end market, and as a result, sell less phones but make (more) profits.

With the A9 being a reasonably big hit in Asia and Europe, with a rise in revenue in the month that followed the launch, this proves that HTC should continue to focus on making good looking, well performing smartphones as the market is there for it, with students or even adults not able or willing to pay over 700€ for a phone, but still wanting to get a solid and good looking device.

Marketing

It has been seen that HTC's biggest problem is marketing. With everything said until now, it is clear that HTC need to take risks and increase their marketing budget, getting at least closer to Samsung's or Apple's budget, if they want to stay in the smartphone industry. With the cutting of low-end smartphones as suggested in "Better target group" (see above), HTC could use this saved-up money to increase their marketing budget. The increase would also have to come from HTC willing to put in resources into this segment. Though, it seems unlikely that HTC would take this risk.

Something that could change in regards to marketing though is the way they handle it. HTC have not made good marketing decisions, and the reaction from the HTC A9's video proves it with a third of the people disliking the video (see figure 21 in the APPENDIX B), as well as Robert Downey Jr's $12M contract, that did not live up to its expectations and received very mixed reviews from the public. Furthermore, HTC do not seem to make the best out of Social Medias, which is a very big marketing tool nowadays. Indeed, Instagram has a very large amount of users with 700M users [58] (as of April 2017 according to statista.com) with 200M of them being active users. With the use of good targeted content and the proper use of "#" (hashtags), Instagram, as well as other Social Medias (Facebook, YouTube, Snapchat, Pinterest, Twitter) serves as a powerful tool to expand brand awareness. Furthermore, being able to post more personal information or behind the scenes or even exclusive benefits, Social Medias are a great way to make businesses more personal, as well as more relatable. With 880k, HTC is still quite far from Sony's 4.1M followers or Google's 3.9M (All of those numbers are as of May 2017) [59]. Furthermore, one of the main advantages of Social Medias is its price: unless a company posts paid ads, the use of Social Medias is free. With creative marketing on Social Medias, it is possible to create a huge fan base, as Daniel Wellington did (Instagram.com/danielwellington). Indeed, the founder of Daniel Wellington, Filip Tysander, made a successful watch brand mostly thanks to its marketing made uniquely on Instagram. With now 3.1M followers on Instagram (May 2017), DW, as abbreviated, is one of the most recognisable wrist-watch brands in the world (for comparison, Rolex, founded in 1905, has 4.2M followers on Instagram, whereas DW founded in 2011, has 3.1M. Rolex and DW both sell around 1M watches a year) [60].

Another solution when it comes to marketing, is marketing their strength. For an innovative company, HTC does not show it off. After analysing HTC's promotion on their high-end smartphones, HTC does not really promote their innovative advantage. Furthermore, a lot of their promotion does not appeal to the mainstream consumers as they are too technical, focusing too much on specifications, and should focus more on creating a need. Indeed, one of Apple's strength is their marketing department which manages to create a need, a must have for the consumer: "If I don't own this device, my life won't be complete". They do this by having consumer focused advertisement, instead of product focused advertisement like HTC has. Apple focuses on the social, intellectual or cultural impact of having an iPhone has on the consumer. For example, in one of their promotions, Apple shows off all of the different benefits the iPhone has on sports, and makes the consumer say "If I have this device I can do this!", creating a need in regards to sports. "What can you do with the device?" instead of "what can the device do for you?" (See figure 6 and 7 for comparison): HTC, building simple, reliable, fashionable and innovative smartphones,

needs to change their marketing proposition, and focus on how their smartphones can impact the user's daily life.

FIGURE 6: APPLE'S COMMERCIAL [61]

FIGURE 7: HTC'S COMMERCIAL [62]

Creating a Unique Selling Proposition

With such a competitive industry, it is important to create a Unique Selling Proposition (USP) to set the products apart from the competitors' ones. As the head of mobile business of Thomson Reuters mentioned in the interview, Android smartphones mostly look the same, meaning that when a customer with no specific product in mind walks in a shop, all that he or she wants is a phone that fits his/her needs and that he/she could get the best deal on it. It is then important for HTC to set themselves apart from the competition thanks to product differentiation, as well as the use of deals that could appeal to many people.

One of HTC unique selling proposition could be their advantage in the virtual reality department thanks to their HTC Vive. Indeed, VR becoming more and more popular, as well as important, HTC should combine both systems to create a unique experience. Whilst Samsung have already made a VR headset, the Gear VR, and sold more than 10 million units, it is still a mobile VR experience. HTC could bring it a step further thanks to their knowledge in VR coming from the HTC Vive, but needs to manage in making it easy to use and have an attractive price for the consumers.

Furthermore, with the smartphone industry being in the specific phase of the Product Life Cycle [11], a dominant design has risen within the industry: a metallic design with plastic antenna lines. HTC has been criticised in the past, noticeably with their HTC One M9, as it was too similar in regards to design, to their previous flagship smartphones, the HTC One M8 and the HTC One (M7). With HTC's resources in smartphone designs, they could create a clear unique selling proposition by designing their next smartphone in a way that is unique and sets itself apart from the rest of the devices within the industry.

Within this chapter, a lot of valuable knowledge on the smartphone company, HTC, were discovered. It can be seen that HTC is an innovation-driven company, with a lack of proper marketing. All of the technologies and patents mentioned in this chapter have potential to give an interesting product, although not all of them are radical innovations, at least at first glance. Therefore, it is important to ideate on these technologies and find a proper solution to the project. This will be done in the next part, Part II: Developing the product.

PART II

DEVELOPING THE PRODUCT

The analysis of both the smartphone industry and the smartphone company HTC not only enabled a better understanding on this industry and this company, but most importantly helped in figuring out in which direction the smartphone should head next in order to bring back product competition, according to HTC patents and resources. Indeed, thanks to the use of literature and the opinions of two experienced and highly ranked professionals, it is clear that the next radical innovation should come through software. With the hardware being so powerful, information can be processed much quicker and much better, allowing for the inclusion of many software features that previously it would be impossible to imagine. With all of this said, all of the tools are there to achieving in developing a product which includes at least one radical innovation interesting enough to bring back product competition.

1. IDEATION

RADICAL INNOVATION

The goal of this project is to bring back product competition by means of radical innovations. This signifies that the implementation of a completely new and innovative technology in the project is necessary in the hopes of achieving the goal. With all of the technologies mentioned above, although some might be radical innovations (Edge Sense for example), none of them are true game changers in this industry, at least as of right now. With all of the information gathered during Part I of the project, it is clear that this "game changing technology" should come from a software standpoint, rather than a hardware standpoint, as the capabilities of the former are much more impressive than the ones of the latter. This chapter is the part where the ideation process of these radical innovations will take place, and will be further developed later in the project.

- Edge Sense: patented by HTC in early 2017, this technology consisting of applying pressure to the sides of the device by "squeezing" the phone, has never been seen in any previous device before, all smartphone brands considered. This technology could be used to trigger certain actions when in use. Furthermore, 3rd party developers (such as apps developers) could potentially contribute with this technology by having certain features in their apps enabled thanks to a squeeze of the phone.
- Artificial intelligence: it is not new that Artificial Intelligence, or AI, is going to increase in importance in the next years to come. AI features have already been introduced in the past, with personal assistants such as the Google Assistant available on Android or Siri, available on IOS devices. The next question is how can AI be made into a radical innovation?

- Computer features: some believe that smartphones will one day replace tablets and laptops, as their hardware and software capabilities will be good enough to disrupt both of these markets. It is then important to figure out a way to make it go into this direction, thanks to the use of a radical innovation.
- Battery efficiency and (wireless) charging capabilities: it is not new that the smartphones Achilles heel is the battery-life. Therefore, if a radical innovation towards this technology could be found, product competition will be most likely be increased. If not, the charging of the battery could be another alternative towards battery-life, if a good enough radical solution could be found in this sector. According to what HTC is working on (see patents and future technology in Company level analysis), wireless charging seems to be the key for this company.
- Camera capabilities (AR): augmented reality could potentially be the next best thing. With companies like Google and Apple working on this technology already, a radical innovation towards this one could potentially be a game changer.
- Implementation with VR: with the HTC Vive's VR headset gaining in popularity, an implementation of this technology into the smartphone industry could set this company apart if done in a unique way.

FIRST PROTOTYPE

HARDWARE PROTOTYPE

Design is one of the main aspects where the manufacturers have stopped innovating, following a dominant design and reusing old designs. Phones are such a personal product that people carry around everywhere, meaning that the device should look good and feel good. Furthermore, the device should be radically different than any other device prior to this one, while still keeping HTC's design language. This with the combination of what people want [63], which is a device that has a big screen (for example 5.7") for a small footprint, a strong design, and a screen that doesn't crack, even when dropped on the floor. One of the most important aspects of the hardware design when combining all of the requirements is that it is still feasible to create by the company HTC, at least in the 2 to 3 years to come. With all of the hardware requirements, multiple sketches have been made (figure 8 and 9) to experiment on what the device should look like.
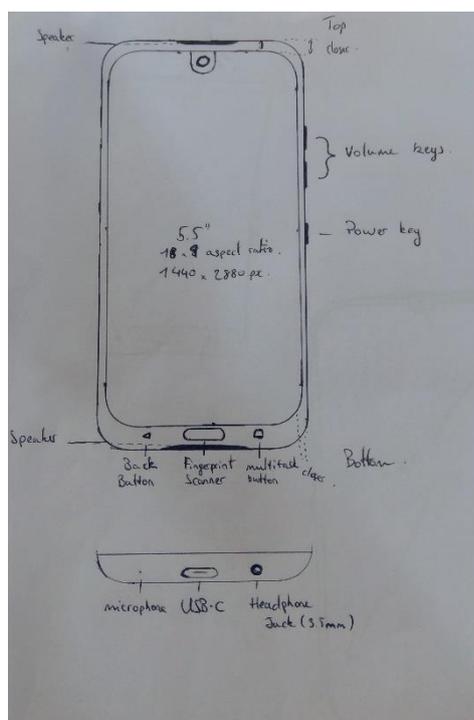
FIGURE 8: FIRST SKETCH
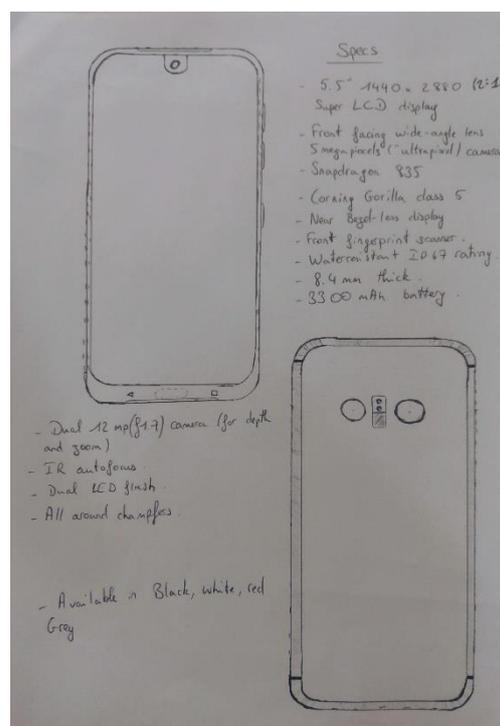
FIGURE 9: SECOND SKETCH

These sketches (not actual size) show off a smartphone with a big screen while still having a relatively small footprint thanks to near bezel-less sides and top, as small bezels on the bottom. Initially, the device was supposed to feature a 5.5" display, but after seeing that a screen size increase would not negatively impact the size of the device, a bigger 5.7" screen was chosen. This is also thanks to the taller 18/9 aspect ratio that was chosen, making the phone not as wide as other phones, and therefore easier to handle. Furthermore, the rounded corners of the device, seen in one of HTC's patents (Part I: Patents and future technologies), helps with the durability of the screen as the point of impact is not on one corner only, but one multiple points of the rounded corners.

In keeping with HTC design language, the fingerprint, back and multitasking button are on the bottom front side of the device, and features pronounced chamfers on the back, running all around the sides of the device. These traits are directly taken from HTC's 2016 flagship: the HTC 10. Though, unlike this device, the back will not be curved but completely flat, with the cameras being flushed into the device. This device will slightly be on the thicker side coming in at 8.4mm (compared to the 7.9mm on the Samsung Galaxy S7 or the 7.3mm on the iPhone 7+ [15]) in order to support a bigger battery, as battery-life was mentioned as being of great importance to the user. Furthermore, a unique feature that will be implemented is the HTC Boomsound stereo front facing speakers which is considered in being of superior quality compared to the competition.

SOFTWARE PROTOTYPE

Creating a software for a phone is a difficult task. Luckily, HTC have a good experience with this, and managed to create a near "pure Android experience" that is simple and intuitive to use. Though, with a redesign of Android made by Google in late 2016, HTC needs to update their software and this is what will be done later on in the project.

In the article released by Droidviews.com in 2015 [67], it explains why "Stock Android", which is the purest version of Android released by Google, is the best. The reasons for this are:

- It's an overall more fluid experience
- It's the easiest (Android) OS to use
- No additional unnecessary features added by other manufacturers
- Fast updates as it's Google's OS

Therefore, the software should resemble "stock Android" in its simplicity and fluidity, as well as adding a few enhancements that will be discussed later in the project.

2. SPECIFICATION

RADICAL INNOVATION

Eventually, the smartphone industry is going to overtake the laptop's one. Professionals need to work from wherever they are and a laptop is too big to take it out whenever needed. Therefore, taking the smartphone one step further into this direction could be a huge step forward, especially if some added features are implemented to make the experience even better. This could be done thanks to several implementations, including the innovative HTC patented Edge Sense feature. Using the combination of three aspects from the "Radical Innovation" part from the ideation phase, Edge Sense, AI and enhanced laptop capabilities, a radical innovation idea came to place:

- Inclusion of a "control key" on the screen's keyboard, enabling "copy-paste", as well as other standard commands such as "undo" and "select all" to name a few, directly from the keyboard, with respectively "Control-C/Control-V", "Control-Z" and "Control-A" buttons for those mentioned.
- Drag and drop capabilities within the same app or from one app to another
- Easy app switching thanks to Edge Sense which enables docks on the sides of the screen. When long-squeezing the phone:
    o On the left side of the screen, a customisable side-bar appears where a total of 6 apps could be added.
    o On the right side, a total of 6 apps of shortcuts appears depending on the app the user is in, as the phone knows which app the user is in and can predict which app the user will interact with next, which allows for better multitasking. Furthermore, the right side-bar is scrollable, where

> one scroll would go to most used apps and another scroll would go to customizable toggles for even better productivity features.
- When a short squeeze is applied to the phone, a certain action will be triggered according to the app the user is in. For example, in the camera app, a short screen will take a picture.
- When a double-squeeze is applied to the phone, a certain customisable action will be triggered independently of the app which is being used.

These features would enable a better switching of the users favourite apps, as well as enhanced multitasking and productivity capabilities, being able to interact and switch quickly between them. Furthermore, with the inclusion of AI in the Edge Sense feature, the suggested apps will better predict what tasks the user wants to perform when in a certain app. This means that over time, the Edge Sense feature becomes more and more precise and therefore more and more useful.

In order to increase user experience, feedback should be implemented when using Edge Sense thanks to vibration and colour changing on the screen, darkening the background image or app, with the side-bars coming in with a smooth playful "popping" animation once the pressure is release. If the user does not put enough pressure, then the animation of Edge Sense starts, but the function will not be activated, resulting in the user going back to exactly where he/she left off. The illustrations be made during the realisation phase further in the project. Furthermore, in order to accommodate people's uses, some other customisability features should be accessible, such as if the pressure sensors are active at any time, meaning also if the screen is off (people could get scared to have the feature turned on at any moment in their pockets or in their hands) and the amount of pressure that the user needs to put to activate the Edge Sense feature.

Going deeper into laptop features, a dock could be made to connect the smartphone to a big screen, just like the Microsoft did with their Windows continuum. Although this is a nice suggestion, it goes beyond the scope of this project, with regards to the time given. This is also why no accessories will be researched or introduced in this project.

DESIGN

HARDWARE DESIGN

When it comes to designing the hardware, the software called "Autodesk Maya 2017 (student version)" will be used. Before the designing of the product on this software can be started, the concept must first be completely finalized. Therefore, one more sketch was made until the computer-rendered version was initiated. This sketch is located below as figure 10.
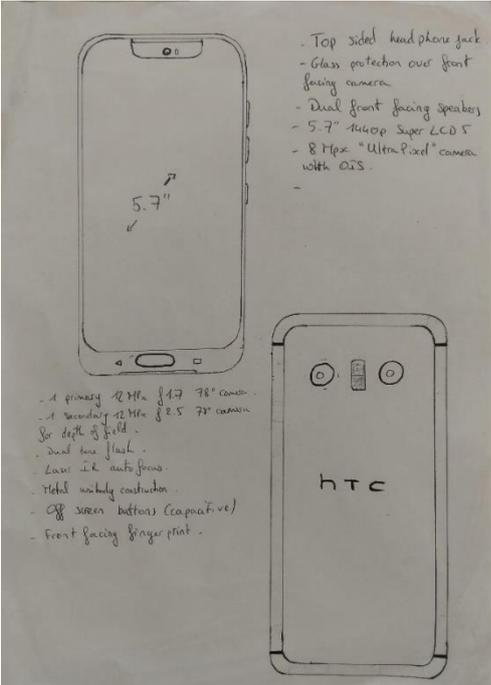
FIGURE 10: THIRD SKETCH OF THE PRODUCT CONCEPT

Overall, the new design prototypes look very similar. The screen was replaced by a larger 5.7" one and a larger bezel was chosen at the top to accommodate for all of the necessary sensors and the camera. This design choice was also chosen for a better protection of the screen and the sensors, dividing the force of impact on a larger surface if the phone falls face down. In addition to all of this, this design choice was also chosen to help with the feasibility of the project.

In terms of the colours for the device, a total of 5 colours were chosen. The reason for that is to reach every type of population (Male, female, elders, and youngsters) that is in the market for a high-end device. Furthermore, colours such red or blue are not common for a smartphone, creating product differentiation in this aspect as well. A list of the five colours can be found below (figure 11).

Colours of the device

Moon Black
Shiny Silver
Ocean Blue
Solar Red
Luxurious Gold

FIGURE 11: AVAILABLE COLOURS OF THE PRODUCT CONCEPT

SOFTWARE DESIGN

In order to showcase the software of the product, the computer software "Adobe Illustrator" was used. The background images are taken from the internet, whereas the icons were either taken from the internet at http://www.flaticon.com/ or created thanks to the use of "Illustrator".

The software has been redesigned to look more like pure Android with what is called the "Pixel Launcher", while still having the simplicity and intuitiveness of the previous version of HTC's Sense OS (previously called HTC Sense). This means that not only the app drawer is different, resembling pure Android, but the inclusion of transitions have also been made to make the user experience more enjoyable. The screenshots can be found later in the realisation phase.

In keeping with HTC's software customs, the home screen will be completely customisable, noticeably thanks to the HTC themes app that remains present, being able to change the icons, the font, the backgrounds and the notification sounds as the user wishes. Though, in order to enhance the user experience even more, by default, the app icons will be of the same shape and size (e.g.: all round), to make the home screens more visually pleasing, as well as make sense. This feature is new, at least compared to other HTC devices in the past. Furthermore, just like HTC's previous device, at launch, the device will not have any duplicate apps, and will be free from any type of bloatware (E.g.: Only one mail app will be installed on the device at launch). This also means that on the AI point of view, the device will use the Google Assistant, unless for certain cases where some AI features will be implemented.

3. REALISATION

RADICAL INNOVATION

The Edge Sense feature have been illustrated thanks to "Adobe Illustrator". With this, a small animation of the coming of the feature once the sides have been squeezed, as explained in the Specific phase of the project, have been roughly illustrated as well with a few frames. This has been made to give the general idea of the Edge Sense feature.

The animation and the Edge Sense side-bars have been roughly illustrated in figure 12 below.

FIGURE 12: ANIMATION AND SIDE-BAR OF THE EDGE SENSE FEATURE.

In this illustration, the left dock is customisable dock, meaning the one where the user can add up to any six apps that he or she wants. The right dock is scrollable, and is composed of the AI dock visible on the first page, a customisable task dock (tasks could be anything like "Call this person", "Pull down notifications bar" or even "Take a screenshot") can be accessed with a left scroll, and a right scroll will give access to the users most frequently used apps.

A picture of the Edge Sense feature on the display can be found in the APPENDIX C under figure 23.

HARDWARE

The hardware design will be displayed thanks to the use of a computer rendering software called "Autodesk Maya 2017". With this, a high precision render could be made, which includes the colour and material of the device wanted as well. The render could be found below, under figure 13.

Figure 13: Maya render of the product concept (front and back)

In this render, it can be seen that the design have not been modified too much compared to the sketches found in the specific phase (figure 10). The overall dimensions of the device is 149.5mm x 67.1mm x 8.4mm (L x H x W).

SOFTWARE

In order to display the software experience from this product concept, the online application "invisionapp.com" was used. This application allows the displaying of the different screens from the software, with the inclusion of transitions when an action is performed (going from one screen to another). A screenshot of the software can be found below under figure 14 whereas the software preview with animations can be found following the website below (Sense OS 8.0). Additionally, a few screenshot of the software prototype can be found in the APPENDIX C under figure 24.

Sense OS 8.0: https://invis.io/CRBU05WYF

Figure 14: Screenshot of the product concept's OS.

With the combination of research/analysis and ideation, a proper radical innovation was found. Though, independently of whether this innovation is game changing or not, product competition could not be brought back if no one knows of the product. In the next section, a marketing strategy of the product concept will be made, in the hopes of diffusing the innovation properly.

4. MARKETING THE PRODUCT

In this section, utilising information from 'Part I' and the first stage of 'Developing the product', a marketing strategy will be made. This will regroup the standard tools of developing a marketing strategy, which are Segmentation, Targeting and Positioning, as well as the Marketing Mix. All of this should help in diffusing the innovation, helping in achieving the goal of this project.

MARKETING OBJECTIVES

- Develop brand awareness: HTC's brand awareness has been going down since 2012. It is time to increase brand awareness, showing that the smartphone industry is not a duopoly one.
- Sales increase: HTC are having a hard time financially and this is mostly due to their lack of proper marketing. A better and more structured marketing strategy can help boost sales.
- Diffuse innovation: The Edge Sense feature is a radical innovation and could help HTC in terms of sales and brand awareness. It is also the main objective of this marketing strategy, as diffusing the radical innovation is one of the goals of the project.

SEGMENTATION

As it was said multiple times in 'Part I: Analysis', HTC needs to simplify its product line-up, and target only the high-end market, as it generates more revenue and gets more attention. Furthermore, the rise of Chinese manufacturers have made it difficult to compete due to their significantly lower prices. With this said, a proper segmentation needs to be made for this product concept, according to the design and the features of the device.

First of all, with any flagship device, its high price tag implies that this device is for people with a somewhat high income and should be marketed as such, in a way that makes the possession of the device make the user feel rich and of high standards, without differentiation of the gender of the user. All of this means that the focus segment in terms of the user's age is about 18 to 65 years old. Furthermore, the design and the colour variety makes the device fashionable, at least to some extent, which accentuates this "high standard" device. The diversity in colours also accustoms for most demographics, which is important to reach as many people as possible.

The main feature of this product concept is its radical feature called Edge Sense, which allows enhanced features such as better app switching, and better interaction between apps thanks to drag-and-drop features. This means that the promotion of this device should be mainly on this feature that is unique, targeting users constantly switching apps, such as people continuously going from one social media platform to

another, or professionals jumping from one productivity app to another. This should also be demonstrated with the high screen-to-body ration with the taller aspect ratio, which makes the display show more content making it easier to interact between the apps. In addition to all of this, the big battery and battery-life of this device enhances this experience, as users can enjoy these features for a longer period of time. This is especially important for businessmen and businesswomen who need to work on their phones for a long period of time.

Another segment that the marketing of this product concept should focus on is people with a sporty lifestyle. Indeed, as seen in the 'Company Level Analysis' in Part I, HTC has a partnership with Fitbit, hinting that HTC wanted to promote a healthy and sporty lifestyle. With this segment representing a lot of people, it is important to promote it, either by making attractive deals for the users when buying the device (e.g.: buy an HTC device and get 50% a Fitbit band or watch), or by showing off features that shows the capabilities of the device in regards to sports.

Lastly, HTC has previously made an impact in the smartphone industry thanks to their external speakers' sound quality which became a standard. Though, their Boomsound™ system, consisting of two stereo front facing speakers is not the only sound system that became a standard, as their headphone sound output from their last flagship (HTC 10) was also well received. With so many people consuming media and listening to music on their phone, it is important to segment these types of people as well as people with a high musical background, such as professionals for example.

It is worth mentioning that HTC has plans in order to keep brand loyalty amongst customers, with services such as "HTC UH-OH" [69] (only available in the U.S. and if bought on the HTC website) which gives a free repair if damage is applied to the phone (water damage, screen damage and many more), and if no repairs were made during the period of use of the device, this person gets a discount on his next HTC device. Though, making this available in more countries will show higher appreciation towards their customers.

TARGETING

The targeting of the new product concept can be broken down into three groups: those who own an HTC device and want to upgrade, those who own a device from another brand but want to switch and those who don't own a device and want to buy one. Although fans and loyal customers are extremely important, the main focus for HTC right now is to capture more sales, which requires to capture the attention from those without an HTC device already. Furthermore, the project consisting of creating product competition, this could only be done if users external to HTC's consumer group find the device appealing. As a result, the targeting of these consumers, in regards to the product concept, should be presented as such:

Age: 18-65

Gender: All

Type: This device is for multiple types of people. This includes mainstream consumers who want a solid flagship device that is beautiful to look at and easy to use, professionals who do a lot of document editing, writing a lot of emails, and/or are constantly switching between apps (productivity and non-productivity apps), as well as power-users who do a lot of social medias, take a lot of pictures and their image is important (hence, the device needs to be stylish), and finally phone enthusiasts that are always looking for the best specifications and want unique features in a smartphone.

Geography: Global sales, although America and Europe need to be of bigger focus as they are big markets and also due to the average salary of the population being higher than the rest of the world.

Accessibility: The device will be accessible through HTC's website htc.com, as well as through all of the major resellers such as Amazon, Carrefour and JD.com to name a few.

POSITIONING

For the positioning of the device, a positioning map will be made from the companies' point of view, according to what devices they are currently releasing. With this, the positioning of HTC according to these companies could be made. The four criteria chosen are low price, high price, features and simplicity. These were based on what people want in a device in regards to technology, according to the price of the device. Simplicity and features were chosen due to the fact that radical innovation is considered as a feature in a smartphone, and usually, the more features available on the device, the harder this one is to operate it. With the price of the phone roughly translating to the quality of it, and price is a lot of the times a decisive factor when buying a product, the inclusion of low price and high price was unavoidable. The positioning of the rival companies were made thanks to the industry analysis made in part I, as well as the analysis made from labbrand [70].

The positioning map can be found below under figure 15.
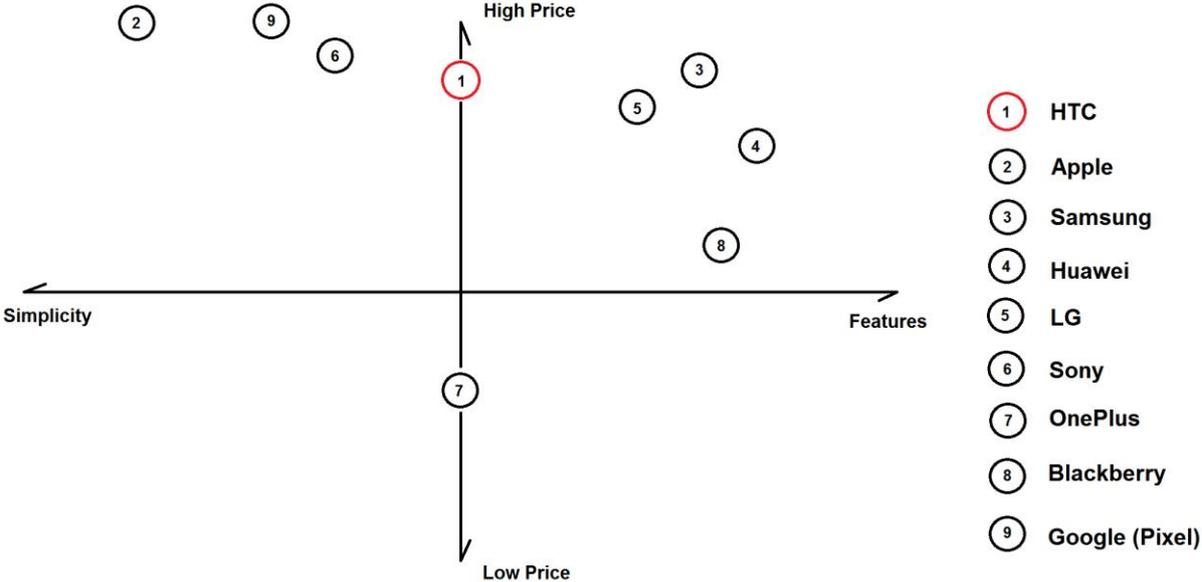
FIGURE 15: POSITIONING MAP OF HTC COMPARED TO THE COMPETITION

After realising the positioning map, something interesting came up: the two most successful smartphone brands are nearly on the opposite side from one another. Indeed, Apple has always been a fan favourite from the mainstream public as it was the easiest to use. Back when it launched in 2007, not many people knew how to operate such devices, therefore, simplifying the layout was the way to go. Though, some consumers quickly understood how a smartphone worked, and that's when the rise of Samsung came up. Previously, during the years 2010 to 2015, Samsung always tried in putting the most features as possible without really focusing on simplicity. This means that if the positioning map was made a few years ago, Samsung would be positioned nearly all the way to the right, where the "features" section would be. Though, realising that the mainstream consumer does not need all of these features as they do not know how to operate them, Samsung got rid of some features, simplifying their layout.

With all of this said, this is why HTC needs to find a perfect balance between simplicity and features, as people now know how to operate a smartphone, but still want it to be relatively simple for everyday tasks, but do want some extra features that makes the smartphone stand-out. Furthermore, in terms of pricing, HTC needs to price their flagships high in order to generate as much revenue as possible, but cannot go to Apple's, Google's or Samsung's price range as they do not have enough brand awareness to justify that price.

MARKETING MIX

PRODUCT

This product is a tangible product that people would use on a daily basis. This is why the device needs to be interesting, simple to use and consistent in its performance. Furthermore, its radical innovation called "Edge Sense" is a unique feature that many actively social people (at least on their smartphones) and professionals would be interested in.

PLACE

As mentioned in the "targeting" section above, this device needs to be sold globally, in the hopes of obtaining as many sales as possible. In all of the different countries, the product needs to be sold through as much retailers as possible, or at least the main ones, if possible, as well as their own website which differs country to country. Furthermore, this product needs to be in highly concentrated electronic places (electronic stores for example), where there needs to be an opportunity to see and try out the device before buying, as well as highly concentrated places where people have a buying mind-set, such as malls for example, as they do in developing countries (as seen in the 'Company level analysis' in Part I).

PRICE

In terms of price, this device need to be high enough to generate the most revenue as possible, but not too high to put people off. With HTC's low brand awareness (as seen in the company level analysis in Part I), they cannot price their devices on-par or above Samsung's or Apple's devices. This means that on average, at launch, this new device needs to be priced between 5-10% lower than their main competitors' devices.

PROMOTION

As seen in the company analysis section "Marketing problems", HTC desperately need to change their promotion, utilising customer-focused promotions which "empowers" the users. This is especially true in photography or videography-based advertisements (social medias or television for example), as these will generate a need for the customer to obtain this product. With this, an increase in budget is necessary to create better content and better diffusion of these adverts. The use of celebrities is also useful in promoting the device. Furthermore, HTC need to find a product name for their flagship smartphone, that stays the same throughout the years and people will know them by. An example of this can be found in APPENDIX B under figure 22, showing the evolution of Samsung and Apple flagship names against HTC's ones.

In order to get a better idea in where HTC could head towards in their advertisements, a brainstorming of suggestions was made and can be found below under figure 16.
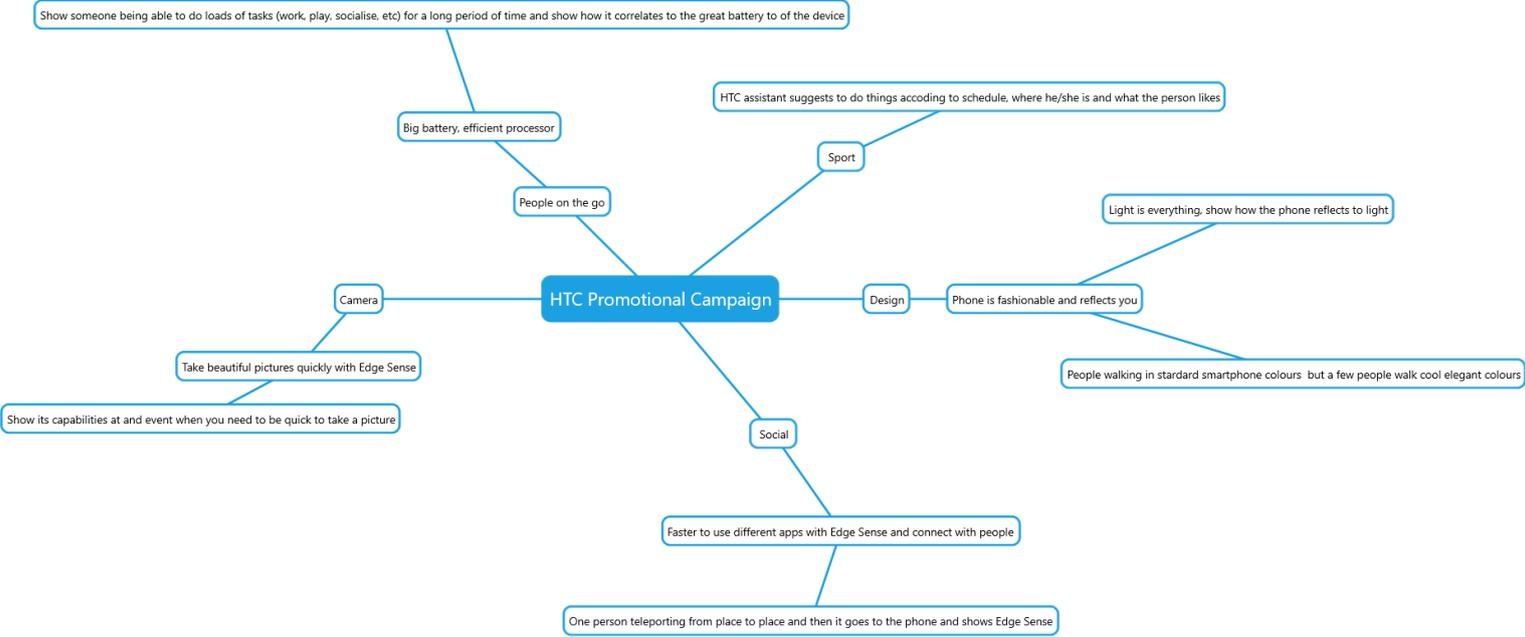
FIGURE 16: BRAINSTORMING OF THE PROMOTION OF THE PRODUCT CONCEPT

EVALUATION AND REFLECTION

EVALUATION

RADICAL INNOVATION

The radical innovation feature of this design is the most important part of this project, which highlights the importance of the evaluation process towards it. This is where feedback from potential customers could be collected, and could be used to enhance the features from this radical innovation, which will help in recreating product competition. The user testing of the radical innovation was made by the use of a semi-structured interview, where a total of 10 people were interviewed randomly, once the innovation of the device was explained and the illustrations (the ones from figure 12) were shown. When explaining the innovation, it is important to not sound excited nor disappointed, as these emotions could bias the results. Furthermore, the same explanation should be given to each tester in order to make the tests fair between one another. For that, the explanation of the feature that was given was the one taken from this paper, from the 'Specification' phase, earlier in Part II of the project. The use of a semi-structured interview is necessary in this case in order to get the most out of the user, which will help in finding the best solution to the project. At the start of the interview, question such as "Do you find this feature interesting?" or "Would you use this feature?" or "What suggestions can you give based on this?" were asked, with additional questions asked according to the reply of the tester.

The outcome of the test were mostly positive which is reassuring to see. Indeed, everyone said that they would use it as they find it really convenient to switch between apps quickly and interact between one another. Furthermore, the commands feature (the control button on the keyboard to do task such as "control-Z") was really appreciated. One of the interviewees was a professional, who confirmed that he is constantly working on his phone. As a result, this person said that this feature would really come in handy for his work. The only negative reoccurring feedback was the lack of customisability of the docks. While one person said that he wished it could be possible to add more than six apps on the customisable dock (making a scrollable dock for example), the others had more problems with the customisability of the docks themselves, with where they are placed, their orientation (vertical instead of horizontal) and the interchange of the docks placement. One of the interviewee suggested the use of another long squeeze (once the docks are open) to interchange the placements of the docks, meaning that the customisable dock will then be on the right, whilst the dock using artificial intelligence will then be on the left. Lastly, one of the interviewees went even further and asked why only two docks on the sides appear and not on the whole screen to have everything show up, and add more functionalities. This is an interesting feedback, as it would make the technology even more powerful and easier to use, with every piece of information being directly on the screen, unlike now where the user has to scroll to get to some other features.

All of this are useful feedback that could be implemented later on in the 'Revision' section, though, when improving the concept based on these feedback, it is important to use this feedback well. Indeed, with customisability comes more complications and more confusion.

HARDWARE DESIGN

For the hardware testing, the same people from the 'radical innovation' testing wanted to be used. Though, due to time issues of some of the interviewees (due to the exam sessions), only half of them had time to talk about the 3D models of the product concept. With this, all of the different five colours of the device were shown as well. The testing of the hardware design was also made under small semi-structured interview to really know how they feel about the device, going deeper on each level until finally all of the information needed was given. At first, when the tester was shown the 360° view of the device, multiple questions were asked like "What do you like about the concept?", "What do you dislike about the concept?", "What would you change?" and finally they were each asked if they think that this design is refreshing and new. If the answer was "no", they would then be asked how this design could be made to make it radically different than any other product.

Luckily, the response to this device was positive. With most people wanting a biggest screen but not a bigger phone, they impressed to see such a big screen on a relatively small body (dimensions: 149.5 x 67.1 x 8.4 (L x H x W) vs HTC 10 dimensions: 145.9 x 71.9 x 9 with a 22% screen size increase). Furthermore, they were happy to see that the device has front facing speakers as all of them consumes a lot of media (YouTube for example), and having the sound come directly to them was something that they liked. Furthermore, a couple of these people said that the button placement (off screen) was a good idea as they think that on-screen button are a waste of screen space. One of the interviewee liked the design, as it goes in the direction that he thinks the future of smartphones should head towards, which is having no bezels on the front of the device, just the screen. When questioned about the durability of this concept, this person replied "I don't think that having a full screen up front makes it less durable. I mean, the bezels in the front are also made of glass so it doesn't make any difference I think".

Overall, the user testing went well and a lot of interesting feedback came out of it. These feedbacks will be used to revise the product, in order to make it more enjoyable for the user and enhance the experience, always in the hopes of making the best product possible that will bring back product competition.

REVISION

During the user testing phase, a lot of interesting feedback came back from it. When it comes to the radical innovation, the customisability of the docks were the major, if not only concern. Though, the more customisable and the more feature-packed the device is, the harder it is to operate. In the 'positioning' of the document (see 'Marketing the product' chapter), it was said that HTC needs to make their devices

balanced between features and simplicity. This is why the sorting out of these feedback is important, in order to not make the device too complicated.

With all of this said, multiple iterations to the product concept was in regards to the software on board the device. These modifications can be found under figure 17 below.
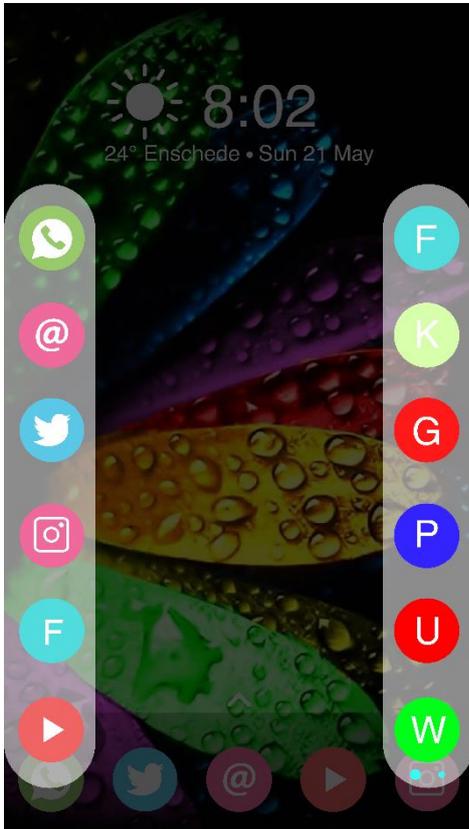

FIGURE 17: MODIFICATIONS OF THE RADICAL INNOVATION

In this illustration, the most noticeable difference is that the AI dock and the customisable dock have been switched places by default, meaning that the AI dock is now on the left and the customisable dock is on the right. This is because as most of the population is right handed, they would want to reach their chosen apps faster and with one handed use. Nevertheless, the places of these docks are interchangeable at any time thanks to another long squeeze when the two docks are open. Another noticeable difference is that now, the customisable tasks are a scroll away from the customisable apps dock and not the Ai dock. This change was due to coherence, with all of the customisable features all in one place. Lastly, the "most used apps" page was removed, out of fear or repetition. Indeed, with the customisable dock, the user will most likely put in his/her most used apps. Therefore, the "most used apps' becomes irrelevant and adds an unnecessary level of complexity.

DISCUSSION

The results of the evaluation phase showed how the product concept is heading into the right direction, which is stepping onto the field of laptops. People are using their smartphones constantly, and some of them are even working only on their smartphone. Though, smartphones are still limited in productivity and multitasking, as no interaction between apps can be made (drag and drop, like a laptop can) and switching between these apps makes is painful, by either going back to the home screen every time, or going to the recent apps, where maybe the app that the user wants to go to is not in list (hasn't been opened yet) or is lost between the many other apps that are opened.

The only limit of a smartphone when it comes to this the screen, as it cannot be too big, hence the device itself being big, if not it loses its portability and because not compelling anymore. Though, as technology will be further developed, the screen-to-body ratio will be increased, and other technologies will be made to help accommodate to this drawback (E.g.: foldable displays).

CONCLUSION

After the extensive amount of research and the user testing, it can be concluded that the goal of the project was reached. Indeed, when researching about the industry, it can be seen that people are not so easily impressed nowadays, and an incremental innovation is not enough to bring back product competition. A radical innovation as this one, even if still limited, managed to get a good reaction from the public. Although only 10 people were interviewed, all of them saw the potential that this radical innovation could have in the future, and all of them said they would use this feature, as well as saying that they could see this feature being compelling to a lot of users. In fact, the radical innovation that has been developed here serves as a steppingstone to what's going to happen next. With limited knowledge in the technologies that companies have in reserve, only a portion of what could potentially be made was made. As a result, the radical innovation displayed here cannot be considered as a disruptive innovation, at least not in this form, as it does not disrupt any other industry like the iPhone 1.0 did. Nevertheless, if HTC develop further this idea, they could potentially create a true radical "disruptive" innovation, disrupting to laptop market (and tablet) market. Though, for the projects sake, the main idea that needed to be given was given, and it was reassuring to see that people were excited about this technology, and what it could mean for the future.

With all of this said, this route chosen for the radical innovation is not the only one. Other technologies can bring back product competition, such as artificial intelligence, augmented reality or even virtual reality. Though, it has to be done in a way that is radically different to receive a reaction from potential customers. Indeed, nowadays, people are accustomed to incremental changes in the smartphone industry, meaning that an upgrade of a previous generation is not enough to get people's attention. Therefore, just as the computer industry in the late 1990s, only a radical innovation

can bring back product competition and excite the industry, by bringing back product competition and differentiation within the industry.

REFLECTION

While reflecting on the experience of writing a thesis, I realised that I really enjoyed this process, at least for the most part. I have always been the person who enjoys to learn by himself, but builds up disinterest when learning is forced upon. This degree of freedom in both the finding of the topic and the way to handle it, was really what I needed in order to make sure to stay interested for the whole duration of the project. I was really passionate to learn into further details the smartphone industry, the topic of my project, as well as performing a case study on a company that I enjoy, HTC, in the hopes of being able to help them get back to a stable position. Furthermore, being able to get in contact with highly ranked professionals is so rewarding and I am really grateful of them to share some of their precious time with me, and could potentially help me later on in my professional career.

The goal of this project, for me personally, was not only to learn more about the smartphone industry and HTC, but mostly about being able to perform a solid case study utilising all of the appropriate business terms. Indeed, wanting to go into a more business field in the future, doing this right was a way to prepare for what's about to come, but also to prove to myself that I can go into this field and make at least an adequate job when doing so. Although at times it was difficult to find motivation on the long run, as a whole I did enjoy performing these researches, analysing them and then writing about these. In fact, the hardest part for me during this project was conducting the analysis of the smartphone industry and the selected company, as I had to also take the time to research on how to perform an industry analysis as well as a company analysis.

After looking at some of the other students' project, I can say that I am grateful that I was able to choose my own topic for the project, in the sector of my choosing. This thesis has helped me both as a student and as a person, proving that I can achieve such work that is somewhat not in relation to my field of study, and prove that I can remain focus on an educational topic over a long period of time, which was not always the case. Being not all the time satisfied with my work, complaining that I could have done more to improve it, I am happy to see that I have no regrets in regards to the quality of my work, and that this time, I am satisfied with myself.

FUTURE WORK
This section is used to discuss about how this project could be improved on in the future. This part will address all of the aspects of the projected that were not implemented due to either a lack of time or lack resources, such as network resources or financial resources.

One of the ideas that unfortunately couldn't come to the realisation, was making a working prototype of the radical innovation feature, under interactive video, was considered (just like the showing of the software prototype) but took too long to realise. If time was not an issue with this project, the realisation of this prototype would have been made, and would have additionally greatly enhanced the user testing, being able to show what the product concept is all about.

Going deeper into the prototyping, it was also wanted to make a hardware prototypes with the appropriate materials (so metal and glass) in order to get a proper idea of what the design might look like, and to make a better user testing out of this. From this, a better version could have been made, not only in the aesthetics department, but mostly in the feel of the phone department. Though, unfortunately, due to time and resources, this type of high-fidelity prototyping couldn't be made.

Of course, if more information was available to work on, more feature would have been implemented into the product concept. Furthermore, with the result from the user testing (which could have been with more people if time was not a restraint), more functionalities would have been added and illustrated here (for example, instead of two docks located on both sides of the screen, have a whole separate menu displayed on the screen when applying a long squeeze).

A complete new approach of the installation, with a completely new radical innovation could have also been implemented here. Though, more information would have been needed to back up this theory.

APPENDICES

APPENDIX A: RELEVANT INFORMATION
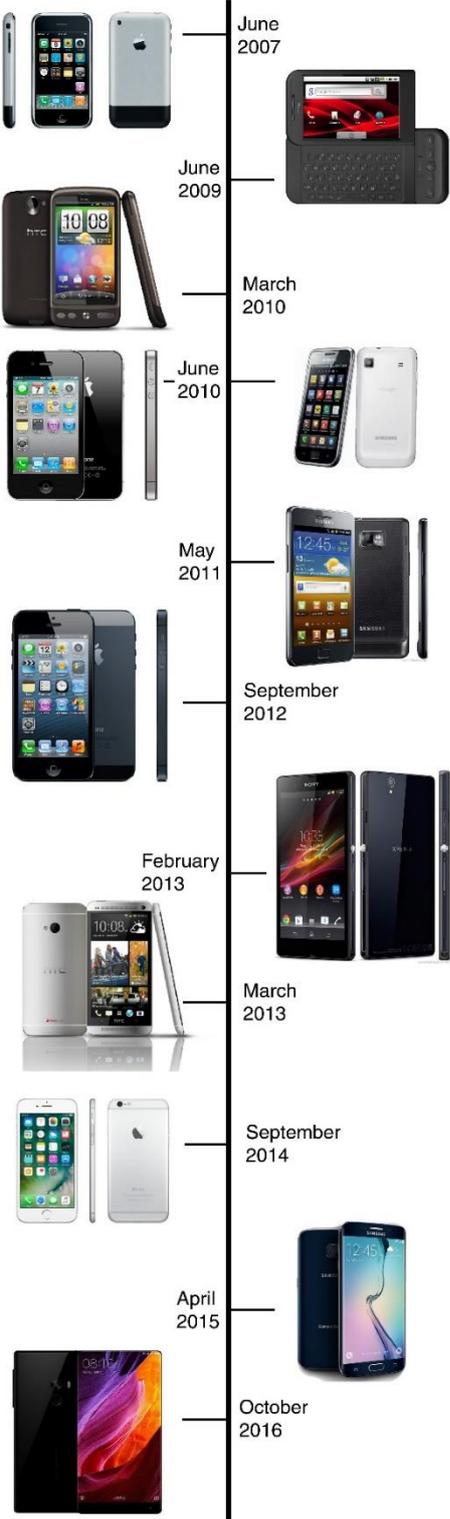
FIGURE 18: EVOLUTION OF THE SMARTPHONE DESIGN

FIGURE 19: IOS 1.0 (ON THE LEFT) VS ANDROID 1.0 (ON THE RIGHT)

FIGURE 20: IOS 10 (ON THE LEFT) VS ANDROID 7.0 (ON THE RIGHT)

APPENDIX B: MARKETING PROBLEMS AND SOLUTIONS

FIGURE 21: A PROBLEM IN HTC'S MARKETING

FIGURE 22: HTC'S CONFUSING NAMING APPROACH FOR THEIR FLAGSHIP DEVICES

APPENDIX C: PRODUCT CONCEPT

FIGURE 23: HTC MOONBLACK PRODUCT CONCEPT WITH EDGE SENSE

FIGURE 24: SCREENSHOTS OF SOFTWARE PROTOTYPE

FIGURE 25: PRODUCT CONCEPT IN GOLD

FIGURE 26: PRODUCT CONCEPT IN BLUE

FIGURE 27: PRODUCT CONCEPT IN BLACK

FIGURE 28: PRODUCT CONCEPT IN SILVER

FIGURE 29: PRODUCT CONCEPT IN RED

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