LUISS Guido Carli
LIBERA UNIVERSITA' INTERNAZIONALE DEGLI STUDI SOCIALI

DEPARTMENT OF IMPRESA E MANAGEMENT

MANAGEMENT COURSE

CHAIR: DIGITAL MARKETING

How internet of things is impacting digital marketing. Samsung case: Family Hub Refrigerator.

SUPERVISOR
Prof. Maximo Ibarra

CO-SUPERVISOR
Prof. Paolo Spagnoletti

CANDIDATE
Andrea Cocco
670191

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Introduction

The aim of this document is to examines the current state of Digital Marketing subject, identifying what are the key factors and external influence that are continuously disrupting the way to communicate a brand, a product, a service or a single message.
The work is composed of three main sections.

The first section will briefly analyze the evolution of communication media, from pigment's paints and papyrus to digital medium that every people use everyday.
The digital revolution affected all the sphere of human behaviour and living style, every single business is affected by the power of this fundamental change.
Marketing discipline is not an exception and despite the marketing process is almost the same, the enhanced mediums and levers brought by technological revolution created a sub-discipline of marketing, called "Digital Marketing".
In this document, I will consider that new levers, such as the search engine market, the display market, email and affiliation programs, up to an analysis of how social media changed people habits and what is a good media mix a company should consider for operating in digital world.
I will talk about digital advertising, explaining why it gives to marketers the possibility to create more and more personalized contents for user, being able to drive a message in a more efficient way. It is possible thanks to algorithms and predictive models made by human to better forecast costumers' behaviour. I will show a reference framework for creating a

predictive model, whose enabler are Big Data. In the document I define Big Data, how to collect them and why they are important for Digital Advertising, in particular for Programmatic advertising.
The final part of first section will discuss about the key metrics to measure the impact of a digital campaign, based on the goals that companies intend to reach.

The second section is about Internet of Things(IoT), what it means and how it is shaping digital marketing. Through IoT and Artificial intelligence is possible to mining all new types of data that was quite impossible to collect in the past. The last part of this section examines some security issues which affect IoT innovation.

The third part of the work is about a real case of IoT product made by Samsung. In that section is showed how Samsung combined the concept of digital marketing on an IoT product, a starting point for the development of future ecosystem of smart product able to produce usage data, analyze them and provide personalized content for their users, wherever they are, at the right time, in the right user device.

1. How much are important data in digital Advertising

1.1 Digital marketing vs traditional marketing

Since the beginning of our existence, humans have been social creatures, using any means at their disposal to communicate thoughts, ideas, visions, opinions and values to all who would listen. They have used hands and voices to speak and write, paint and shape, mold and design, and in doing it, they have often relied on an intermediary as pigment and papyrus, to transmit thoughts and visions into a physical medium that would store them for later observation, review, or sharing.[1]

Communications media have grown in both sophistication and impact over time, inventions such as the printing press, phonograph, magnetic tape recorder, and motion picture let human increase social connection to an exponential level, allowing a single person or group to share their thoughts and vision with millions across the world.

Indeed, it is fair to say that communications media have always played a role in shaping human cultures, although their relative influence has been largely dependent on external geographical and technological factors.

The great religious doctrines, artistic masterpiece, writings, all eventually become iconic treasures recognized and enjoyed all over the world but it often took time, decades, centuries or even millennia in some cases, that because have been dependent on an analog distillation process often controlled by a select group of intermediaries and constrained by the limitations of geographical distance and existing technology to reach their

[1] Bill Kovarik, *"Revolutions in Communication: Media History from Gutenberg to the Digital Age"*, 2011

greatest cultural import.

In marketing is exactly the same, geographical and technological constraints played a fundamental role in the diffusion of a message.

Marketing was born in US in the first '900[2], some text gives the paternity of the marketing in the XVII century in Japan, when a merchant of Tokyo introduced the organization of his warehouse with innovative criteria that today we call marketing techniques: this merchant organized his market taking account of the preferences of his clients and after a study of the market, obviously these were only first steps.

The real origin of the modern marketing was in 1910s, in 1915 was born the National Association of Teachers of Advertising, made of teachers, academics and marketing scholars, that only for theory, while, on the field, business was still in the hands of the single entrepreneur and his experience. Some years later, in 1930s, the American Marketing Society, an association made by scholars, manager, entrepreneurs and advertisers, flanked businessman in their decisions. In 1934, with the National Association of Marketing Teachers, the Marketing is completely separated from the Advertising discipline in the field of academic studies.

The growth of the US market pushed to the study of the distribution and to the research of the best corporate organization in order to satisfy an ever bigger and more global market. Until the 1960s the marketing is the study of the distribution of goods and services from the producer to the costumer. With the flow of the time the word "marketing" acquired a more general sense, with the comeback of the meaning of advertising, distribution, selling, market analysis and market research all mixed in its meaning and today the definition proposed by the American Marketing Association for

[2] http://adage.com/article/ad-age-graphics/ad-age-a-history-marketing/142967/

marketing is:

"the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large."[3]

Definition that consider all the activities of marketing considering the internal environment, including the communication to the employment inside the company and the process or procedures of an organization, the external environment, that is, the right communication with the world, and the interactive environment, that is the link with clients and other companies.

A lot of tasks that are related in direct way into marketing subject, listing a series of activities that together are the subject of marketing and another series of activities that we define a marketing process, something much more linked to branding than before.

As part of branding in marketing process a company has to know the industry in which is going to operate, the players that are inside the battleground, has to analyze the potential new players, has to consider the operational model evolution in that industry, and has to imagine the disruptive scenarios;

Is also a task of marketing knowing how to measure the performance of a business, from the commercial point of view using KPI indicators and from financial aspects knowing how to read a analyze financial trends;

After that marketers have to consider the strategic shareholders' goals in order to generate cash flow in future and to guarantee profitability of the business;

[3] https://www.ama.org/AboutAMA/Pages/Definition-of-Marketing.aspx

It's also about marketing decide how to challenge the value proposition, to quickly understand the reason behind a bad performance, that because the value proposition of a company is constantly being challenging so that means that a company has to be agile in order to change their value proposition not to be displaced by competitors or future ones.

The operational aspect is what usually is called in literature as marketing mix, this task consists in make your product or service deliverable to the customer audience, in this part you have to exploit your brand touch point, here is where an idea became reality.

Another important part of marketing is the business planning activity, this regards the planning of a budget for short and medium term projecting the company's performance according to shareholder goals.

So as described there is a process of activity related to marketing, and talking about traditional marketing can we consider as it anything except digital means to communicate a brand a product or a logo.

Many examples might include tangible items such as business cards, print ads in newspapers or magazines, it can also include posters, commercials on TV and radio, billboards and brochures. Another overlooked means of traditional marketing is when people find a particular business through a referral or a network and eventually you build a rapport with them.

Because of its longevity, people are accustomed to traditional marketing. Finding ads in magazines and newspapers, or reading billboards are still familiar activities and people still do them all the time. On the other side most of the time, traditional marketing is reaching only a local audience even though it is not limited to that. One of the primary disadvantages of traditional marketing is that the results are not easily measurable, and in many cases cannot be measured at all. In most cases, traditional marketing is also more costly than digital marketing, but the biggest disadvantage

today is that traditional marketing is static, which means there is no way to interact with the audience.

In that context digital interface has changed all of that. Digital technology may very well prove to be one of the most profound innovation in human history, this is a great leveller, allowing average citizens from all walks of life and all corners of the planet to impact the greater world in countless ways, endowing them with the ability to publish and disseminate ideas and innovations in a matter of minutes, or even seconds.

The term digital marketing appeared only recently in the world of professional marketing and communication and it refers to the promotion of products and brands among consumers, through the use of all digital media and contact points.

Although digital marketing has many similarities with internet marketing, it goes beyond it, since it frees itself from the internet's single point of contact and accesses all so called digital media, including, for example, mobile telephony and interactive television, as the communication channel.

The term digital marketing therefore seeks to bring together all the interactive digital tools at the service of marketers for promoting products and services, while seeking to develop more direct and personalized relationship with consumers.

With marketing and advertising becoming increasingly interactive, digital marketing covers ever more techniques and methods generally derived from traditional marketing, for example direct marketing, since it can communicate individually with a target but in a digital way.

The world of digital marketing continues to evolve and as long as technology continues to advance, digital marketing will as well. Examples of digital marketing include things like websites, social media mentions, YouTube videos, and banner ads.

Digital marketing is considered a form of inbound marketing and its goal is for people to find you. Businesses put content or ads out for individuals to find. People may conduct an organic online search, a paid search, find your business on a social network or by reading content that has been published online such as a blog or an article. The more they see you or your content, the more familiar they will become with your brand and they will eventually develop a trust and a rapport with you through this online presence.

One benefit to using digital marketing is that the results are much easier to measure, and more important is that a digital campaign can reach an infinite audience. It is also possible to tailor a digital campaign to reach a local audience but it can also be used on the web and reach the entire globe when appropriate. One of the disadvantages to using digital media marketing strategies is that it can take some time to realize measurable success.

In the coming years, marketing will be digital or nothing. Capable not only of selling but also creating loyalty and even fanaticizing customer relationships, digital marketing is essential for attracting and retaining increasingly connected consumers and for ever more fragmented media uses.

1.2 Levers of digital marketing

For digital companies the marketing process is the same of traditional companies, while the execution and the analysis are different because there are digital channels that provides real time analytics, with that you can adapt your visual merchandising with real time traffic data, and you will get an immediate reaction.

The digital ecosystem is composed by smartphone, apps, cloud and broadband and that elements have a lot of implication in marketing: it destroy the previous value chains, but more important that shorten distances between company and clients, now digital levers let fix market failures that in the past was impossible to fix using traditional instruments.

First of all we have to define the digital market, that consist in the communication of a message exploiting different levers, the search market, the display market, the emailing, affiliation programs and social media.[4]

Each of this segment is an ecosystem in its own right:

- Search market consists of the purchase of keywords. These keywords are bought at auction from search engines and enable text ads to be constructed, which are seen under the "sponsored link" heading of results pages.

  Purchase are made through Google Adwords program and also include a network of partner (websites, blogs, partner search engines), the so-called "display network".

[4] Flores Laurent, *"How to measure digital marketing"*, 2014, chapter 2

Text ads benefit form rather favourable investment environment, for the following reasons:

- The number of searches is growing globally;
- Text ads are becoming more effective, particularly through better use of investment feedback levers, such as the call to action buttons that encourage internet users to click and the landing pages to which users are redirected after clicking;
- Mobile connection open up new development prospects for the search market. For example, in many developed ad developing economies, people access the internet via their mobile phones
- Geolocated searches era growing rapidly.

• The display market is the segment covering traditional advertising or branding. Two factors accounts for this vitality. First, purchase is increasingly made by auction. Real-time bidding (RTB) allows one's advertising to be seen based on the auctions one agrees to. These auctions focus on behavioural targeting and are generally based on the cost per thousand impressions. Second the creativity of formats is an important factor in the dynamics of the market.

The use of these formats varies according to their capacity to create interaction with internet users. Video is booming and is driving growth in the market, since advertisers are constantly looking for interactivity and greater audience commitment.

- The email market in the most threatened market segment, but is also the segment that has historically been the most “effective” for “tracking” consumer behaviour.

  Emailing needs to adapt to marketing management objectives:

  - Homogenize the company’s overall communication.
  - Strengthen proximity between the customer and the brand.
  - Be consistent across all channels.
  - Communicate in a personal and relevant way with every customer.
  - Increase the ROI of marketing actions.

  Nevertheless, a revolution in usage and congestion of the emailing market is threatening it.

- The affiliation market allows any website or blog having an advertising space to be monetized. As with display, an intermediary is inserted between the affiliate who wants to advertise and the affiliate who wants to sell the space.

Mobile telephony like the Internet, it is a medium that embodies all the others: tv, radio, augmented reality display, Internet, cinema, with the major characteristics of mobility and its corollary, geolocation. In addition is the first medium that is always handheld, that is mostly switched on, making the consumer reachable at all times, the most effective medium for developing user-generated content, the best medium for tracking

consumers: tracking their navigation, their purchases, their consumption habits through geolocation, their age and gender, and even their virality potential and finally probably the most "measurable" of media.

In this mobile environment a crucial role is played by social media.

Once considered millennials' territory, social media is now being used by everybody. No matter who a company target buyers are, they're using social media, making it more important than ever to develop an effective social media marketing program. Social media marketing should always be conducted through the lens of corporate objectives.

Some campaigns may be intended to drive brand awareness, other campaigns may be designed to support a product launch, that means that different social media campaigns will be direct linked to different evaluation model to measure their success.

Talking about overall media, a possible classification of that media is to divide them between owned, paid and earned media.

- Owned media are the communication media directly managed by the company, the institutional website, the mobile site, organization's blog, official Facebook or Twitter account and so on. On that kind of media lays the total control of the message that a company have to be communicate. The main target are the existing customers and the potential one.
- Paid media are the medium that are bought by the company to reach the desired visibility. Among these there is the display ads, network, TV and radio campaigns and the paid search on

Google. The main target of that media are strangers, the aim is to reach potential new costumers.

- Earned media are all the communication channel in which the company is involved by quotations, review and conversation among users. Review on Tripadvisior, Facebook's share and likes and so on. On this channel is important to listen to and monitoring consumers' conversations, ideas and judgments. The role in earned media is something that companies can't buy, but has to be gained. However, it can be boosted by pr digital action, word of mouth and viral marketing.

A good media mix must consider a well-balanced use of their paid, owned and earned media to perform better in the digital context.

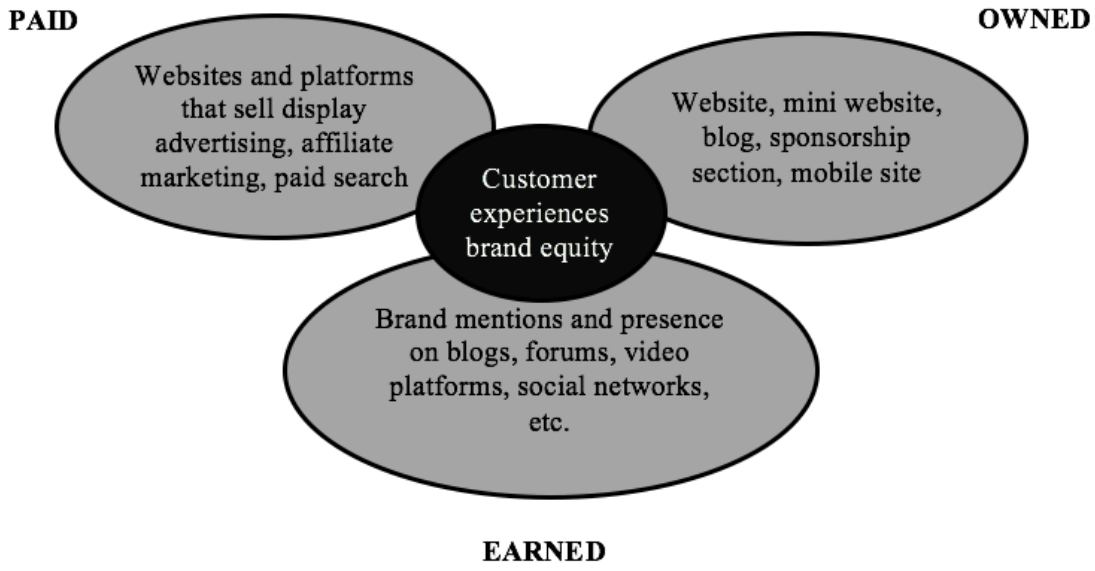

Fig 1.1 – POEM: paid, owned, earned media

1.3 The digital advertising, a continuous disruption

In many ways, as advertising has gone from traditional media to new media, it has not changed very much. The idea of advertising via posters was simple: buy enough of them at the lowest possible price per poster and get them out in as many places as possible, so it was about two things: volume and price. Advertisers were searching the highest possible volume at the lowest possible price.

In the same direction came newspapers, magazines, radio, and the same sort of growth happened with TV.

Marketers repeated always the same formula shaping it for the different type of media, creative agencies came up with clever ways to get the message across and also utilized new media like video for TV commercials and audio for radio, but the idea remained the same: delivery message to as many people as possible at the lowest cost.

Despite dramatic advances in digital media, devices, and new types of media like social media, most digital ads today don't look very different than the billboards that have been around since the beginning of advertising, for instance banner ads are simply sized down versions of billboards.

Digital media presents immense opportunities to not only make significantly more functional billboards but also smarter billboards that understand consumers' interests and tailor advertising and messaging directly to their needs.

The vast amounts of data we now have is about to improve this aspect of advertising, in order to be more personalized and relevant.

Many factors come together in recent years to create this opportunity: technological aspects, consumer behavioral changes, and the widespread

use of social media.

The biggest change in consumer behavior has been a greater willingness to share personal information, social media played a fundamental role, people now share online anything and everything, including who their friends are, their likes and dislikes, their interest and habits.

This is a big cultural shift in thinking to a general openness to sharing personal information in return for a more personalized experience.

Many years ago, people worried about others tracking them and sharing their own information, today we let apps like Uber, TripAdvisor, Instagram, and others freely use our location to help us quickly get a car service, make reservations to restaurants nearby.

We also deliberately check-in in many mobile apps, telling everyone where we are.

The rapid proliferation of mobile devices has essentially served to personalize our digital media consumption, today people prefer to have their own personal offers of films and TV contents using Netflix, instead of watching what is on TV, and rather than listening to radio, people subscribe premium Spotify accounts to listen to their own playlist.

In addition to mobile devices becoming personal media devices, they also became sharing devices. Through the use of social media, personal devices produced a billions of location, preference, and other kinds of data shared by users. These data and "new data" produced by wearable devices and by Internet of things is a treasure that companies can use to personalize experiences.

Computing power and bandwidth have also increased to a point where tasks that used to take several minutes to hours can be now done in a fraction of second. Cloud computing have also significantly reduced the costs of storing and processing the massive amounts of data needed to

effectively personalize advertising.

In marketing data has always been viewed as something to analyze in a second moment, doing a post analysis on the campaign results, research, and sales data trying to understand how to market to their prospects and customers, data was not used for targeting and personalizing experiences for customers. Nowadays marketers view data as a strategic asset that has to be utilized as a key part of marketing process.

The investments in data and analytics are likely to get marketing teams the kinds of information they can use and rely on to deliver personalized services to their customers.

In the past year, Oracle Corporation acquired BlueKai and Datalogix, two Big Data companies focused on providing data for targeting and personalizing advertisements. This reflects the growing appetite marketing organizations have to spend on marketing technology and infrastructure.

APIs (application programming interfaces) have been significantly important to the rapid evolution and adoption of technology in the media and advertising industry. The successes of Facebook, Apple, and Google as media/technology companies can definitely be attributed to their heavy and aggressive investments in APIs that have allowed third-party apps and platforms to plug into and help grow their ecosystems.

In the digital advertising arena, APIs have played a key role. An API called openRTB has been largely responsible for the ability for brands to buy and sell media programmatically. This API allows sellers and buyers of media to communicate electronically about availability of inventory, ask and bid prices, information about the inventory itself, etc. All this has been done using a set of standard APIs, and it has enabled programmatic media buying and selling to scale and gain adoption rapidly despite the varied

media suppliers, supply-side and demand-side platforms, and exchanges that are invariably involved in such media transactions. [5]

In the world of personalized advertising, APIs can now tell us everything from where a user is located to what the local weather is like to what movie theater is playing a particular movie. All these APIs serve up data that can be used for more effective personalization.

APIs also allow for interoperability and ease of integration between the pieces of software that have to come together to make personalization work. For example, most data management platforms have APIs by which dynamic/personalized ad platforms can fetch data to personalize ads.

Brands have been inspired by the way Facebook and Twitter have been able to offer them ad products with very fine-grained targeting and real-time messaging capabilities. Today, within a few minutes, a brand can think up a message or creative idea it wants to communicate to a very specific audience and have it sent to that audience within minutes. The question many brands are rightfully asking is "Why can't I do this across all my media?" For various reasons, including especially the limited types of ad formats offered by social media platforms, brands want to use those same techniques of micro-messaging and real-time marketing across their display advertising.

Marketers are also realizing that the traditional path to purchase has changed significantly due to the impact of social media and mobile devices. Now consumers can make purchase decisions in real time without following the traditional paths to purchase. This means brands also have to be able to be in that purchase path in real time with something to say or offer that will tilt the purchase decision in their direction.

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[5] Diaz Nesamoney, *"Personalized Digital advertising"*, 2015

A lot of the key ingredients are in place to make personalized advertising a reality, so what's missing? As in any other emerging area in digital advertising, there's a lot of confusing terminology and technologies, as well as a lack of APIs and standards for how data, content, and ad serving platforms come together to make it all happen. This is all changing as we speak, and it is already evident that marketers are taking this opportunity head on and collaborating with technologists to make their desires reality.

1.4 The Personalization of Media

The Internet give to marketers the possibility of customizing content and media to users. When the Internet started to become popular consumers could download or access content they wanted.

The tremendous initial successes of dial-up content services like AOL and CompuServe proved that consumers really wanted to be able to select the content they wanted to view, and they wanted to do it on their schedule, not on the schedule of a TV program guide.

Portals like Yahoo, MSN, and AOL produced vast amounts of news, sports, and other entertainment content and allowed users to choose the content they wanted to consume and when to consume it. Everything had changed.

The era of mass media was ending, and a big transition to "customized" media was under way. This movement, which started in the late 1990s and had its first big bubble and peak during the .com bubble of 2000, was in fact the first of several disruption the media and advertising industry would undergo, thanks to the introduction of digitally produced and distributed content and media.

The first website went live in 1991; in 1992 there were 10 websites; and in 1993 there were 130. In 1999 there were 3 million websites, and by 2000, that number had jumped to 1.7 million. The billionth website in the world went live in September 2014. In some ways there was not only a shift going on in media consumption from traditional media to digital media but there was actually an increase in media consumption due to the ready availability of media in places other than the family room.

Prior to the Internet, media consumption while people were at work was minimal because TV watching and newspaper and magazine reading were not easy to do at work. When the Internet came to workplaces, people could surf the web whenever they took a break from work. The next big change was the introduction of laptops, which suddenly made the Internet portable. No longer did you have to be sitting in front of your TV at home or your desk at work, your media could travel with you on your laptop, as long as you had a Wi-Fi connection. An important change that happened here is that media consumption became personalized.

For marketers, at first the Internet seemed like a great new medium to use for marketing. However, the very first problem with media delivered via the Internet is the significant fragmentation of audiences across websites. There were now not 300 channels but 300 million and very quickly over a billion. This posed an immediate problem for marketers trying to leverage the medium: how do you ensure that you are delivering advertising to a relevant audience when your audience is so significantly fragmented? You couldn't buy media for a specific 'cable channel' or a "sports section" at scale. A number of media aggregators eventually cropped up.

Ad exchanges and ad networks essentially helped solve the reach problem first by aggregating media across several thousand smaller sites and making it easier for brands to achieve their reach goals with a single media buy.

This still left open the issue of how to achieve greater relevance and to ensure that the right audience was being reached. To address the relevance issue, aggregators started organising websites into audience segments, which made it easier for brands to buy. This was the first time marketers were able to see how technology combined with digital media could give them a great way to achieve both reach and relevance goals in a world of

increasingly fragmented media. While laptops and Wi-Fi significantly personalized media, there was yet another big change underway, and Steve Jobs saw it coming. While everyone saw wireless networks as being designed far making phone calls first and then maybe media, Steve Jobs put media first. As someone once joked, the iPhone was a great phone if you didn't have to make phone calls, as Steve Jobs would say, it was an insanely great media device. Thousands bought the cool-looking phone and discovered a phenomenal portable and highly personal media device.

In 2014, the rapid growth of mobile devices reached a very important milestone: for the first time ever, more tablet devices were shipped than PCs. Social media created or another form of digital media and still more fragmentation of media. What became even more challenging for marketers was the crossover between social media and the new world of mobile apps, which was clearly distinct from websites and web browsing experiences. Social media also brought about a dramatic change in consumer behaviour in that it appeared to have unlocked an innate desire in people to want to share things. YouTube was the first of this kind of "social media," though at that time various names like user generated content were being used to describe the phenomenon. YouTube really gave the media and advertising industry the first inkling that people really wanted to tell everyone about themselves. Mobile devices increased this phenomenon by making it easy to take pictures, cheek in, update statuses, post, tweet, etc., easily and conveniently.

Facebook created a new category, of media that had not even been thought about as media. People uploaded pictures, shared content, uploaded videos, etc, about 300 million images are uploaded to Facebook each day, and 4.75 billion pieces of content are shared by Facebook users each day, this new kind of media is also much more personal.

In the process of sharing and liking content and media, consumers tell media companies everything there is to know about them. Suddenly, after marketers had spent years trying to figure out how to build profiles of users and their online habits, users had decided to just volunteer all this data and information. Each consumption point of digital media was also creating preference data where users were essentially not only sharing or selecting media, they were effectively also sharing information about themselves, their likes, dislikes, and other information that could be used to create more personalized media experiences for them. When you log into Netflix or Amazon, you immediately notice that both services have essentially analysed items you have viewed or purchased in the past and created recommendations based on your history. This idea of personalizing media or product choices was pioneered in the early days of e-commerce and is very prevalent today. While media companies started trying to personalize media for their users, a bigger problem had emerged for marketers: It was no longer possible to rely simply on targeting. It has become evident that all the preference data caused by media fragmentation, mobile devices, and social media is just the tip of the iceberg of data that can be used for personalization. With the recent explosion of smart devices diffusion, wearable technology, and the Internet of things, consumers are creating more and more data that tells the world what they do every day, what they like, how much they slept, what they like to eat, what they buy, etc.

What consumers expect in return is smart, personalized experiences, whether it be in media, applications or advertisements.

The big buzzword among chief marketing officiers and marketing organizations has been BigData. They have spent few years figuring out how to collect all this data and it is time to use in digital advertising to create smart, personalized ad experiences.

1.5 Data in Advertising

Retailers, banks, governments, social network, credit reference agencies and telecoms companies, among others, hold vast amounts of information about customers. They know where they live, how much they spend, their lifestyles and opinions. Every year the amount of electronic information about people grows as they increasingly use internet services, social media and smart devices.

Large and complex data sets have existed for decades, in that sense Big Data is nothing new, however, by the early 2010s "Big Data" had become the popular phrase to describe database that are not just large, but enormous and complex.

There isn't a universally agreed definition of "Big Data", but the features of Big Data that are considered important are:[6]

- Volume: any database that is too large to be comfortably managed on an average PC, laptop or server can be considered Big Data. Big Data is generally taken to be on a database that contains more than a terabyte of data (1TB = 1000GB). Some Big Data sources contain petabytes of data (1PB = 1000TB).
- Variety: Big data contains many different types of structured and unstructured data. Structured data is tidy and well defined and can usually be represented as numbers or categories: for examples your income, age, gender and maritial status. Unstructured data is not well defined. It is often textual and difficult to categorize: e-mails, blogs, web pages and transcripts of phone conversations.

[6] Steven Finlay, *"Predictive analytics, data mining and Big Data"*, 2014, chapter 1

- Volatility: Some types of data are relatively static, such as someone's place of birth, gender, social security number and nationality. Other data changes occasionally, such as one's address, your employer or the number of children that you have. At the other extreme some data is changing all the time: for example what music your are listening to right now, the speed you are driving and your heart rate. Big data is often volatile.
- Multi-sourced: Some Big Data sources are generated entirely from an organization's internal system. This means they have control over its structured and format. However, Big Data often includes external data such as credit reports, census information, GPS data and web pages, and organizations have little control over how it's supplied and formatted. This introduces additional issues around data quality, privacy and security, over and above what is required from internally sourced data.

Company proactively search for and obtain new data: they bring all data together and analyse it to produce insights about what people have done, what they are doing and what they are likely to do in the future, that influence their decision making and what actions to take.

A Big Data philosophy is about taking a holistic view of the data available and getting the best out of what a company have. If an organization is doing this, then it doesn't matter if it has few megabytes or many terabyte of data; if they are structured or not and where it comes from.

From a technology perspective one seeks out IT solutions that deliver the required storage and analytical capability.

A myth about Big Data is that you need a huge amount of data to build a predictive model. A couple of thousand customers are more than enough,

and many useful models have been built using less data than this. Obviusly, the more data you have about people, the more predictive your models will be. Big data has attracted so much interest in recent years because it goes beyond the traditional data sources that people have used in data mining and predictive analytics in the past.

In particular, Big Data very often are:

- Textual data. This comes from letters, phone transcripts, e-mails, web-pages, tweet and so on. This are unstructured data and therefore needs a lot of processing power to analyse it.
- Machine generated data. GPS data from people's phones, web logs that track internet usage and devices fitted to cars. Machine-generated data is generally well structured and easy to analyse, but there is a lot of it.
- Network data. That are information about people's family, friends and other associates. What is important is the structure of the network to which an individual belongs, how many people are in the network, who is at the centre of the network and so on.

It used to be that the prime source of data for all sorts of predictive models was well structured internal data sources, possibly augmented by information form a credit reference agency or database marketing company, but these days Big Data that combines traditional data sources with these new types of data is seen as the frontier in terms of consumer information. The problem is that there is so much different and varied data around that it is becoming increasingly difficult to analyse it all.

The IT and the analytical community are improving proportionally, the first are continuously developing their hardware ad software to obtain and store

more diverse data, the latter are trying to find better and more efficient ways to squeeze useful insights from all the data that IT solutions have gathered.

One feature of Big Data is that most of it has a very low information density, making it very difficult to extract useful customer insights from it, that because huge proportion of the Big Data out there is absolutely useless when it comes to forecasting consumer behaviour.

Companies have to work hard in order to find out the useful data that will improve the accuracy of their predictive models: they need big computers with lots of storage, and clever algorithms, to find the important stuff amongst the chaff.

In that context there are a lot of money to be made selling Big Data solutions, and whether the buyer actually gets any benefit from them is not the primary concern of the sales people.

In some cases the benefits of Big Data can be too small to justify the expense: in banking, for example, the potential for new Big Data sources to improve the predictive ability of credit scoring models is fairly small, over and above the data already available, that is because the key driver of credit risk is past behaviour, and the banks have ready access to people's credit reports, plus other data supplied by Credit Reference Agencies such as Equifax, Experian and TransUnion.

On the other end, marketing team that are trying to identify people who might be interested in their products but have no data to go on, will search externally in Big Data company.

For those already using predictive analytics, Big Data is very much the icing on the cake once there is a very good IT systems and good analytics in place, however, if internal data systems are inefficient, they wont store

as much data as they could and if analytics culture is not well developed, Big Data solutions are not the next step.

Companies should concentrate making better use of the easy to access data they already have before moving on to more complex solutions.

Unless an IT and analytics systems are pretty slick, a company need to spend for incremental improvements to their current systems, rather than implementing a whole new suite of dedicated hardware and software specifically for handling Big Data.

In terms of the percentage uplift that Big Data provides, that's something of an open question, and is very dependent upon the type of predictive models someone want to build and how much data they already make use of.

If there is already a good data and analytics, and a company implement a Big Data strategy in the right way, they may see a 4-5% uplift in the performance of predictive models. If they don't currently have much customer data, and Big Data gives the ability to predict customer behaviour where this wasn't an option before, then they could be looking at benefits of significantly more than 10%.

Another perspective is that the biggest benefit of Big Data have little to do with enhancing existing models in well run data rich organizations.

The greatest opportunities for Big Data are where it is making new forms of customer prediction viable.

Most existing healthcare systems are reactive: they treat you when you are already ill. Combining predictive analytics with Big Data makes it more viable to shift the emphasis to prevention. It becomes possible to predict how likely each citizen is to develop certain conditions and intervene before the illness becomes apparent. This has the potential to add years to average life expectancy.

Marketing is another area where Big Data is proving its worth. Combining information about people's movements, gathered from their smartphone, with supermarket data about what type of food they like to buy, they can be targeted with promotional offers for restaurants in the city they are visiting before they get there.

Another marketing application is to use real time information about electricity and gas usage to forecast when someone is likely to be at home, and therefore a good time to contact them.

These applications of predictive analytics is where the frontier of Big Data and predictive analytics currently lies.

1.6 Predictive Models

Using analytics in organization, and/or expect to invest heavily in the staff and IT required to deliver high-quality predictive analytics, then it makes sense to have at least some appreciation of what a company is investing in and why it will bring benefit.

It's a myth to have a background in mathematics or statistics to be able to understand how a predictive model works, or how it can be used.

It's true that using predictive analytics to build a predictive model is a technical task, done by nerdy types who enjoy it, but understanding what predictive models are and how to use them does not require specialist training. A typical credit scoring model, used by banks the world over, works by simply adding up the relevant points to get a score. The higher the score the more creditworthy someone is.

If someone starts talking about the predictive models that they could build for a company, before they have asked it what want to achieve, there is something strange.

When discussing predictive models, the starting point should always be some objective within the organization. Predicative analytics then may be the right tool to help deliver what is the objective. Models are used to predict all sorts of different things, but whether or not a predictive model is going to help to meet objectives boils down to just three things:

1. Will the model improve the efficiency?
2. Will the model result in better decision making?
3. Will the model enable to do something new that the company has not been able to do before?

Talking about efficiency, is replacing a manually based decision-making process with an automated one. Sometimes this results in people being redeployed productively elsewhere, but more often than not efficiency means job losses or a devaluation of people's skills. This is important because it means that implementing predictive models for the first time, or they are deploying in a new area where they have not been used before, or a company will meet resistance and will need a strategy to deal with it.

With regard to the second point, the evidence from many different studies is that models created using predictive analytics make better predictions than their human counterparts, and in many situations better predictions means making more money. However, having a model that can predict something with a high degree of accuracy it’s not enough.

Perhaps the biggest mistake people make when developing predictive models is to deliver a model that is not then used for anything. The predictions generated by the model is to do something to influence or control people's behavior, which in turn generates some benefit for them or for you. Identifying people who are likely to purchase something is fine, but then it need to act on this information to increase sales. This could be by encouraging existing customers to spend more (e.g. discount off their next purchase), or to use them as a conduit to attract new customers who would otherwise have spent their money elsewhere (e.g. two for one deal for the customer and a friend).

Let’s think about a model that predicts the likelihood of default on a loan. Knowing how likely someone is to default does not make to company any money. The decision is whether or not to offer loans. Therefore use the model score as the basis of our decision about whether or not to give

someone a loan. Making the right decision on the basis of the score is far more important than the score itself.

When thinking about predictive analytics, always have these three things in mind: How will a predictive model improve operational efficiency? How will it improve the decision making process? And what value does the model provide? If it is impossible to answer these questions then maybe is better to reconsider whether it's worth proceeding. Otherwise the risk is wasting a lot of time and money creating something that might be very predictive, but doesn't do anything to help to achieve goals.

The example of a score distribution shows a lender who has to decide whether or not to grant loans to customers who had applied for one. The score distribution is the key tool that underpins the use of all predictive models and is the basis for assessing how well a model performs.

To translate word in a concrete example, let’s assume that a company had to set up a national online store, it sells selected quality wine also in-store, and it sees online selling as a low cost and low risk strategy for reaching a much larger customer base than it currently has access to.

The setup and running costs will be low because the company use of its existing warehousing and IT systems, so all that remains to be done is to find the right customers to target and persuade them to buy.

The biggest challenge is to identify which customers to target, and then develop an appropriate marketing campaign to attract them to buy online.

So let's start by thinking about what the business wants to achieve.

Let’s assume that the board has laid out the following objectives:

-Objective 1. Recruit a good number of customers in the first year of operation. i.e. at least 25,000 buyers.

-Objective 2. Make a profit during the first year. Therefore, the revenues generated from the products sales only need to cover the cost of the wine plus the marketing cost of acquiring new customers.

The board has given the marketing team a budget of €1,2m to meet the objectives.

Analysis of in store transactions shows that the average profit on a single bottle case of wine is €75.

A direct marketing campaign costs €2 for each person targeted. A typical campaign includes texts, e-mails, mail shots and voice messages, delivered over several weeks.

The marketing department has access to a contact list, supplied by a database marketing company, containing details of 5 million people. The list contains names and contact details, plus geo-demographic information such as income, occupation, age, car ownership and so on, but the list does not contain information about the company product buying behavior.

Using the budget provided by the board, the company could run a direct marketing campaign targeted at 600,000 people, selected at random from the contact list.

Another option would be to forget the list, and go for a mass communication strategy, spending the recruitment budget on TV ads, sponsorship of websites, articles in magazines and so on. However, the Marketing Director knows that neither of these strategies will be successful because the products the company is selling are the domain of a very specific consumer segment.

In order to meet the business objective, the Marketing Director knows that they need a way to target just those people who like that product, and he believes predictive analytics may be the tool to help them do this.

So in this case, predictive analytics is going to be used as an efficiency tool to reduce the costs associated with targeting and recruiting profitable new customers.

So what does the marketing department do? If they want to use predictive analytics then they need some consumer data to analyze. To construct a model using predictive analytics, two types of data are required:

- Predictor data. This is the information that is going to be used to make the prediction; i.e. the things that could feature in the model. For this problem, the predictor data is the geo-demographic information such as income, occupation, age and so on, that has been supplied with the contact list.
- Behavioral data. This is information about the behavior we want to predict. For this example, the behavior is whether the customer buys wine or not. In technical terms, this is what a data scientist calls the "Dependent variable," "Target variable" or the "Modeling objective."

Predictive analytics is all about understanding the relationships between the predictor data and behavioral data. You can't do predictive analytics if one of these types of data is missing. For behavioral data, you also need representative samples of each type of behavior so that the differences between behaviors can be analyzed. For our case study, this means that information about people who did not buy the product is just as important as information about those that did. The predictive analytics process then analyzes the data to identify how the predictor data can be used to differentiate between each behavior.

The marketing department has lots of predictor data that was supplied with the contact list, but it has no information about outcomes. Therefore the marketing team needs to obtain some before it can construct a predictive model. To obtain data about wine-buying behavior, the marketing team undertakes a test campaign targeting 100,000 of people selected at random from the contact list, for a total campaign cost of 200,000.

As the test campaign progresses, the first sales come within just a few hours, Sales peak after about a week, followed by a gradual decline over several weeks. At the end of the sixth week the campaign winds up as new sales drop to zero. Summarizing the key findings from the test campaign.

Out of 100,000 people who were contacted, 1,600 responded by buying wine. This is a response rate of 1.6%. Each contact cost €2. Therefore the average spend required to secure one sale is €125 (€2*100,000/1,600).

The information in supports the Marketing Director's belief that a random targeting strategy would be unsuccessful. This is because in order to generate the required number of sales specified for objective 1, it would be necessary to target 1,562,500 people at a cost of more than €3m.

However, with the budget they can only afford to target 600,000. In fact, with a response rate of 1.6%, a random contact strategy can be expected to generate just 9,600 sales from 600,000 contacts.

We can also establish that a random contact strategy would be loss-making. This is because the average profit of €75 per case won't cover the average costs to recruit each customer, so the marketing department would fail to meet the second objective as well.

However, the main purpose of the test campaign is not to generate sales, but to gather data about wine buying behaviour. The marketing department now has some behavioural data to work with and sets about the task of

building a predictive model using the data it has acquired from the test campaign.

To build the model, the marketing team's data scientist takes all of the available information about the 100,000 people contacted as part of the trial, and loads it into a statistical software package for analysis. There are many specialist software packages that one can use to build predictive models, but the most popular ones are SAS, SPSS and R. These days it's pretty rare to actually do any math yourself when building a predictive model, the software takes care of all the required calculation to generate a model using the appropriate mathematical and statistical technique.

The role of the data scientist is to decide what technique or parameters to use and explore the range of possible models, using their experience and expertise to derive the best model that they can.

Obviously you want the model to be as predictive as possible, but often there are business requirements and constraints that need to be taken into account. It is very common to sacrifice a small amount of predictive accuracy to ensure that these business requirements are met.

Model developer may be required to force certain variables to feature in the model or ensure that certain ones are excluded.

After week of developing models, tweaking them and exploring different options, the data scientist comes up with a type of model that is called the "Decision Tree."

With the decision tree you can divide 100,000 targeted consumers, classifying it for gender, income level, family composition, marital status, age and so on, so for example all the male people with less than 35 years addressed by the test campaign will be under the same class.

For each class, the data scientist will be able to calculate the response rate, the cost for response and the profit for response. Marketing team think will apply the decision tree to the remaining five million people on the contact list who have not yet been targeted.

To decide how to spend their remaining $1m budget, the marketing team calculate what kind of classes they can afford to mail and at how much cost. So they choose what is the cut-off class that the marketing team are going to use for this model. Those scoring better than cut-off class are targeted, those scoring below the cut-off are not.

So the decision tree will help the marketing team to meet both of the objectives set by the board.

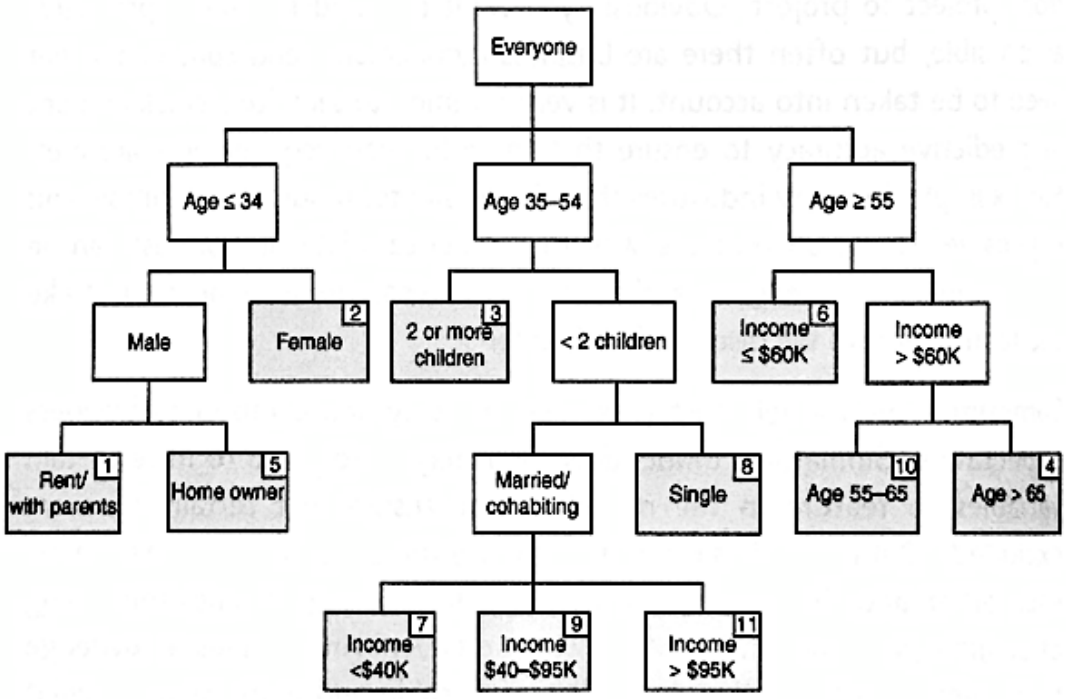

Fig. 1.2 – Decision tree

Decisions were made using only the scores from the models, no humans are involved in determining what the outcomes should be. Each and every decision about a customer is made automatically on the basis of the score alone.

However, in many practical applications it is common to use business rules to override score based decisions, in order to meet strategic objectives beyond the scope of the model, or to ensure that certain actions are or are not taken for some individuals, regardless of the score that they receive.

One reason for override rules is legislation. There are laws that require you to treat certain people in different ways.

1.7 Programmatic Advertising

Programmatic advertising automates the decision-making process of where ads are placed, using artificial intelligence and real-time bidding for online display, mobile and video campaigns. It's a method to resolve the highly fragmented industry that advertising had become, to maximize the return on investment in an ad budget. Programmatic advertising can hit the right audience at the right time to drive higher quality leads for brands.

It is not clear whether the push for dynamic and personalized advertising came about as a result of the major shift to programmatic media buying or whether these two simply happened at the same time.

Brands have adopted programmatic platforms because of the cost and process efficiencies that these platforms have brought.

Personalized advertising allows brands to be relevant while all retaining the scale that programmatic buying platforms provide. By utilizing dynamic ads which ensure that the right messaging and content are delivered to individuals, higher engagement can be gained without any significant loss in scale or increase in costs. As they tap into personalized advertising, many brands have started to think of display advertising as more of a publishing model than a campaign model. In other words, instead of thinking in terms of successive campaign cycles, they think in terms of evergreen media on programmatic platforms within which they can deliver specific messaging to their audience, customized very specifically to audience needs.

This style of campaign execution allows brands to execute in the moment messaging, as they are already in market with a campaign and simply have to change the messaging in their advertisements without having to go

through the whole cycle of campaign planning and launch, which may often take so much time that the moment may have passed.

A brand can dynamically alter just components of the ad related to the offer while the campaign is still in flight.

Using programmatic buying platforms, brands can now execute annual buys that give them the benefit of pricing and also give them the flexibility of launching messaging and creative changes into that same media.

Dynamic advertising technology enables such media buys to be used through the year for various campaigns, special offers and new product launches without having to go through the whole process each time.

One of the emerging models in programmatic media buying that could prove to bring about even greater media efficiencies using data is triggering the media buy using external data signals. For example, an allergy medication campaign could be set up with programmatic bid pricing but be activated and run only when pollen counts are high or when air quality is low. Other examples would be activating a campaign for emergency supplies when a hurricane or storm warning is activated and activating a campaign for warm drinks when the temperature drops. Programmatic media buying has had a profound impact on the advertising industry and presents tremendous price and scale efficiencies but perhaps at a cost in terms of engagement and relevance to a brand's audience. Personalized advertising can help brands retain the scale and price efficiencies while increasing relevance. It also allows marketers to spend more time on messaging and communication and less time on trying to find that magical creative concept that will strike everyone.

1.8 Planning for a Data-Driven Ad Campaign

One of the key challenges with personalized ad campaigns is the creative approvals needed. Managing this process well can make the difference between a process that seems to take forever and one that comes together quickly and launches on time.

The brand team needs to explore the available data signals and identify what is relevant to the brand. This involves trying to identify possible correlations between consumers of the brand and the data signals.

After identifying key data signals, the next step is to identify how granular the data signal should be.

The next step is to figure out what specific conditions of the data signals should trigger delivery of a specific creative or messaging. It may develop assets for each of the trigger conditions, it is also important to develop creative messaging for a default condition that does not meet any of the rules.

At this point the creative team starts to think of the creative canvas on which to deliver personalized creative and messaging. This involves defining what parts of the ad will remain constant and what parts of the ad will be personalized to the user. The default is the version of the ad that would be served if none of the programmed conditions were being met in the dynamic ad. Creative production is the next step, it's the process of building out all the variations of the ads and messaging. It can be very challenging if it's done using technology platform that is not designed for dynamic ads. First same in each variant of the ad, as the logo, the skin or some animation. This should be separated out form the variable components of the ad, such as messages, videos and map location.

A good idea at this stage is to identify the metrics that will be measured in order to determine the success of the campaign.

Key metrics for performance oriented dynamic ad campaigns are usually click-through, view-through, and conversion rates. Oh the other side, branding campaigns tend to focus on other metrics, like engagement time, interactions and views. Measuring the views is also a key for personalized ad campaigns, because if an ad campaign has a low number of view on impression, the impact of the personalization will simply not be seen because is not enough relevant for users to create sufficient engagement.

1.9 Measurement of personalized Ad Campaign

Reporting and measurement of personalized ad campaigns are critical to marketers. With personalized ads, the creative variants of an ad can quickly get into the hundreds and thousands, and so collecting very precise data about each variant that was delivered and on what site becomes very critical.

Measurement of ROI for dynamic and personalized advertising campaigns can vary based on the goals of the campaign. In general, dynamic ad campaigns can be sorted into performance marketing efforts and branding efforts.

Most campaigns are usually set up and measured to optimize either leads and conversions or brand engagement.

Performance, or direct response, campaigns that employ dynamic or personalized content often try to determine what types of content are producing the best results.

Measures here often include the following key metrics:

- Click-through rates: Measures how often users clicked through the ad to a web page;
- View-through rates: Measures hew often users saw the ad and then reached the advertiser's website via other means;
- Conversion rates: Measures how often users, after having seen the ad or clicked through the ad, actually purchased a product.

It is critical that performance oriented dynamic ad campaigns not only measure these metrics but also report on them, so it becomes easier to optimize a campaign for better performance.

For campaigns that are much more focused on brand awareness, personalized advertising can be very impactful in creating awareness and engagement, but, it may also be more challenging to measure the impact of personalized advertising.

Brand lift studies, which have long been used to determine the lift caused by branding campaigns, are still a very effective means to measure the impact of personalized advertising.

It is often beneficial also to run an A/B test of standard creative versus personalized creative, it is the simplest form of testing to determine what creative or content combination is producing the best results. A/B testing involves creating two variants of messaging or creative and running them in parallel in a single campaign, with an equal exposure of both variants to the users who see the ad. The campaign is then optimized to serve the version that is producing the best performance between the two.

fig. 1.3 – A/B testing

More sophisticated A/B testing based optimization algorithms often perform sampling with both creative variants to ensure that any changes in

the performance of either creative is constantly monitored and factored into the weighting of the creative.

It may also be that a creative variant that wasn't performing too well at a point in time may start performing well. Therefore, the ability to constantly test and evaluate combinations of creative is vital to campaign performance.

2. Internet of things

2.1 Background of IoT

The term Internet of Things (IoT) was used for the first time by Kevin Ashton in 1999, while holding a presentation at Proctor & Gamble. He used the term to link the idea of radio frequency identification (RFID) to the then new topic Internet.[7]

Since then the use of this term has blossomed and major companies have predicted an increase in IoT. The reason IoT has become so huge depends partly on two things: Moore's law and Koomey's law.

Moore's law states that the number of transistors on a chip doubles approximately every two years. This has enabled people to develop more powerful computers on the same sized chip.[8]

Koomey's law explains that the number of computations per kilowatt-hour roughly doubles every one and a half years. Kevin Ashton states that these two laws have together enabled us to create powerful and energy efficient computers. By turning the graph for Moore's law upside down it can be interpreted as the size of a computer is halved every two years. Doing the same thing to Koomey's law can be interpreted as the amount of energy needed to perform a computation is dropping at a rapid rate. Combining these interpretations tells us that we can perform the same amount of computations on increasingly a smaller chip, while consuming decreasing

[7] Kevin Ashton, *"That's Internet of Things"*, 2009
[8] G. E. Moore, *"Cramming More Components onto Integrated Circuits", 1965*

amounts of energy. [9]

The potential result is a small, powerful, and energy efficient computer which enables us to provide more advanced services using less chip area and at a lower energy that what has been possible before.

Defining the term IoT can be somewhat difficult, the basic concept of IoT is to connect things together, thus enabling these "things" to communicate with each other and enabling people to communicate with them.

"...a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies"[10],

That is the definition of IoT proposed by ITU's Telecommunication Standardization Sector.

Interconnecting the physical world with the virtual world and applying this concept to all things opens up new possibilities in the sense of being able to at any time access anything from any place. "Things" in the physical world are objects that physically exist and from the perspective of IoT we are able to sense, operate, and connect to these things, while in the virtual world "things" are objects that can be stored, accessed, and processed.

IoT involves sensors in order to collect information, sensors are already being used in daily life, smartphones contain different kind of sensors, such as accelerometers, cameras, and GPS. Built-in sensors are nothing new in

[9] J. G. Koomey, S. Berard, M. Sanchez and H. Wong, *"Assesing Trends In The Elecritcal Efficiency Computation Over Time",* 2009

[10] ITU Telecommunication Standardization Sector, *"ITU-T Recommendation database"*, 2012

today's society. IoT is already happening, but might be not seen compared to smartphones which can both be seen and touched. IoT technology already exists but is not necessarily seen, so the development of IoT might progress a long way before it is visible for everyone.

The most vital part of achieving IoT is communication, because in order to interconnect different devices they must be able to communicate. There are some fundamental characteristics for IoT that provide a clearer picture of the actual differences between IoTs and other devices:

- Interconnectivity: Everything can be connected to the global information and communication infrastructure, it is the basic characteristic for IoT.
- Things-related services: Things related services resolves around devices being constrained by its CPU performance, memory, and power which limits what a device can do, when it can do it, and how often it can do it.
- Heterogeneity: Devices within IoT have different hardware and use different networks but they can still interact with other devices through different networks. Supporting heterogeneity is the biggest challenge because there are a lot of different protocols in use. Interacting through multiple networks will be challenging from both security and technical perspectives, therefore, there are some requirements relevant for IoT, such as security and privacy protection. Security includes privacy consideration, since data collected by for instance a sensor might contain information that is sensitive personal information. A thing that reports a geographical location can for privacy reasons add noise to its position, thus the physical location compared to the virtual location can differ. This

prevents the device from having an exact location mapped to it thus protecting spatial privacy.

- Dynamic changes: The state of a device can change dynamically, thus the number of devices can vary. (Device states: connected, disconnected, waking up, and sleeping)
- Enormous scale: The number of devices operating and communicating will be larger than the number of devices in the current Internet. Most of this communication will be device to device instead of human to device.

2.2 What is IoT

IoT includes different objects with different capabilities, which have a common way of communicating for enabling transfer of information, where this information is understood by two or more objects in order to make a process more efficient.

Objects include both virtual and physical objects, but are not limited to:

- Electronic devices such as computers, mobile phones, televisions, machines, and robots;

Sensors communicating includes:

- Different protocols and technologies for sending digital or analogue signals through nodes, (i.e. Constrained Application Protocol, File Transfer Protocol, Hypertext Transfer Protocol, Local Area Networks, Wide Area Networks, Body Area Networks, Wi-Fi, Ethernet, fibre optic links, radio and more)

Capabilities include:

- Gathering information, processing information, storing information, and presenting information.

A process could include:

- Tracking health information, heating your home, lighting public streets, and keeping track of assets.

An example of non-IoT is a single object speaking its own language and potentially connected to a communication network, but no other object is

able to interpret this data and therefore no other object can contribute with any functionality to this non-IoT device.

The contexts in which the term IoT is being used are very different, such as the body, homes, cities, industry, and the global environment.

• In terms of the body, IoT enables sensing and connectivity, for example tracking activity, health status, and other relevant information could improve not only the user's daily life, but also their future health by preventing bad habits.

• When talking about the home, IoT is often considered in terms of remote and local monitoring and management of different home electronics and lights, or simply to keep plants in the yard alive by using an automatic watering system.

• In correlation to cities, the term IoT is used to describe systems that effectively gather and process information generated by various infrastructures, for example monitoring centres for traffic lights, street lights, camera surveillance and the power grid. These systems offer the potential to improve the flow of vehicles and people through the city centres and also greatly improving the energy efficiency of transport systems, while also improving personal and societal safety.

• Optimizations of operations, boosting productivity, saving resources, and reducing costs are typically the main goals of IoT solutions applied in industry. For example, industry might use IoT to keep track of business assets, improve environmental safety, and maintain quality and consistency in a production process.

• Last, but not least important, is environmental monitoring where IoT can help us understand and better manage those resources we have. Sensors can

help protect wildlife, track water usage and flows, monitor local weather, monitor use of natural resources, or give warnings before and after natural disasters to prepare people for what is to come.

The ITU-T has defined a reference model for IoT. This model is divided into the four layers: application layer, service support and application support layer, network layer and device layer.[11] Each one of these layers also includes management and security capabilities. These capabilities have both generic and specific capabilities that can cut across multiple layers.

- The application layer contains IoT applications which require certain support capabilities from the underlying layer to function.
- The service and application support layer consists of generic support capabilities which can be used by IoT applications, examples of such capabilities could be data processing or storage. The specific support capabilities are those other than the generic capabilities which are required to create support for diversified applications.
- The network layer is divided into networking and transport capabilities. The networking capabilities provide relevant control functions for network connectivity, while the transport capabilities focus on the transport of IoT service and application specific data.
- The device layer is where the device capabilities include direct and indirect interaction with the communication network. Unlike direct interaction, indirect interaction requires a gateway to be able to send and receive information via the network. Two other capabilities are

[11] ITU Telecommunication Standardization Sector, "ITU-T Recommendation database", 2012

ad hoc networking and sleeping and waking up which enable devices to connect in an ad hoc manner and saving energy. The device layer also includes gateway capabilities to support devices connected via different types of wired and wireless technologies by supporting multiple interfaces. In some situations, protocol conversion is needed to support communication between devices using different protocols at the device and network layer.

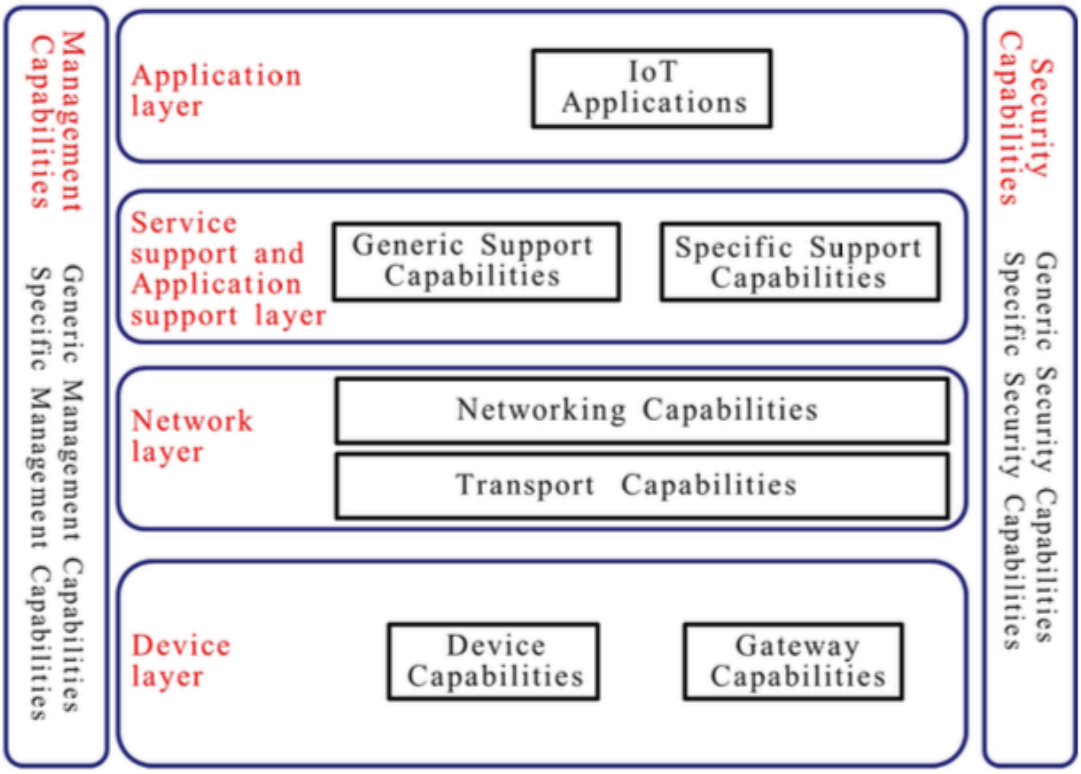

Fig. 2.1 ITU-T reference model

Generic management capabilities include device management, such as remote device activation, de-activation, diagnostics, and firmware or software updates, and local network topology, traffic, and congestion management.

The generic security capabilities are independent of the application and include authorization and authentication at the application, network, and

device layer.

Moreover, all of the layers have their own individual capabilities.

- At the application layer: application data confidentiality and integrity protection, privacy protection, security audit and anti-virus;
- At the network layer: signaling data confidentiality and integrity protection;
- At the device layer: device integrity validation, access control, data confidentiality, and integrity protection.

2.3 What IoT needs to work: Artificial Intelligence

Together with the expansion and the goal of a sustainable society, people need better ways to collect and distribute information over the Internet, maintaining accuracy, reliability, relevancy, and security.

Many years ago, almost every piece of digital information was typed, recorded, or in some other way created by human beings. Humans are fundamentally limited in the rate at which they can generate information. However, computers and other devices can generate information without any human interaction, which increases the possibility to collect sufficient information to reduce unnecessary loss and costs.

However, in order to take appropriate actions based on decisions, people need to know that the information they are basing their decisions on is secure and accurate.

In order to achieve accuracy, reliability, and relevancy in the enormous amounts of generated and processed data, there is need of transferring the human intelligence and appropriate security mechanisms to the systems in use. Artificial intelligence (AI) is the word used to describe computer systems with intelligent behaviour, such as representation, searching, reasoning and learning, which are the four fundamental features of AI. [12]

A system with AI needs an internal representation of a problem or related knowledge to be able to know when a problem arises.

After a problem has been identified the next step is to find out what to do, which is often done by using different kinds of search methods. When relevant information associated to the problem has been found, reasoning together with the knowledge is used to find a fitting solution.

[12] D. A. Gustafson, "Artificial intelligence", 2014

Most systems with AI also have the ability adapt and optimize if necessary, which is done by machine learning based on historical statistics for example.

The activities of Artificial Intelligence can be spread around in IoT and does not require that all the activities occur in the same place. In IoT, the collection of all these activities is what creates the AI. The flow of data in regards to sensing and processing can be presented in different ways. The flow can be as simple as an object acquiring data through a sensor, which it then processes and finally transmits in the form of a data packet.

The simplest way of describing a data processing flow is a monitoring object collecting data which is sent to a computation device that processes and analyses the data. The computation device then sends the result to a terminal which executes a command based on the result or simply presents the data to for example a user.

The processing of data may not occurs only once during the dataflow in IoT, the sensor itself might do some processing before the data is sent to a larger collection point which in turn sends the data to a processing point. The use of remote processing is especially relevant when the system consists of multiple objects that together provide the data necessary in order to decide if for example a command needs to be executed or not.

The artificial intelligence is not necessarily positioned in the same platform or device since their placement will depend upon the structure of the IoT environment.

When connected to the Internet, the possibilities that others can see us, hear us, and control devices is greatly expanded through the deployment of IoT. Moreover, privacy and personal integrity concerns arise as more data is collected about our activities and personal information, in the form of

locations, habits, or financial account numbers. Additionally, many of the decisions and actions that will be taken based upon and using IoT will have real-world costs, risks, and benefits. For these reasons, ensure that security considerations are part of the design process and not something that is added late in the development of each IoT device.

When deploying things that are capable of connecting to the Internet it will be important that implementations are done correctly, otherwise systems and their information might be exposed to attacks.

2.4 Security in IoT

IoT is facing more severe challenges on the security aspect, there are the following reasons:

- the IoT extends the internet through the traditional internet, mobile network and sensor network,
- every "thing" is connected to internet;
- these "things" will communicate with each other.

Therefore, the new security and privacy problems will arise, there is a need to pay more attention to the research issues for confidentiality, authenticity, and integrity of data in the IoT.

With the development of advanced network techniques, distributed multi-agent control and cloud computing, there is a shift integrating the concepts of IoT and autonomous control in machine to machine (M2M) research to produce an evolution of M2M in the form of Cyber-Physical-System (CPS). M2M is a broader terminology for any technology that enabled networked devices to exchange information and perform actions without the manual assistance of humans, CPS mainly focuses on allowing smart interaction, interactive applications, distributed real-time control, cross-layer optimization and cross-domain optimization. Therefore, some new technologies and methodologies should be developed to meet the higher requirements in terms of reliability, security and privacy.[13]

[13] M. Chen, J. F. Wan, F. Li, *"Machine-to-machine communications: architectures, standards, and applications"*, 2012

The security of information and network should be equipped with properties such as identification, confidentiality, integrality and indisputability. IoT will be applied to the crucial areas of national economy, i.e. medical service and health care, and intelligent transportation, thus security needs in the IoT will be higher in availability and dependability.

In general, secure architecture of the IoT can be divided into four key levels:[14]

- The most basic level is the perceptual layer, which collects all kinds of information through physical equipment and identifies the physical world, the information includes object properties or environmental condition. The key component in this layer is sensors for capturing and representing the physical world in the digital world.
- The second level is network layer. Network layer is responsible for the reliable transmission of information from perceptual layer, initial processing of information, classification and polymerization. In this layer the information transmission is relied on several basic networks, which are the internet, mobile communication network, satellite nets, wireless network, network infrastructure and communication protocols are also essential to the information exchange between devices
- The third level is support layer. Support layer will set up a reliable support platform for the application layer, on this support platform all kind of intelligent computing powers will be organized through

[14] H. Suo, J. F. Wan, C. Zou, J. Liu, *"Security in the internet of thing"*, 2012

network grid and cloud computing. It plays the role of combining application layer upward and network layer downward.

- The application layer is the terminal level. Application layer provides the personalized services according to the needs of the users. Users can access to the internet of thing through the application layer interface using of television, personal computer or mobile equipment and so on.

Network security and management features play an important role in above each level.

- Perceptual Layer: Usually perceptual nodes are short of computer power and storage capacity because they are simple and with less power. Therefore, it is unable to apply public key encryption algorithm to security protection. And it is very difficult to set up security protection system. Meanwhile attacks from the external network such as deny of service also bring new security problems. In the other hand sensor data still need the protection for integrity, authenticity and confidentiality.
- Network Layer: Although the core network has relatively complete safety protection ability, but man in the middle attack and counterfeit attack still exist, meanwhile junk mail and computer virus cannot be ignored, a large number of data sending cause congestion. Therefore, security mechanism in this level is very important to the IoT system.
- Support Layer: Do the mass data processing and intelligent decision of network behavior in this layer, intelligent processing is limited for malicious information, so it is a challenge to improve the ability to recognize the malicious information.

- Application Layer: In this level security needs for different application environment are different, and data sharing is that one of the characteristics of application layer, which creating problems of data privacy, access control and disclosure of information.

According to the above analysis, we can summarize the security requirements for each level in the following

- Perceptual Layer: At first node authentication is necessary to prevent illegal node access; secondly to protect the confidentiality of information transmission between the nodes, data encryption is absolute necessity; and before the data encryption key agreement is an important process in advance; the stronger are the safety measures, the more is consumption of resources, to solve this problem, lightweight encryption technology becomes important, which includes Lightweight cryptographic algorithm and lightweight cryptographic protocol. At the same time the integrity and authenticity of sensor data is becoming research focus.
- Network Layer: In this layer existing communication security mechanisms are difficult to be applied. Identity authentication is a kind of mechanism to prevent the illegal nodes, and it is the premise of the security mechanism, confidentiality and integrality are of equal importance, thus we also need to establish data confidentiality and integrality mechanism.
- Support Layer: Support layer needs a lot of the application security architecture such as cloud computing and secure multiparty computation, almost all of the strong encryption algorithm and encryption protocol, stronger system security technology and anti-virus.

- Application Layer: To solve the security problem of application layer, two aspects are needed. One is the authentication and key agreement across the heterogeneous network, the other is user's privacy protection. In addition, education and management are very important to information security, especially password management.

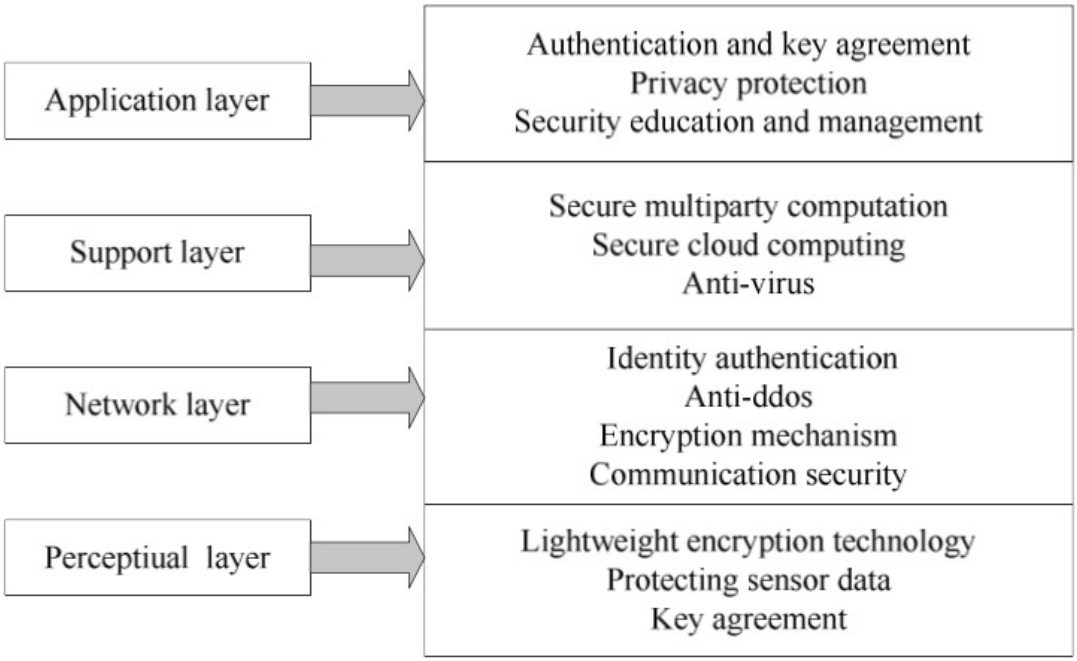

Fig. 2.2 – Security requirements

In summary security technology in the IoT is very important and full of challenges. In other hands laws and regulations issues are also significant.

Looking into the state of research for the security requirements on encryption mechanism, communication security, protecting sensor data, and cryptographic algorithm.

In the traditional network layer are adopted by-hop encryption mechanisms, in this way the information is encrypted in the transmission process, but it needs to keep plain text in each node through the decryption and encryption operations. Meanwhile in the traditional application layer

encryption mechanism is end-to-end encryption, that is, the information only is explicit for the sender and the receiver, and in the transmission process and forwarding nodes it will be always encrypted.

In the IoT network layer and application layer connect so closely, so there is a need to choose between by-hop and end-to-end encryption. The features of by-hop encryption are low latency, high efficiency, low cost, and so on. However, because of the decryption operation in the transmission node ca get the plaintext message, so by-hop encryption needs high credibility of the transmission nodes.

Using the end-to-end encryption, are allowed different security policy according to the type of business, thus it can provide high level security protection to the high security requirements of the business. However, end-to-end encryption can not encrypt the destination address, because each node determines how to transmit messages according to the destination address, which causes it can not hide the source and the destination of the message being transmitted, and bring about malicious attacks.

To summarize when the security requirement of some business is not very high, can be adopted by-hop encryption protection; when the business needs high-security, then end-to-end encryption is the first choice.

For what concern communication security, there are some protocol can provide integrity, authenticity, and confidentiality for communication, such as TLS/SSL or IPSec. TLS/SSL is designed to encrypt the link in the transport layer, and IPSec is designed to protect security of the network layer, they can provide integrity, authenticity, and confidentiality in each layer. Then communication security mechanisms are also rarely applied nowadays. Because in the IoT small devices are less processing power, this

leads that communication security is often weak. Meanwhile, the core network is always the current or next-generation Internet, so DDoS still exists and is a very severe problem. Botnets and DDoS attacks will destroy the availability of communication. When lager-scale or organized DDoS attacks happen, how to do the disaster recovery is highly significant, so is needed to pay more attention to researching better preventive measures and disaster recovery mechanisms.

Protecting sensor data is becoming research focus, and confidentiality of sensor data is a lower demand because when an attacker can just place its own sensor physically near, he can sense the same values. So at the sensor itself the confidentiality need is relatively low.

The main research target in sensors is privacy, and privacy is also a major problem. Should be adopted the mechanisms to protect the privacy of humans and objects in the physical world. Most times people are often unaware of sensors in their life, so we need to set up regulations to preserve the privacy of people. In literature, several guidelines are given to solve this problem in the design phase: at first users must know that they are being sensed, the second users must be able to choose whether they are being sensed or not, the third users must be able to remain anonymous. When the user has no realization of these guidelines, that regulations must be made.

Finally, what concern cryptographic algorithms, the algorithm used to encrypt data for confidentiality is the advanced encryption standard (AES) block cipher. The asymmetric algorithm is often used to digital signatures and key transport, frequently used algorithm is the Rivest Shamir Adelman

(RSA); the diffie-hellman (DH) asymmetric key agreement algorithm is used to key agreement; and the SHA-1 and SHA-256 secure hash algorithms will be applied for integrality. Another significant asymmetric algorithm is known as elliptic curve cryptography, ECC can provide equal safety by use of shorter length key.

To implement these cryptographic algorithms available resources are necessary such as processor speed and memory.

So how to apply these cryptographic techniques to the IoT is not clear, more effort to further research are necessary to ensure that these algorithms can be successfully implemented in constrained memory and low-speed processor of IoT devices.

IoT is a very active and new research field, so a variety of questions need even to be solved, at different layers of the architecture and from different aspects of information security.

2.5 Future Of IoT: from IoT to IoE (internet of everything)

Although the concept of Internet of Everything emerged as a natural development of the IoT, IoE encompasses the wider concept of connectivity from the perspective of modern connectivity technology use cases. IoE comprises of four key elements including all sorts of possible connections:

- People. Considered as end-nodes connected across the internet to share information and activities. Examples include social networks, health and fitness sensors, among others.
- Things. Physical sensors, devices, actuators and other items generating data or receiving information from other sources. Examples include smart thermostats and gadgets.
- Data. Raw data analyzed and processed into useful information to enable intelligent decisions and control mechanisms. Examples include temperature logs converted into an average number of high-temperature hours per day to evaluate room cooling requirements.
- Processes. Leveraging connectivity among data, things and people to add value. Examples include the use of smart fitness devices and social networks to advertise relevant healthcare offerings to prospective customers.

IoE establishes an end-to-end ecosystem of connectivity including technologies, processes and concepts employed across all connectivity use-cases. Any further classifications such as Internet of Humans, Internet of Digital, Industrial Internet of Things, communication technologies and the

Internet itself will eventually constitute a subset of IoE if not considered as such already.

2.6 IoT shaping digital Marketing

Marketing is about more than the data-driven marketing context of the Internet of Things. IoT enables marketers to create totally different experiences in bridging the digital and physical world, in particular when they have to think out of the box and beyond the pure aspect of personalized messaging. Today, most IoT projects are about the optimization and automation of processes and goals that are only indirectly related with the customer and their experience.

However, in retail industries, there is a stronger external and customer-facing component, whereby the focus on customer experience and customer engagement is more important. The connected consumer who is becoming over-connected, is a great source of data for marketing and so for digital advertising.

The usage of the IoT enables marketers to provide highly contextual and tailored messages to consumers, for instance in connection with digital billboard in physical situations, such as via mobile or other devices in digital interactions. So in the shopping environment of retail, marketers are increasingly looking at IoT.

The main strengths of the Internet of Things in marketing have everything to do with an essential part of the IoT as such: data and data analytics. Being advertising nowadays so much data-driven, Internet of Things data appears like a very attractive gold mine for marketers.

Marketers tend to think in terms of messages and campaigns too often. While that is important, the main power of data, is to understand patterns and create actionable knowledge and insights.

In that context marketers gain the possibility to analyze customer buying habits and gaining deeper insights in the buying journey.

Marketers need acting with messages in real-time, the Internet of Things in marketing should be about end-to-end experience optimization, the *"right information at the right time and place and so forth"*.

But looking at the customers holistically and seeking for being real customer-centric and data-driven addicted, the opportunities of the Internet of Things in marketing are several other than just messages.

Here are a few examples of how everything is connected in marketing from the customer perspective.

If supply chains don't work properly, customer experience will suffer, no matter how good your messages.

Marketers can also use data on customer behavior to enable better experiences or better arrange and present the products they sell, for instance in a shop. Real-time engagement might be one goal but real-time optimization, beyond the message context is even more important, also outside the strict marketing environment. It isn't just about the buying journey and the resolving of issues to get happier customers.

When establishing trust regarding data usage, the real power of the Internet of Things in marketing lies in the ability of marketers to think out of the box and optimize for their customers in a much broader way, regardless of touch points or stages in the overall customer life cycle.

Better listening and engagement are a start. Better service should be a consequence. Better end-to-end customer experience is another game.

Here IoT can play a determinant role, not just in the context of the Consumer Internet of Things but also in Industrial Internet of Things applications where simple value can be created.

Setting up a cost-effective way to let customers see available parking spots within their devices should be a killer feature of a mall or a store, but also smart packaging solutions, developing applications that enable to connect specific products in ways that consumers haven't experienced before, new ways of delivering goods, and so on.

To conclude, the use of the Internet of Things in marketing is really about thinking outside of the box and offering relevant services in the most valuable ways for the real customer in real life.

3. Case Study: Samsung Family Hub refrigerator

3.1 Samsung

Samsung Group is a South Korean multinational conglomerate headquartered in Seoul. It comprises numerous businesses, most of them united under the Samsung brand, and is the largest South Korean business conglomerate.

The South Korean group of high tech world was born in the middle of ’30s fo the previous century, it was not the society that is today:

On March 1938, the founder Lee Byung-Chull started a business in Taegu. At the start, the business focused primarily on trade export, selling dried Korean fish, vegetables, fruit, and Chinese noodles to Manchuria and Beijing. In more than a decade, Samsung would have its own factory and confectionery machines, its own manufacturing and sales operations, and ultimately evolve to become the modern global corporation that still bears the same name today.

At the beginning of ’50s, Lee set off a series of large investments that marked the entry of Samsung in insurance, textile and international trade field.

In 1953 Lee inaugurate a headquarter in Tokyo, and in the second half of ’60s Samsung started to operate in electronic, with the set up of different productive divisions. Were created Samsung Electronics Devices, Samsung Electro-Mechanics, Samsung Corning e Samsung Semiconductor & Telecommunications. In 1969 started the mass production of first Samsung black and white TV. In less than five years Samsung changed very quickly

their original value proposition, form a food company became the lead producer in the world in television sets field. Il 1974 Samsung sold the millionth black and white TV and in 1978 became the first company in the world to sell an amount of 4 million televisions.

In 1974 Samsung also acquired “Hankook Semiconductor”, entering in the market of semiconductor mass production. In 1977 started the production on colour TV and microwave ovens.

In 1977 the product line of Samsung ranged between high tech, through building industry and also shipbuilding industry. That made Samsung an important driver of the economic growth and development of South Korea.

With the acquisition of Hanguk Jeonja Tongsin in 1980 Samsung enter in the telephony market. Its early products were switchboards, the facility was developed into the telephone and fax manufacturing systems and became the centre of Samsung's mobile phone manufacturing. The company grouped them together under Samsung Electronics in the ’80s.

In 1980s, Samsung Electronics began to invest heavily in research and development, investments that were pivotal in pushing the company to the forefront of the global electronics industry.

In 1982, it built a television assembly plant in Portugal; in 1984, a plant in New York; in 1985, a plant in Tokyo; in 1987, a facility in England; and another facility in Austin, Texas, in 1996. From 2012, Samsung has invested more than $13 billions in the Austin facility, which operates under the name Samsung Austin Semiconductor. This makes the Austin location the largest foreign investment in Texas and one of the largest single foreign investments in the United States.

After Lee, the founder's death in 1987, Samsung Group was separated into four business groups: Samsung Group, Shinsegae Group (discount store,

department store), CJ Group(Food/Chemicals/Entertainment/logistics) and the Hansol Group(Paper/Telecom). Today these separated groups are independent and they are not part of or connected to the Samsung Group.

In Samsung portfolio remain the electronics, engineering, building and high tech segments.

Samsung started to rise as an international corporation in the ’90s: it became the world's largest producer of memory chips in 1992 and is the world's second-largest chipmaker after Intel. In 1995, it created its first liquid-crystal display screen and, in ten years, grew to be the world's largest manufacturer of liquid-crystal display panels.

In 2000, Samsung opened a computer programming laboratory in Warsaw. Its work began with set-top-box technology before moving into digital TV and smartphones.

From 2005 Samsung caught up an impressive series of record, first of all it became the world first producer of Televisions, a position that hold still nowadays.

In first quarter of 2012, Samsung Electronics became the world's largest mobile phone maker by unit sales, overtaking Nokia, which had been the market leader since 1998.

This incredible result arise from the ability of Samsung in choosing Android OS as operative system for their smartphones. The key moment was in 2007, when Apple introduced in the market a new concept of smartphone with the iPhone. Up to 2007, the dominant design for a smartphone were the ones proposed by Nokia and Blackberry. Apple changed the idea of smartphone proposing a full multi-touch display without physical keyboard. Nokia and Blackberry underestimated the relevance of that innovation and were still focusing on producing their

classic devices, but Google that was developing Android OS on a Blackberry-type phone decided to change their plan and decided to “go back to drawing board” to adapt their open source OS to touchscreen technology. In 2009, Samsung started the mass production of their first Android phone, the Samsung Galaxy. The homonymous product line, turned out to be a cash cow, Samsung developed the line in a full range family of product, form low-end to high-end devices. In 2011, thanks to the efforts in R&D and thanks to aggressive marketing expenses Samsung was able to close the gap with Apple in smartphone market, and the year later displaced the Nokia’s leadership in mobile phone industry.

In 2014 the South Korean Company unveiled the Galaxy Note Edge, the world’s first smartphone with a curved edge screen, along with the Gear S, the first wearable device featuring 3G connectivity. In the same year it acquired SmartThings, a U.S. based IoT platform developer.

In 2016, with a smartphone market in a stagnant situation and share that were declining, Samsung has tried to hit the jackpot launching with a few weeks in advance with respect to the timetable the new Samsung Galaxy Notes 7. The top range of South Korean company had to be the turning point that would have relaunched Samsung mobile.

Unfortunately since the first days after the launch, some users have started to have problems of overheating which brought to explosion on their smartphone. In less than a month, Samsung was obliged first to recall all device in the hope that by changing the battery would be solved the problem and subsequently has blocked the production and forced all users to turn off their new Samsung Galaxy Notes 7.

The damage for the company was quantified in billions of dollars and also in the stock exchange the title has suffered.

In November 2016 was announced the acquisition of Harman Kardon, a company specialized in audio systems and in the production of devices for cars connected.

To buy Harman Kardon, Samsung paid more than $8 billions, the most expensive acquisition made by the South Korean company. One of the objective of Samsung was to rehabilitate their image after the Note 7-gate and at the same time take an important place in the market of IoT devices mounted on smart car, a sector in which Harman Kardon was one of the leading companies.

In 2016 during the IFA exposition in Berlin, Samsung unveiled his new product, the Samsung Family Hub refrigerator, available in US market and also in the European one in the first months of 2017. This is a next step in IoT ecosystem, a double door refrigerator, able to distinguish itself from the many models in commerce, thanks to a 21 inches display integrated directly on the front, all of this mounting Android OS.

3.2 Samsung Family Hub refrigerator

Samsung revealed his first connected refrigerator during the IFA exposition of 2016, it was a connected fridge with a 21.5-inches touchscreen display.

The touchscreen connects to home Wi-Fi network and provides a lot of non-refrigeration functionality, including family calendars, taking notes and reminders, photo display and streaming music. The touchscreen allows to compile family grocery list and send those list to the smartphone.

There are also some cameras that combined with the display let users the possibility to track the expiration date of a food, an internet browser that allow to access the websites and also some built-in apps for kitchen everyday use such as timer, chef's recipes, personal recipe organizer and so on. A second version of this smart bridge was presented during the 2017 CES(Consumer Electronic Show), it extended the original concept with the add of voice control, and a line-up of different smart connected fridge in European and US Layout.

Fig. 3.1 - Samsung Family Hub

Samsung's family of Family Hub smart fridges got a little bigger year by year, with a total of 10 models to choose from, and in May 2017 the fridge was launched in Italian Market in 2,499€ and 3,999€ configurations.

Inside the refrigerator are three cameras that take photos every time the doors close. Users can view what's inside the fridge from their smartphone, as well as control refrigerator and freezer temperatures, check the status of the water filter, and control ice maker. Thanks to an app called *Groceries*, created in partnership with Mastercard, every family member is able to add foods on the online cart, in a second moment can be done the checkout and pay directly with credit card. It's a powerful computer in the kitchen, useful to read recipes, listen to music, stream also the TV if it is a Samsung smart TV. The aim is to make the fridge the central point of dining room.

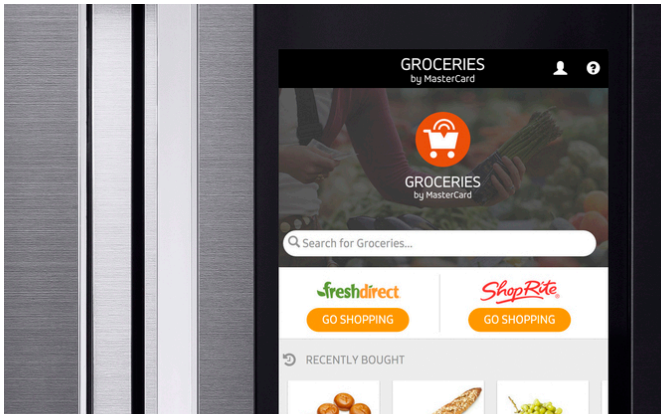

Fig. 3.2 – Groceries by mastercard

With a tap on the app *Morning Brief* is possible to monitor weather condition, sync all family members calendars to organize the tasks. The display works as a virtual bulletin board, with digital equivalent of post-it notes, photos and reminders.

3.3 Value proposition

Going to analyze the value proposition for consumers of Samsung Family Hub, the first notable thing is the smart connectivity features. In a context in which smart and automated house topic is gaining more and more relevance the connected fridge is something that expand the list of smart object inside an house. For what concern the Hub, it let the user to access data about the fridge outside the home, a way to have always the most updated situation of what is inside the fridge and what is needed, something that before that was impossible to know in such a punctual way. Another service that is proposed to customers is the possibility to differentiate the temperature of three storing levels inside the fridge, in mobility or also in house, that to have a better management of foods cooling requirements for a better preservation over time.

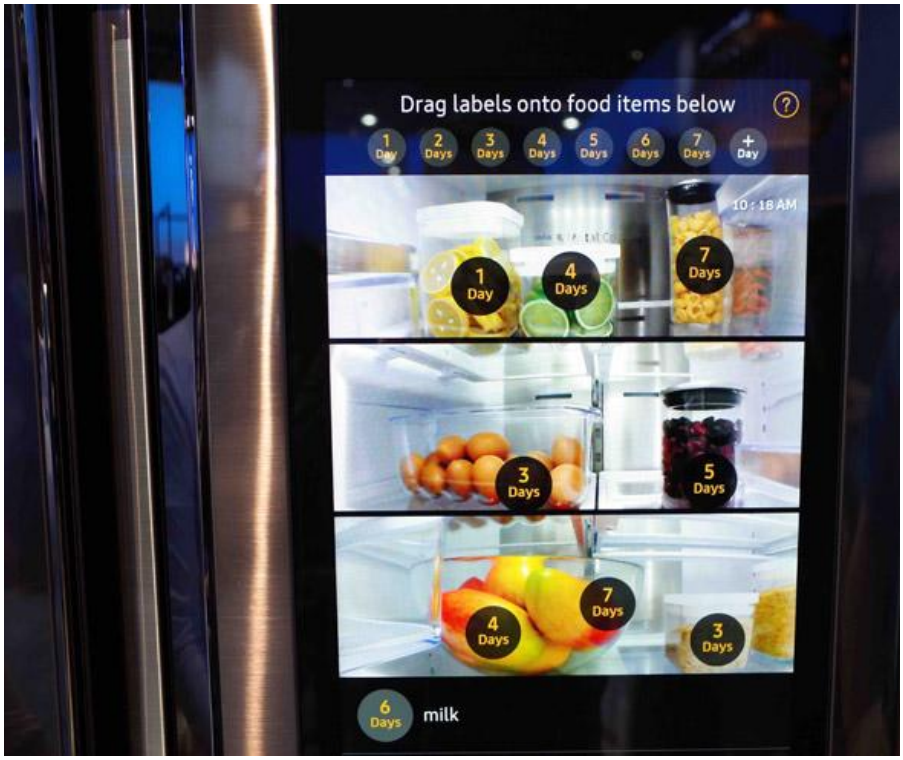

Fig. 3.2 – Food expiration date tracking

Another service provided by Samsung is *Club des Chefs*, a collection of recipes made with star Chefs, all this is at hand of who have to cook, like a receipt manual, but made by chef specifically for Samsung and its fridge. The last important service that Samsung made for improving customer journey is the online grocery shop. It is the key function for the business behind that fridge, from the perspective of users it allows to simplify the way to buy foods. Online grocery market is still relevant, consumers are demanding for a shopping experience that enables them to shop in a way that's convenient for them and fits in with their busy lives.

From the perspective of Samsung there are three important considerations to be done around the Family Hub. First of all it turns the fridge buyer into a raw resource, and that resource is "someone who provides lots of data for free." The kitchen of the future will be collecting and broadcasting a lot of actionable data. New camera-and-software system learn to identify new jars, bottles and containers based on a pre- existing image library and some experience based learning. The idea here is that the fridge will be able to keep an inventory of its contents, which customers then will use to update their grocery list. This fridge will be collecting data about what they are consuming and how often they are consuming it.

Refrigerators that track what people eat are only the latest entrant in the market of buying and selling data on consumers' food habits, in fact grocery chains' loyalty programs have been doing it for years. Who can provide solid data on how people shop, should tweak their inventory accordingly and provide all sorts of prompts that invite people to spend more.

The second consideration about the Hub for Samsung business is that it helps to expand the product's ecosystem of South Korean company. The

first example is the mirroring functionality of the fridge: it will work only with Samsung smart TV. All the services provided by the Hub through its display is synched in Samsung proprietary apps. The partnership for the project *Club des Chefs,* with the most important worldwide star Chefs, allowed the company to develop and high end line-up of household appliances, like ovens, microwave ovens and stoves. All these things contribute to increase in the users the willingness to buy other Samsung products and devices, making a comfortable user experience through all the components that belong to Samsung ecosystem.

The third and last consideration about Samsung is that the partnership he developed to allow *Gorceries* app work, are a direct revenue stream in everyday usage of the fridge, allowing the company to operate with a single product into the growing IoT market but also in online grocery market.

3.4 Market overview

As seen so far, we can conclude that Samsung with its Family Hub is going to operate inside two different markets: The smart home device market and online grocery market.

IoT prognostications are everywhere, for now, we have wearable computers, vacuuming robots, and smart refrigerators, by 2020, Gartner Research forecasts approximately 20.8 billion IoT enabled devices, while IDC projects a $1.7 trillion global IoT market.[15]

Early growth was led primarily by devices and connectivity: robot vacuum cleaners and internet connected thermostats. Today, we have an array of Wi-Fi enabled products for every room in the house.

Roughly one in every four US internet users currently owns a smart home product or device, from an internet connected home alarm system to a smart meter or smart refrigerator, even a smart doorbell or garage door.

Consumers with a household income more of $100,000 are statistically more likely to interact with smart home devices (43%), followed by men (32%). Conversely, consumers above the age of 50 are least likely to interact with smart home devices (13%).

26% of current smart home users say they bought their first device to either increase overall convenience, improve their quality of life, or help them be more productive. Meanwhile, 10% wanted to make their home safer, and another 10% cited affordability. A bunch of current smart home consumers likened a device to a personal assistant that has the ability to remember or doing things they forgot to do.

Directional differences emerge across demographics on further analysis.

[15] Pwc, *"Smart home, seamless life"*, 2017

Only 6% of current smart home device users ranked energy savings as a motivator for purchase. This represents a disconnect from non-users, who say that saving money would hugely motivate them to future purchase.

For consumers who are not current smart-device users, the motivation to buy a smart device converges around four main themes: savings, safety, convenience, control.

Savings on monthly energy bills are the most impactful benefit of a smart home device in the eyes of current non-users. Eighty-six percent say reducing their energy bill or increasing energy efficiency affects their decision to own a connected home device in the future.

Consumers above age 50 are least likely to buy smart home devices. Unlike digital natives, they often need to be encouraged to try new technology. They may be more comfortable once the technology becomes more widely available, and they clearly understand the benefits.

Price is the number one purchase barrier for smart home devices.

Nearly half of non users 42% are considering price as their biggest hesitation but adoption barriers differ between individual smart devices and smart home solutions. For individual devices the main hesitation is the value for price, for the latter, the main barrier is complexity and lack of understanding.

A key feature of smart devices is their ability to track and analyze information at various levels. A health monitor, for example, tracks steps at the basic level. For $10 a month, however, consumers have access to a premium account with enhanced monitoring and tracking capabilities. And connectivity with other users, which has proven to help further motivate activity and fitness.

The report (as shown in figure 3.1) underline that there are some features a consumer would be willing to pay for: enhanced safety features are most popular: 75% of consumers are willing to pay more for extra security.

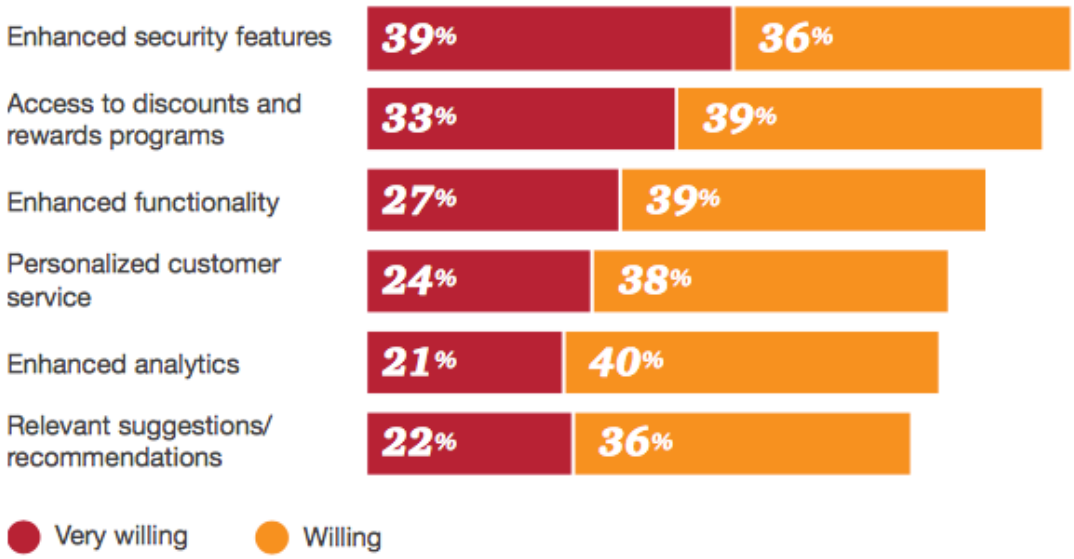

Fig. 3.4 – Most demanded features

According to a new IAB report for 65% of Internet of Things users are fine to receive ads on their devices, and more, 44% are willing to watch them if they receive a coupon in return.

Increased control of home functionality is a key motivator of smart home device purchase, and in that context, an easy to use integrated app is essential to maximizing that functionality as well as usage.

There is a strong correlation between smart home device use and connectivity with an app: 74% of customers say that they use their smart home devices more frequently because it connects to their mobile device.

In a universe of unlimited smart home device options, consumers rank smart lights top the list, most likely due to their lower price point and ability to save money while increasing home efficiency. This was followed

by smart video cameras and locks, which correspond with security, an essential consumer priority.

The second market in which Samsung is going to operate is the online grocery market, consumers are no longer shopping entirely online or offline, rather, they are taking a mixed approach, using whatever channel best suits their needs.

The most successful retailers and manufacturers will be at the intersection of the physical and virtual worlds, leveraging technology to satisfy shoppers however, wherever and whenever they want to shop.

The Nielsen Global E-commerce and the New Retail Survey polled 30,000 online respondents in 60 countries to understand how digital technologies will shape the retail landscape of the future.[16] They look at how consumers are using technology and offer insights about how retailers and manufacturers can use flexible retailing options to improve the shopping experience and drive increased visitation and sales across channels. They also examine retail sales data to determine how distribution and channel shopping preferences are changing around the world and how that affects what the future of retailing look likes.

A quarter of global respondents are already ordering grocery products online for home delivery, and more than half are willing to use it in the future. Increasingly, retailers are introducing e-commerce models that make it even easier for time crunched consumers to get the items they need. 14% of global respondents say they use an automatic online subscription

[16] Nielsen Company, *"The future of grocery"* report, 2015

service, in which orders are routinely re-filled at a specified frequency, and more than half (54%) are willing to do so in the future.

In 2011, Tesco introduced the first virtual supermarket in a South Korean subway system, and the model has spread to other markets. Today, 13% of global respondents say they're already using a virtual store and 58% are willing use them when they become available.

A smaller number of consumers are using "click and collect" services in which they order groceries online for pickup at a store or other location. Just 10% of global respondents say they order groceries online and pick them up in store.

The growth of online Consumer Packaged Goods(CPG) sales has been driven in part by the maturation of digital natives, the consumers who grew up with digital technology. Millennials have an unprecedented enthusiasm for technology, and online shopping is an habit for them.

30% of Millennials (ages 21-34) and 28% of people aged 15-20 respondents saying they are ordering groceries online for home delivery, compared with 22% of aged 35-49, 17% of 50-64 and 9% of Sages 65+.

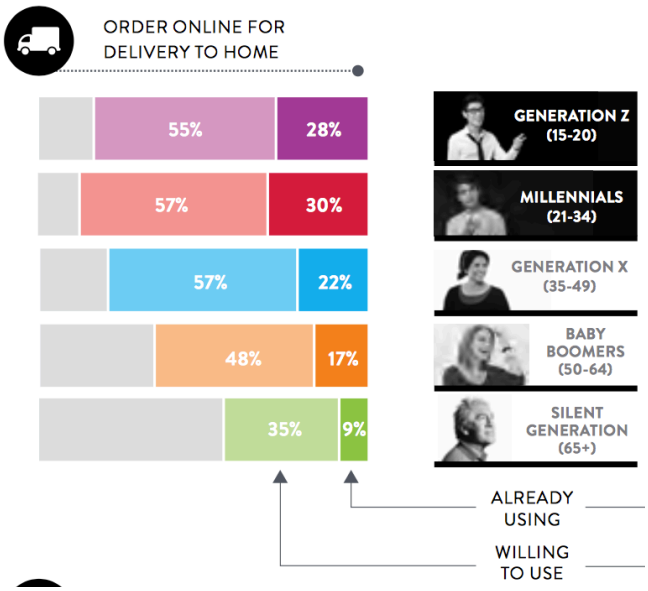

Fig. 3.5 – CPG shopping

Millennials are at the beginning of their careers and are starting to form households, while the younger generation members will soon be graduating college and joining the workforce. It is critical that retailers and manufacturers understand how these consumers are using technology and include digital touch points along the entire path to purchase.

Willingness to use digital retailing options in the future is highest in the developing markets in the Asia-Pacific (60% on average), Latin America (60%) and Africa/Middle East regions (59%), and trails in Europe (45%) and North America (52%).

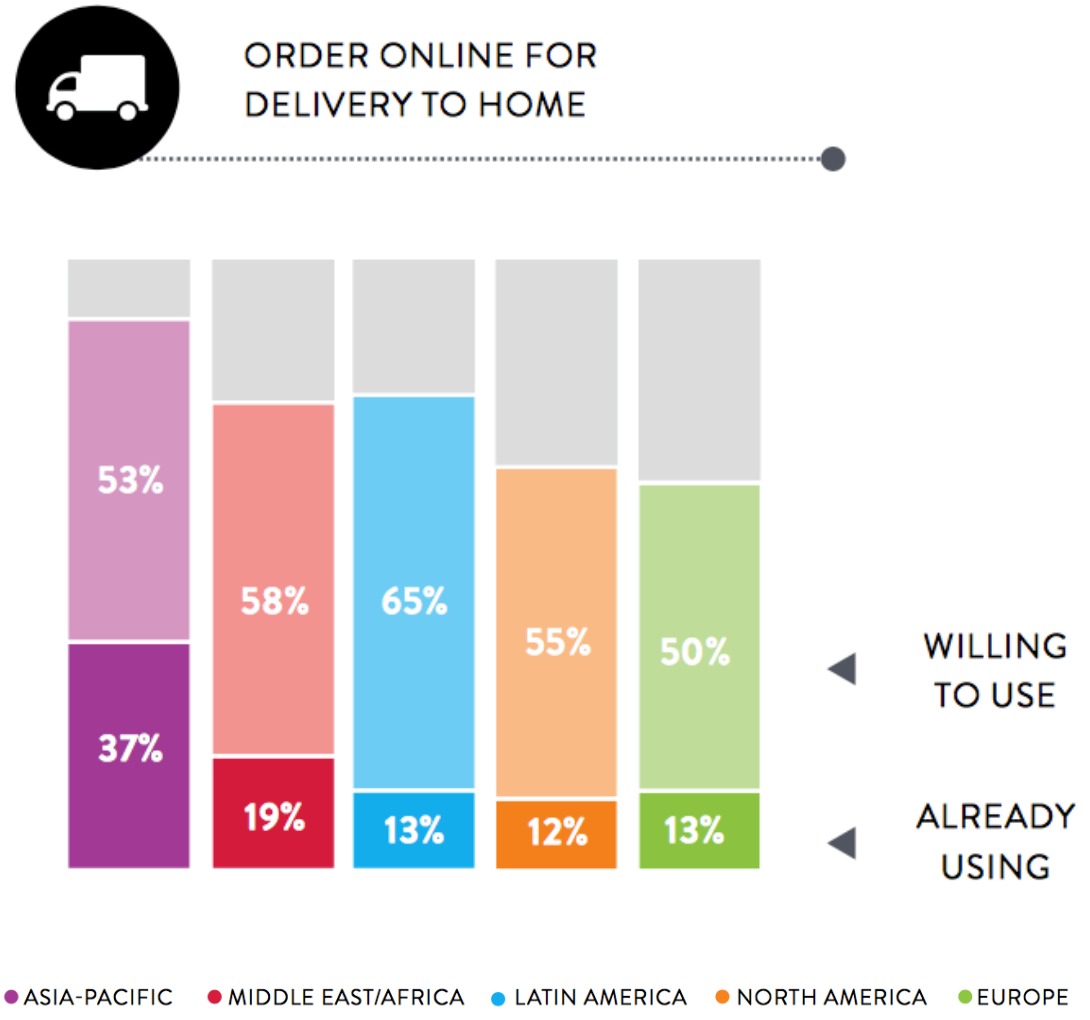

Fig. 3.6 – Digital retailing attractiveness

Globally, the trade channel mix is becoming more fragmented as consumers shift toward smaller store formats. On a value basis, large supermarkets and hypermarkets account for just 51% of global sales, but smaller formats grew at a faster rate over the past 12 months.

In fact, year over year sales growth in drug stores +6%, small supermarkets +5% and traditional stores +4%, doubled, or more than doubled, that of large supermarkets and hypermarkets, which grew a modest 2% each.

While there is some growth for large stores, the real winners are mini markets, small supermarkets and convenience stores. And digital is taking proximity retailing to a new level of customer centricity.

However, Channel structures and trends vary greatly between countries.

In developed markets, 80% of sales come from large supermarkets and hypermarkets.

In developing markets traditional stores continue to be the dominant channel, accounting for 38% of total retail channel sales, but sales in supermarkets, hypermarkets and drug stores are growing at a faster rate.

3.5 Revenue model

Going to analyze the revenue model of Family Hub, of course the first revenue stream of a physical product like a refrigerator is the sell price.

Samsung Family Hub cover the high-end target of the market, it is sold for a starting price of 2,499€, the flagship models cost up to 3,999€.

These models expand the line-up of traditional Samsung refrigerator, so that the South Korean company can exploit their experience in the market, using the same selling point and the same distribution channel also for that products.

The second revenue stream for that kind of product is the selling of additional product or service trough the fridge itself. The direct touch-point built in the smart device allow the company to gain from the selling of product on the fridge. The *Groceries* app is what is designed for this task, and to create a channel like this Samsung decided to build a partnership with third parties despite of creating completely new online service fully under control. The requirements for third parties partner are a good experience in the field of online grocery sales and a good coverage of distribution channel in the areas that have to be served.

European partnerships with Eataly and Lidl were built in this direction, FreshDirect and ShopRite are the partners for US market, Kakao for Korean one and the selected partner for Italy is Supermercato24, a food delivery service able to serve orders on a daily base and if required also in an hour.

3.6 Partnership

In this section are listed the most important partner of Samsung for the grocery online service:

- Eataly is the biggest Italian's food marketplace in the world, it serves 11 different countries with 38 locations. It accounted €380millions revenues for the year 2016. From July 2016 Eataly activated the online market with delivery in 29 different countries.
- The second partner is Lidl, a German global supermarket chain, it placed more than 10 thousand locations in 28 European countries, in 2016 it registered €85.7billions revenues.
- Kakao is a Korean internet company, known for its chat app KakaoTalk. In January 2017 Kakao launched its food-delivery service, it is incorporated into the app. In July 2016, Kakao acquired a 20% stake of CNT Tech, a developer of an order-receiving platform for more than 80 franchise restaurant brands in Korea. CNT Tech has 90% of market share in the ordering platform sector.
- FreshDirect is an online grocery market that operates in New York City metropolitan area. FreshDirect operates in a manufacturing practice called Just In Time. The service is popular for its distribution of organic food and locally grown items, as well as items that consumers see in supermarkets daily. In September 2016 it closed a $189million investment given by J.P. Morgan Asset Management in order to expand geographically in US.
- ShopRite is a retailers' cooperative of supermarkets in the north-eastern United States. ShopRite consists of 48 affiliates with over

296 stores. ShopRite has been the largest retailer of food in New Jersey for close to 20 years and is also the biggest seller in the entire New York metropolitan area.

- Supermercato24 is the selected Samsung's partner for Italian market.

  It is an Italian Start-up founded in September 2014, it serves 16 provinces of the country. A buyer can choose the product among 1,351 supermarkets, the order is forwarded to "personal shoppers", people who do shopping for customers, and delivered the shopping bag to the desired address. It serves 500 order every day, in 2016 it recorded 3 million revenues, a 400% growth rate compared to 2015.

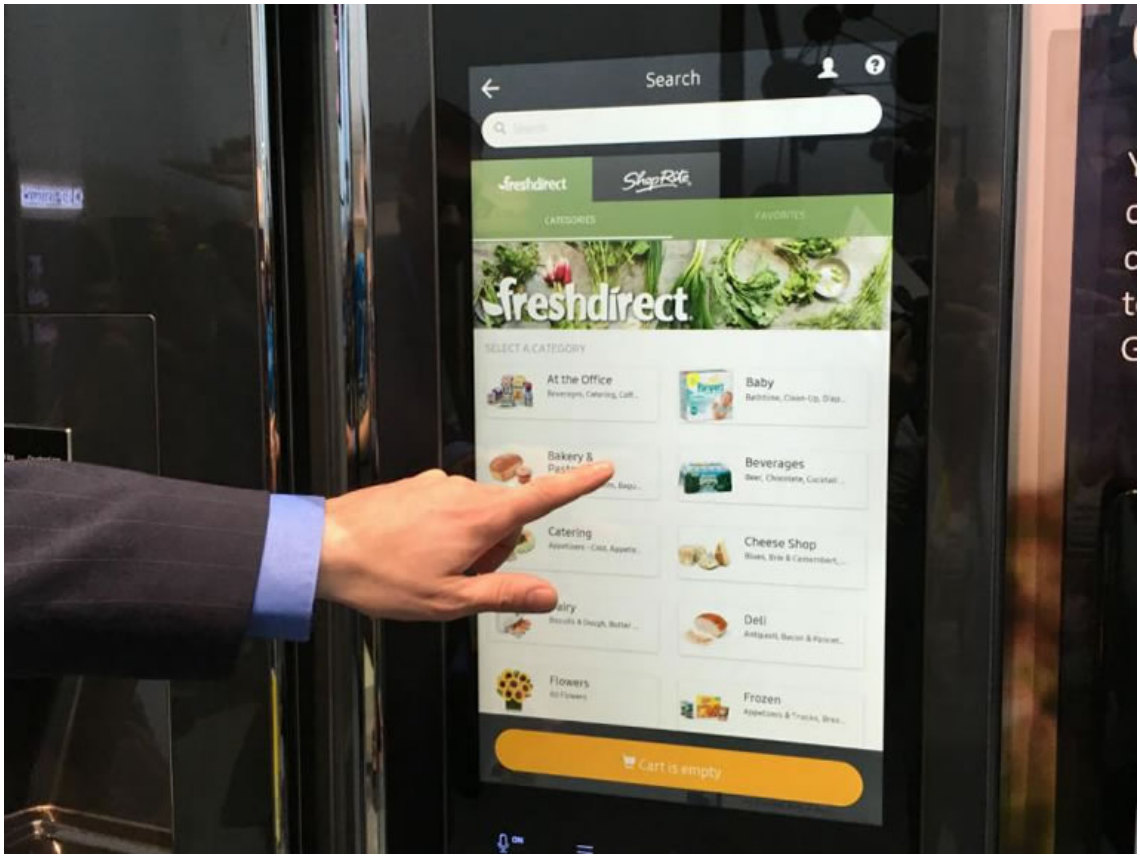

Fig 3.7 – *Groceries* app in US market

3.7 Samsung ecosystem

The ecosystems that characterize the offer of the main players in the mobile market need constantly to be fed, not only technologically with new solutions but also with strategies, skills, initiatives. Microsoft, Google, Apple and Samsung knows that cannot avoid this.

In a market more and more dynamic full of different ecosystems, the current dominant can be overcome in a near future, by others, more innovative and aggressive but especially able to seize the new emerging trends and new consumer tastes.

Each technology ecosystem is a complex system characterized by a web of relations that configure different but interconnected relational networks.

In technological terms and in a reference to the mobile market today, speaking about ecosystems refers to the set of products, services, producers and consumers who recognize, interact and evolve around a product or special technology contributing to the life of the ecosystem with interactions that add value to them.

The most known technological ecosystem are today Microsoft's Windows, Apple's iOS and Google's Android. Around the platform that originates each ecosystem grew applications, devices, third party partnerships, developers' community, online stores, business models, selling channels and users communities.

Not all the ecosystems have a consistent identity, Android ecosystem for example is widely fragmented, inside Google's platform are playing multiple actors like Samsung, Htc, Sony, Lenovo, Amazon and LG that constitutes their own sub system.

On the other side Google's ecosystem seems to fit better for IoT applications and wearable technology.

Samsung on the other hand, since 2012 is trying to become independent from Android's ecosystem, developing their own mobile platform, Tizen, the OS that is inside most smart home and wearable devices.

Tizen is the core of Samsung Smart Home project, a service enabling users to control and manage their home devices through a single application.

Samsung has developed a dedicated Smart Home software protocol (SHP) to enable connectivity between all Samsung Smart Home products as well as those from other device and appliance manufacturers.

Samsung Smart Home provide three main service features enabling users to connect with their devices from anywhere: Device Control, Home View and Smart Customer Service.

With Device Control, users can control home devices while inside or outside the home, or even while travelling abroad. Home View feature let users use their smartphone to get real-time views of their home via installed cameras. Smart Customer Service notifies users when it is time to service devices or replace consumables materials.

Smart Home ecosystem is today composed by a range of Smart TVs, refrigerators, ovens, microwaves ovens, stoves, dishwashers, air conditioners, robot vacuums, cameras, light bulbs, speakers, mobile and wearable devices.

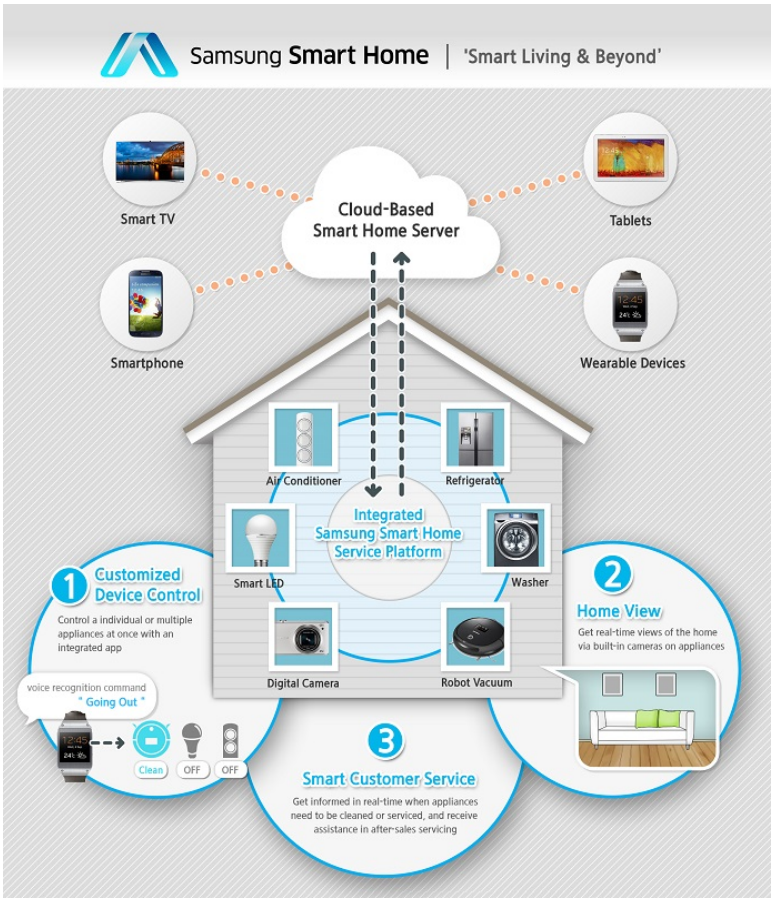

Fig. 3.8 – Samsung Smart Home framework

The experience Samsung developed in home appliances over year, combined with the reputation that gained in recent years in mobile market let the company create a consistent ecosystem of IoT products.

Coming back to Samsung Family Hub, today smart refrigerator technology is typically only available in high-end models. However, is expected smart features will be available into lower-priced models. Beyond that, new features will enhance the possible interaction in the ecosystem. The smart fridge of the future should know when you are low on your favourite foods and beverages, and use that information to assemble a grocery list using AI. The fridge should then send the grocery list to online grocery store, which then will fill the order and deliver those groceries.

While seeing a recipe on smart TV Food Network the fridge stores the recipe and determines whether there are all the ingredients necessary, if they aren't, it automatically adds those items to the next grocery list.

Within the kitchen, will be able to send a recipe from smart refrigerator to smart oven to automatically set the precise cooking time and temperature.

Connecting smart refrigerator to smart scale or fitness band it should know what foods you should be avoiding for a right diet.

All that is a bit in the future, but it is something to look forward to, and digital companies that do not plan for this new markets probably will struggle to establish a market position.

Conclusions

As shown in that work, digital revolution changed everyone way of life, the way to work of all humans. It interests also marketing subject, without changing basic dynamics, but enhancing the possibility and creating digital marketing. More and more precise and efficient ways to do business and target customers are now allowed thanks to digital disruption.

Mobile revolution made the second step, letting everyone to be connected always and everywhere. Social media created a need for human beings to share their habits, their location, their music tastes, providing marketers a gold mine of data useful for creating contextual contents for users.

In that context Big Data, with the instrument of predictive models, give to marketers the possibility to create more and more efficient digital campaigns, instantly measuring if the campaign is given the expected results or not.

In Big Data ecosystem a primary role is played by the universe of IoT, a machine to machine communication system trough artificial intelligence.

A powerful technology to be developed according to security measure explained in that work.

The practical approach proposed by Samsung, how it implemented an IoT system able to sell product in a new way, exploiting new and more precise data about costumers food preferences. Furthermore, the Samsung concept of creating all home appliances that provides useful data for thinking new services, an ecosystem where every single product add value to a system that in the next year will acquire a fundamental role for company who wants to operate in digital world.

Companies decisional process is becoming more and more data oriented, but the human interaction won't lose value, because they are the direct responsible of data analytics. Every company will be able to have good data, human being have the task to utilize it in right way.

IoT are a resource, with the ability of produce information about human behaviour. The success of that operation depends on the ability of companies to ride this wave of technological opportunity.

References

Bibliography

- Chaffey Dave, *"Internet Marketing: Strategy, Implementation and Practice"*, 2009

- Charlesworth Alan, *"Digital marketing, a pratical approach", 2014*

- Chen M., Wan J. F., Li F., *"Machine-to-machine communications: architectures, standards, and applications"*, 2012

- Downes Larry, Nunes Paul, *"Big Bang disruption",* 2014

- Finlay Steven, *"Predictive analytics, data mining and Big Data"*, 2014

- Gustafson D. A., *"Artificial intelligence"*, 2014

- ITU Telecommunication Standardization Sector, *"ITU-T Recommendation database"*, 2012

- Kaufman Ira, Northon Chris, *"Digital marketing, integrating strategy and tactics with values"*, 2014

- Kevin Ashton, *"That's Internet of Things"*, 2009

- Koomey J. G., Berard S., Sanchez M. and Wong H., *"Assesing Trends In The Elecritcal Efficiency Computation Over Time",* 2009

- Kovarik Bill, *"Revolutions in Communication: Media History from Gutenberg to the Digital Age"*, 2011

- Laurent Flores, *"How to measure digital marketing", 2014*

- Mayer C. P., *"Security and privacy challenges in the internet of things"*, 2009

- Moore G. E., *"Cramming More Components onto Integrated Circuits"*, 1965

- Nesamoney Diaz, *"Personalized Digital advertising"*, 2015

- Nielsen Company, *"The future of grocery"* report, 2015

- OECD, *"Internet of things"* background report, 2016

- Pwc, *"Smart home, seamless life"*, 2017

- Schmeiser Lisa, *"Smart Refrigerators: The Value Proposition Isn't Apparent Yet"*, 2016

- Sisti Alessandro, *"Digital tansformation war",* 2017

- Suo H., Wan J. F., Zou C., Liu J., *"Security in the internet of thing"*, 2012

Sitography

- http://adage.com/article/ad-age-graphics/ad-age-a-history-marketing/142967/

- http://digital-marketing-strategy.weebly.com/digital-marketing.html

- http://winsupersite.com/cloud/smart-refrigerators-value-proposition-isnt-apparent-yet

- http://www.affaritaliani.it/mediatech/samsung-con-il-nuovo-frigo-familyhubtm-la-spesa-on-line-con-supermercato24-484692.html?refresh_ce

- http://www.cs.utexas.edu/~fussell/courses/cs352h/papers/moore.pdf

- http://www.datamanager.it/2017/04/samsung-gli-elettrodomestici-intelligenti-smart-home/

- https://www.eataly.net/it_it/

- http://www.e-businessconsulting.it/adv/programmatic-advertising/

- http://www.iab.org/wp-content/IAB-uploads/2011/03/Turner.pdf

- http://www.ninjamarketing.it/2017/02/03/programmatic-advertising/

- http://www.okpedia.it/origine-del-marketing

- http://www.rfidjournal.com/articles/view?4986

- http://www.samsung.com/us/aboutsamsung/corporateprofile/history06.html

- https://www.supermercato24.it

- http://www.thismarketerslife.it/digital/web-marketing-o-digital-marketing-alla-fine-e-sempre-marketing/

- https://digiday.com/media/what-is-programmatic-advertising/

- https://livestream.com/blog/livestream-open-api

- https://mariacristinapizzato.it/ab-test-cose-e-come-realizzarlo/

- https://news.samsung.com/global/samsung-electronics-unveils-family-hub-2-0-and-smart-built-in-appliances-at-ces-2017

- https://news.samsung.com/global/samsung-unveils-new-era-of-smart-home-at-ces-2014

- https://newsroom.cisco.com/feature-content?type=webcontent&articleId=1208342

- https://samsung.hdblog.it/2017/04/28/Samsung-Family-Hub-frigorifero-smart/

- https://successstory.com/companies/samsung-group

- https://techcrunch.com/2016/05/05/samsung-family-hub/

- https://vwo.com/ab-testing/

- https://www.agendadigitale.eu/mercati-digitali/ecommerce/programmatic-advertising-la-nuova-frontiera-della-pubblicita/

- https://www.ama.org/AboutAMA/Pages/Definition-of-Marketing.aspx

- https://www.cnet.com/news/samsung-new-fleet-of-family-hub-smart-refrigerators-on-sale-now/

- https://www.i-scoop.eu/internet-of-things-guide/internet-things-marketing/

- https://www.samsung.com/us/showcase/smart-home-appliance-washer-dryer-and-refrigerators/

- https://www.thedigeon.com/it/tech/casa-hi-tech/family-hub-il-frigorifero-del-futuro-secondo-samsung.html

- https://www.wired.com/insights/2014/11/iot-wont-work-without-artificial-intelligence/

- https://www.youtube.com/watch?v=xSYkp8_Dn2E

LUISS Guido Carli
LIBERA UNIVERSITA' INTERNAZIONALE DEGLI STUDI SOCIALI

DEPARTMENT OF IMPRESA E MANAGEMENT

MANAGEMENT COURSE

CHAIR: DIGITAL MARKETING

How internet of things is impacting digital marketing. Samsung case: Family Hub Refrigerator.

SUPERVISOR
Prof. Maximo Ibarra

CO-SUPERVISOR
Prof. Paolo Spagnoletti

CANDIDATE
Andrea Cocco
670191

ACADEMIC YEAR

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How internet of things is impacting digital marketing. Samsung case: Family Hub Refrigerator

Introduction

The aim of this document is to examines the current state of Digital Marketing.
The first section will analyze the evolution of communication media, from pigment's paints and papyrus up to the digital revolution.
Despite the marketing process is almost the same, the enhanced mediums and by technological revolution created "Digital Marketing".
The levers of this revolution are the search engine market, the display market, email and affiliation programs. Considering how social media changed people habits I will analyze a good media mix a company should consider for operating in digital world.
I will talk about Big Datam explaining why it gives to marketers the possibility to create more and more personalized contents in advertising.
The final part of first section will discuss about the key metrics to measure the impact of a digital campaign.
The second section is about Internet of Things(IoT), what it means and how it is shaping digital marketing. Through IoT and Artificial intelligence is possible to mining all new types of data that was quite impossible to collect in the past. The last part of this section examines some security issues which affect IoT innovation.
The third part of the work is about a real case of IoT product made by Samsung. In that section is showed how Samsung combined the concept of digital marketing on an IoT product, a starting point for the development of future ecosystem of smart product able to produce usage data, analyze them and provide personalized content for their users, wherever they are, at the right time, in the right user device.

1. How much are important data in digital Advertising

1.1 Digital marketing vs traditional marketing

Since the beginning of our existence, humans have been social creatures, using any means at their disposal to communicate thoughts, ideas, visions, opinions and values to all who would listen.

Communications media have grown in both sophistication and impact over time, and with digital revolution geographical and technological constraints in the diffusion of a message were finally possible to be overcame.

Marketing is: *"the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large."*

A lot of tasks that are related in direct way into marketing subject, something much more linked to branding than before: is required to know the industry, how to measure a performance of a business, considering strategic goals, decide how to challenge the value proposition, what is marketing mix and business planning.

People are accustomed to traditional marketing, whose biggest disadvantage today is that it is static, there is no way to interact with the audience.

Digital marketing brings together all the interactive digital tools at the service of marketers for promoting products and services, while seeking to develop more direct and personalized relationship with consumers.

In the coming years, marketing will be digital or nothing. Capable to create loyalty and even fanaticizing customer relationships, digital marketing is essential for attracting and retaining increasingly connected consumers and for ever more fragmented media uses.

1.2 Levers of digital marketing

Digital market, that consist in the communication of a message exploiting new digital levers: the search market, the display market, the emailing, affiliation programs and social media.

- Search market consists of the purchase of keywords on search engine platforms.
- The display market is the segment covering traditional advertising or branding. Purchase is increasingly made by auction. Real-time bidding allows one's advertising to be seen based on the auctions one agrees to.
- The email market, the segment that has historically been the most "effective" for "tracking" consumer behaviour.
- The affiliation market allows any website or blog having an advertising space to be monetized
- Once considered millennials' territory, social media is now being used by everybody. No matter who a company target buyers are, they're using social media, making it more important than ever to develop an effective social media marketing program

A good media mix must consider a well-balanced use of their paid, owned and earned media to perform better in the digital context.

Owned media are the communication media directly managed by the company

Paid media are the medium that are bought by the company to reach the desired visibility

Earned media are all the communication channel in which the company is involved by quotations, review and conversation among users

1.3 The digital advertising, a continuous disruption

Despite dramatic advances in digital media, devices, and new types of media like social media, most digital ads today don't look very different than the billboards that have been around since the beginning of advertising. Banner ads are simply sized down versions of billboards.

Digital media presents immense opportunities to not only make significantly more functional billboards but also smarter billboards that understand consumers' interests and tailor advertising directly to their needs.

The vast amounts of data we now have is about to improve this aspect of advertising, in order to be more personalized and relevant. Computing power and bandwidth have also increased to a point where tasks can be now done in a fraction of second. In the past, data has been viewed as something to analyze in a second moment, doing a post analysis on the campaign results, research, and sales data, it was not used for targeting and personalizing experiences for customers.

APIs (application programming interfaces) have been significantly important to the rapid evolution and adoption of technology in the media and advertising industry. APIs can now tell us everything from where a user is located to what the local weather is like to what movie theater is playing a particular movie. All these APIs serve up data that can be used for more effective personalization.

1.4 The Personalization of Media

For marketers, Internet seemed like a great new medium to use for marketing. The first problem with media delivered via the Internet is the significant fragmentation of audiences across websites. To ensure that the advertising is delivered to a relevant audience, ad exchanges and ad networks started organising websites into audience segments, which made it easier for brands to buy.

With the recent explosion of smart devices diffusion, wearable technology, and the Internet of things, consumers are creating more and more data that tells the world what they do every day. What consumers expect in return is smart, personalized experiences, whether it be in media, applications or advertisements.

1.5 Data in advertising

There isn't a universally agreed definition of "Big Data", but the features of Big Data that are considered important are:

- Volume: any database that is too large to be comfortably managed on an average PC, laptop or server can be considered Big Data.
- Variety: Big data contains many different types of structured and unstructured data
- Volatility: Some types of data are relatively static, on the other end some data is changing all the time
- Multi-sourced: some Big Data sources are generated entirely from an organization's internal system. However, Big Data often includes external data.

In particular, Big Data very often are: textual data, machine generated data and network data.

The greatest opportunities for Big Data are where it is making new forms of customer prediction viable.

1.6 Predictive Models

When discussing predictive models, the starting point should always be some objective within the organization. Biggest mistake people make when developing predictive models is to deliver a model that is not then used for anything.

When thinking about predictive analytics, always have these three things in mind: How will a predictive model improve operational efficiency? How will it improve the decision making process? And what value does the model provide? Decisions were made using only the scores from the models, no humans are involved in determining what the outcomes should be. Each and every decision about a customer is made automatically on the basis of the score alone.

1.7 Programmatic Advertising

Programmatic advertising automates the decision-making process of where ads are placed, using artificial intelligence and real-time bidding for online display, mobile and video campaigns. Programmatic advertising can hit the right audience at the right time to drive higher quality leads for brands. A brand can dynamically alter just components of the ad related to the offer while the campaign is still in flight.

Using programmatic buying platforms, brands can now execute annual buys that give them the benefit of pricing and the flexibility of launching messaging and creative changes into that same media.

Dynamic advertising technology enables such media buys to be used through the year for various campaigns, special offers and new product launches without having to go through the whole process each time.

Personalized advertising can help brands retain the scale and price efficiencies while increasing relevance. It allows marketers to spend more time on messaging and communication and less time on trying to find creative concept that will strike everyone.

1.8 Planning for a Data-Driven Ad Campaign

The brand team needs to explore the available data signals and identify what is relevant to the brand. After identifying key data signals, the next step is to identify how granular the data signal should be.

The next step is to figure out what specific conditions of the data signals should trigger delivery of a specific creative or messaging.

At this point the creative team starts to think of the creative canvas on which to deliver personalized creative and messaging. This involves defining what parts of the ad will remain constant and what parts of the ad will be personalized to the user.

The next step is creative production, it's the process of building out all the variations of the ads and messaging. It can be very challenging if it's done using technology platform that is not designed for dynamic ads. First same in each variant of the ad, as the logo, the skin or some animation. This should be separated out form the variable components of the ad, such as messages, videos and map location.

A good idea at this stage is to identify the metrics that will be measured in order to determine the success of the campaign.

1.9 Measurement of personalized Ad Campaign

Measurement of ROI for dynamic and personalized advertising campaigns can vary based on the goals of the campaign.

Measures often include the following key metrics:

- Click-through rates: Measures how often users clicked through the ad to a web page;
- View-through rates: Measures hew often users saw the ad and then reached the advertiser's website via other means;
- Conversion rates: Measures how often users, after having seen the ad or clicked through the ad, actually purchased a product.

For campaigns that are much more focused on brand awareness, personalized advertising can be very impactful in creating awareness and engagement, but, it may also be more challenging to measure the impact of personalized advertising.

2. Internet of things

2.1 Background of IoT

The term Internet of Things (IoT) was used for the first time by Kevin Ashton in 1999. The reason IoT has become so relevant today, depends partly on two things: Moore's law and Koomey's law.

Defining the term IoT can be somewhat difficult, the basic concept of IoT is to connect things together, thus enabling these "things" to communicate with each other and enabling people to communicate with them.

The most vital part of achieving IoT is communication, because in order to interconnect different devices they must be able to communicate. There are some fundamental characteristics for IoT that provide a clearer picture of the actual differences between IoTs and other devices: Interconnectivity, things-related services, heterogeneity, dynamic changes, enormous scale.

2.2 What is IoT

IoT includes different objects with different capabilities, which have a common way of communicating for enabling transfer of information.

Objects include electronic devices such as computers, mobile phones, televisions, machines, and robots.

Sensors communicating includes different protocols and technologies for sending digital or analogue signals through nodes.

Capabilities include gathering information, processing information, storing information, and presenting information.

A process could include tracking health information, heating your home, lighting public streets, and keeping track of assets.

The ITU-T has defined a reference model for IoT. This model is divided into the four layers: application layer, service support and application support layer,

network layer and device layer.

2.3 What IoT needs to work: Artificial Intelligence

In order to achieve accuracy, reliability, and relevancy in the enormous amounts of generated and processed data, there is need of transferring the human intelligence and appropriate security mechanisms to the systems in use. Artificial intelligence (AI) is the word used to describe computer systems with intelligent behaviour, such as representation, searching, reasoning and learning, which are the four fundamental features of AI.

A system with AI needs an internal representation of a problem or related knowledge to be able to know when a problem arises.

Most systems with AI also have the ability adapt and optimize if necessary, which is done by machine learning based on historical statistics for example.

2.4 Security in IoT

Secure architecture of the IoT can be divided into four key levels: perceptual layer, network layer, support layer and application layer.

Network security and management features play an important role in above each level.

Security requirements are encryption mechanisms, communication security protocols, protecting sensor data, and cryptographic algorithms.

2.5 Future Of IoT: from IoT to IoE (internet of everything)

IoE comprises of four key elements including all sorts of possible connections: people, things, data, processes. IoE establishes an end-to-end ecosystem of connectivity including technologies, processes and concepts employed across all connectivity use-cases.

2.6 IoT shaping digital Marketing

The main strengths of the Internet of Things in marketing have everything to do with an essential part of the IoT as such: data and data analytics. Being advertising so much data-driven, Internet of Things data appears like a very attractive gold mine for marketers.

The main power of data, is to understand patterns and create actionable knowledge and insights. In that context marketers gain the possibility to analyze customer buying habits and gaining deeper insights in the buying journey.

Marketers need acting with messages in real-time, the Internet of Things in marketing is about an end-to-end experience optimization, the *"right information at the right time and place and so forth"*.

3. Case Study: Samsung Family Hub refrigerator

3.1 Samsung

Samsung Group is a South Korean multinational conglomerate headquartered in Seoul. It comprises numerous businesses as the electronics, engineering, building and high tech.

In first quarter of 2012, Samsung Electronics became the world's largest mobile phone maker by unit sales, overtaking Nokia.

In 2016 during the IFA exposition in Berlin, Samsung the Samsung Family Hub refrigerator, a next step in IoT ecosystem, a double door refrigerator, able to distinguish itself from the many models in commerce, thanks to a 21 inches display integrated on the front.

3.2 Samsung Family Hub refrigerator

Samsung family hub connects to home Wi-Fi network and provides a lot of non-refrigeration functionality such as managing family calendars, taking notes and reminders, photo display and streaming music. The touchscreen allows to compile family grocery list and send those list to the smartphone.

There are also cameras that combined with the display let users the possibility to track the expiration date of a food, an internet browser that allow to access the websites and also some built-in apps for everyday use such as timer, chef's recipes, personal recipe organizer and so on.

A second version of this smart bridge was presented during the 2017 CES, it extended the original concept with the add of voice control, and a line-up of different smart connected fridge in European and US Layout.

3.3 Value proposition

In a context in which smart and automated house topic is gaining more and more relevance the connected fridge is something that expand the list of smart object inside an house. The Hub, it let the user to access data about the fridge outside the home, let customers is the possibility to differentiate the temperature of three storing levels inside the fridge, that to have a better management of foods cooling requirements for a better preservation over time. One important service that Samsung made for improving customer journey is the online grocery shop.

For Samsung the fridge is a raw resource, trough them the buyers provides lots of data for free. The Hub represents for Samsung something that helps to expand the product's ecosystem value of South Korean company and the partnerships developed to allow online grocery market app work, are a direct revenue stream in everyday usage of the fridge.

3.4 Market overview

Samsung with its Family Hub is going to operate inside two different markets: The smart home device market and online grocery market.

IoT prognostications are everywhere, for now, we have wearable computers, vacuuming robots, and smart refrigerators, by 2020, Gartner Research forecasts approximately 20.8 billion IoT enabled devices, while IDC projects a $1.7 trillion global IoT market.

The second market in which Samsung is going to operate is the online grocery market, consumers are no longer shopping entirely online or offline, rather, they are taking a mixed approach, using whatever channel best suits their needs. Willingness to use digital retailing options in the future is highest in the developing markets in the Asia-Pacific (60% on average), Latin America (60%) and Africa/Middle East regions (59%), and trails in Europe (45%) and North America (52%).

3.5 Revenue model

Samsung line-up of Family Hub refrigerators, open two different revenue stream channels.

The first revenue stream of a physical product like a refrigerator is the sell price. The second revenue stream for that kind of product is the selling of additional product or service trough the fridge itself. The *Groceries* app is what is designed for this task, and to create a channel like this Samsung decided to build a partnership with third parties despite of creating completely new online service fully under control.

3.6 Partnership

European partnerships are with Eataly and Lidl, FreshDirect and ShopRite are the partners for US market, Kakao for Korean one and the selected partner for Italy is Supermercato24, a food delivery service able serve orders on a daily base.

3.7 Samsung ecosystem

In technological terms and in a reference to the mobile market today, speaking about ecosystems refers to the set of products, services, producers and consumers who recognize, interact and evolve around a product or special technology contributing to the life of the ecosystem with interactions that add value to them.

Each technology ecosystem is a complex system characterized by a web of relations that configure different but interconnected relational networks.

Samsung Smart Home ecosystem is today composed by a range of Smart TVs, refrigerators, ovens, microwaves ovens, stoves, dishwashers, air conditioners, robot vacuums, cameras, light bulbs, speakers, mobile and wearable devices.

The experience Samsung developed in home appliances over year, combined with the reputation that gained in recent years in mobile market let the company create a consistent ecosystem of IoT products.

Conclusions

As shown in that work, digital revolution changed everyone way of life, the way to work of all humans. It interests also marketing subject, without changing basic dynamics, but enhancing the possibility and creating digital marketing.

Mobile revolution made the second step, letting everyone to be connected always and everywhere. Social media created a need for human beings to share their habits, their location, their music tastes, providing marketers a gold mine of data useful for creating contextual contents for users.

In that context Big Data, with the instrument of predictive models, give to marketers the possibility to create more and more efficient digital campaigns, instantly measuring if the campaign is given the expected results or not.

In Big Data ecosystem a primary role is played by the universe of IoT, a machine to machine communication system trough artificial intelligence.

A powerful technology to be developed according to security measure explained in that work.

The practical approach proposed by Samsung, how it implemented an IoT system able to sell product in a new way, exploiting new and more precise data about costumers food preferences. Furthermore, the Samsung concept of creating all home appliances that provides useful data for thinking new services, an ecosystem where every single product add value to a system that in the next year will acquire a fundamental role for company who wants to operate in digital world.

Companies decisional process is becoming more and more data oriented, but the human interaction won't lose value, because they are the direct responsible of data analytics. Every company will be able to have good data, human being have the task to utilize it in right way.

IoT are a resource, with the ability of produce information about human behaviour. The success of that operation depends on the ability of companies to ride this wave of technological opportunity.

References

Bibliography

- Chaffey Dave, *"Internet Marketing: Strategy, Implementation and Practice"*, 2009

- Charlesworth Alan, *"Digital marketing, a pratical approach", 2014*

- Chen M., Wan J. F., Li F., *"Machine-to-machine communications: architectures, standards, and applications"*, 2012

- Downes Larry, Nunes Paul, *"Big Bang disruption",* 2014

- Finlay Steven, *"Predictive analytics, data mining and Big Data"*, 2014

- Gustafson D. A., *"Artificial intelligence"*, 2014

- ITU Telecommunication Standardization Sector, *"ITU-T Recommendation database"*, 2012

- Kaufman Ira, Northon Chris, *"Digital marketing, integrating strategy and tactics with values"*, 2014

- Kevin Ashton, *"That's Internet of Things"*, 2009
- Koomey J. G., Berard S., Sanchez M. and Wong H., *"Assesing Trends In The Elecritcal Efficiency Computation Over Time",* 2009
- Kovarik Bill, *"Revolutions in Communication: Media History from Gutenberg to the Digital Age"*, 2011
- Laurent Flores, *"How to measure digital marketing", 2014*
- Mayer C. P., *"Security and privacy challenges in the internet of things"*, 2009
- Moore G. E., *"Cramming More Components onto Integrated Circuits"*, 1965
- Nesamoney Diaz, *"Personalized Digital advertising"*, 2015
- Nielsen Company, *"The future of grocery"* report, 2015
- OECD, *"Internet of things"* background report, 2016
- Pwc, *"Smart home, seamless life"*, 2017
- Schmeiser Lisa, *"Smart Refrigerators: The Value Proposition Isn't Apparent Yet"*, 2016
- Sisti Alessandro, *"Digital tansformation war",* 2017

- Suo H., Wan J. F., Zou C., Liu J., *"Security in the internet of thing"*, 2012

Sitography

- http://adage.com/article/ad-age-graphics/ad-age-a-history-marketing/142967/

- http://digital-marketing-strategy.weebly.com/digital-marketing.html

- http://winsupersite.com/cloud/smart-refrigerators-value-proposition-isnt-apparent-yet

- http://www.affaritaliani.it/mediatech/samsung-con-il-nuovo-frigo-familyhubtm-la-spesa-on-line-con-supermercato24-484692.html?refresh_ce

- http://www.cs.utexas.edu/~fussell/courses/cs352h/papers/moore.pdf

- http://www.datamanager.it/2017/04/samsung-gli-elettrodomestici-intelligenti-smart-home/

- https://www.eataly.net/it_it/

- http://www.e-businessconsulting.it/adv/programmatic-advertising/

- http://www.iab.org/wp-content/IAB-uploads/2011/03/Turner.pdf
- http://www.ninjamarketing.it/2017/02/03/programmatic-advertising/
- http://www.okpedia.it/origine-del-marketing
- http://www.rfidjournal.com/articles/view?4986
- http://www.samsung.com/us/aboutsamsung/corporateprofile/history06.html
- https://www.supermercato24.it
- http://www.thismarketerslife.it/digital/web-marketing-o-digital-marketing-alla-fine-e-sempre-marketing/
- https://digiday.com/media/what-is-programmatic-advertising/
- https://livestream.com/blog/livestream-open-api
- https://mariacristinapizzato.it/ab-test-cose-e-come-realizzarlo/
- https://news.samsung.com/global/samsung-electronics-unveils-family-hub-2-0-and-smart-built-in-appliances-at-ces-2017
- https://news.samsung.com/global/samsung-unveils-new-era-of-smart-home-at-ces-2014

- https://newsroom.cisco.com/feature-content?type=webcontent&articleId=1208342

- https://samsung.hdblog.it/2017/04/28/Samsung-Family-Hub-frigorifero-smart/

- https://successstory.com/companies/samsung-group

- https://techcrunch.com/2016/05/05/samsung-family-hub/

- https://vwo.com/ab-testing/

- https://www.agendadigitale.eu/mercati-digitali/ecommerce/programmatic-advertising-la-nuova-frontiera-della-pubblicita/

- https://www.ama.org/AboutAMA/Pages/Definition-of-Marketing.aspx

- https://www.cnet.com/news/samsung-new-fleet-of-family-hub-smart-refrigerators-on-sale-now/

- https://www.i-scoop.eu/internet-of-things-guide/internet-things-marketing/

- https://www.samsung.com/us/showcase/smart-home-appliance-washer-dryer-and-refrigerators/

- https://www.thedigeon.com/it/tech/casa-hi-tech/family-hub-il-frigorifero-del-futuro-secondo-samsung.html

- https://www.wired.com/insights/2014/11/iot-wont-work-without-artificial-intelligence/

- https://www.youtube.com/watch?v=xSYkp8_Dn2E