Università
Ca'Foscari
Venezia

Master's Degree programme – Second Cycle
(*D.M. 270/2004*)
in International Management

Final Thesis

Ca' Foscari
Dorsoduro 3246
30123 Venezia

Patterns of innovation diffusion: the case of wearable technologies

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Academic Year
2014 / 2015

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SUMMARY

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4. Fourth Chapter

Cases discussion

Introduction

"Innovation almost never fails due to a lack of creativity.
It's almost always because of a lack of discipline."[1]

In this quote lies the major reason that led to the layout of this dissertation. Looking at the world around us we can see how much things have changed in the last 20 years; we are now living in a way that our parents would have believed futuristic, always connected with machineries that can perform a huge variety of tasks for us.
Considering the heavy presence of technology in our lives, the key word for the future is interconnectivity.
Surprisingly, even though our reality seems to be all about technnology, according to Cisco's researches today still the 99% of the physical world is not connected to the internet, in particular we quote:

"Despite all these connections, we estimate that more than 99% of all physical objects that may one day join the network are currently still unconnected. Think about that – we've only just begun to connect the unconnected. What will happen when a full one percent of things are actually connected?"[2].

This figure suggests that there is a lot of room for new products and technologies, and moreover that there is a huge number of potential consumers to gain.
For this reason, even though many are skeptic about wearable technologies, we found studying this field an interesting opportunity: it is

[1] Keeley L. with Pikkel R., Quinn B., Walters H., "Ten types of innovation – the discipline of building breakthroughs", Wiley, 2013
[2] "The Internet of Everything: bringing the future to life", Cisco, 2014

true that the boom is predicted to happen every year since few years yet, but actually things are moving.

In the first chapter we will analyze the data relative to the market of Iot (Internet of Things), trying to figure if they are credible by considering also some counterparts; IoT can be considered the container of everything related to wearables, and also smartphones and "connected" objects in general.

In the second chapter we will have an in-depth insight of the theory behind innovation diffusion, in particular the fundamental notions elaborated by Everett Rogers. After the presentation of various types of innovation, that will be useful for the last chapter, we will also consider some influent variables regarding the diffusion of wearable devices.

In the third chapter we will introduce wearable technology properly, with definitions and an explanation on why it should be an interesting market to invest in, also considering in what kind of innovation theory this wide area of study could be placed. There will be few examples for each field: fashion, health care, house appliances and corporate level

In the last chapter then we present some cases for the area more interested by the first wave of wearables, that are watches, bracelets, jewelry and glasses. Every case will be analyzed, presenting the product and the major causes for success or failure. In particular there will be a fixed scheme in order to see what kind of innovation each company decided to focus on.

The main purpose is to think at innovation with a systematic approach, in order to spot more easily positive or negative factors that can influence the diffusion of these innovations.

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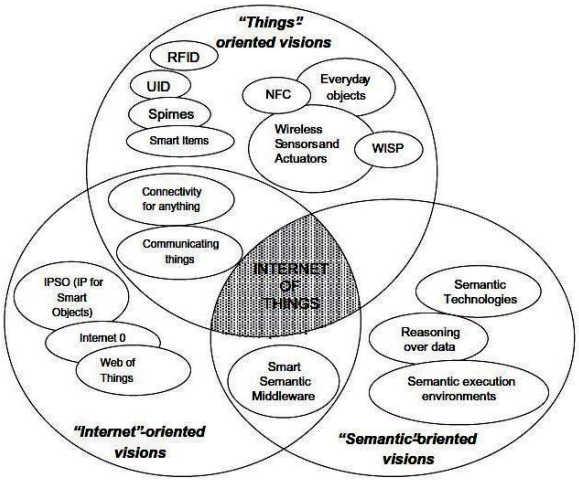
1. Current scenario, forecasts and challenges

With this first chapter we are going to have a clear insight on current and emerging scenarios on the theme of wearable technologies. In particular, we will start analyzing data on the Internet of Things market, since this increasingly emerging category indeed includes wearables and everything that works with them.

The majority of data presented are taken from articles quoting IDC (International Data Corporation) surveys and the website of IDC itself. Since IDC is a subsidiary of IDG (International Data Group), data will be taken also from the affiliates websites, like TechWorld. Moreover, the quarterly report on the State of the Internet by Akamai Technologies will help us understand the current scenario – in the end, everything we are speaking about needs Internet, so it could be meaningful analyzing also this variable.

- Internet of Things

First of all, a proper definition: what is Internet of Things? According to Atzori, Iera and Morabito we can say that it is the common area between three different fields, that contributes to it , as shown in this image:



Source: "The Internet of Things: a survey" Atzori et al.

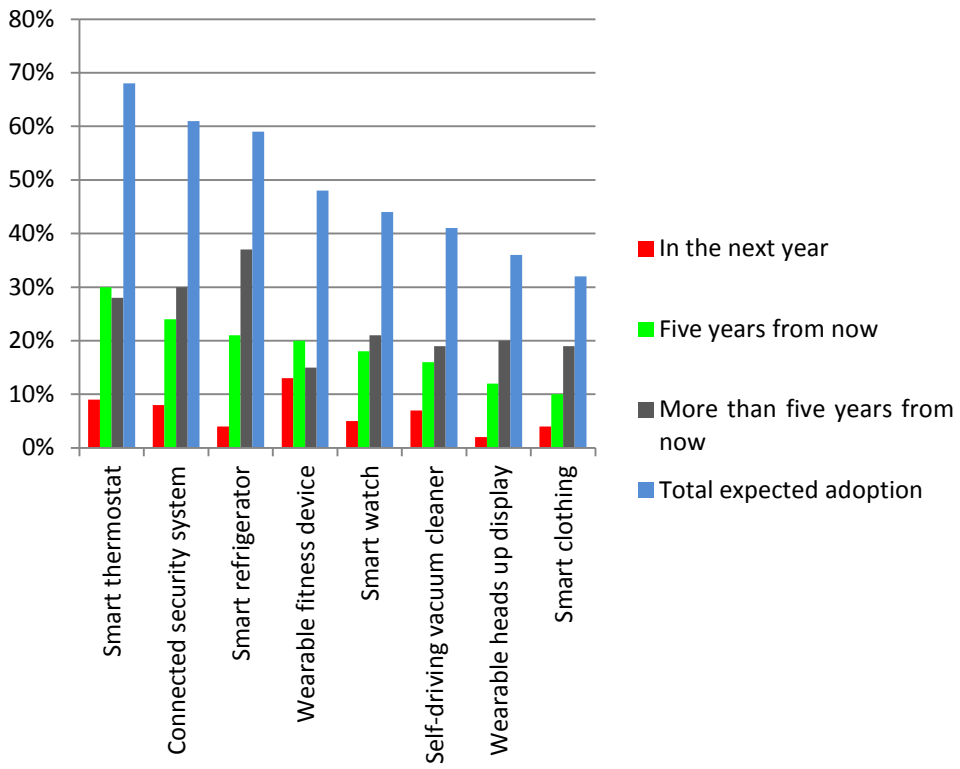
The survey from which the image is taken then goes on with a panoramic of application fields, study that we will consider at the end of the third chapter.

Considering IoT data, many surveys have been done and many will be. The potential to change the world is similar to that of Internet 20 years ago. The concept behind this expression "IoT" is that devices are using information put inside the system by people, but in the future they could be using data gathered by themselves: if computers could perceive changes without a human being help, then we would reduce waists and costs[3]. This happens for example every time we use thermoregulation systems: Ariston Wireless Room Sensor can communicate with the boiler through a specific signal and it allows the householder to set the desired temperature. In this way there is a great spare in costs since the boiler will maintain a constant temperature.

This is only one example in a world of things that is constantly increasing nowadays: companies are trying to produce independent devices capable of not only gathering information, but also able to process those data and give feedbacks. Internet of Things can have many forms: in our hands, in our houses and cars. There are projects also at country level, like the one supported by the Ministry of Science and Technology in China called "Agricolture Internet of Things and Food Safety and Quality", where the goal is to track the processes along the supply chain, allowing consumers to see online what they are buying, and also at city level, like the city of Nice with its Connected Boulevard, used to optimize all aspects of city management, including parking and traffic, street lighting, waste disposal and environmental quality.

[3] "That "Internet of things" Thing", K. Ashton June 2009, RFID Journal

The annual study[4] on 2014 selling and perception of IoT from Acquity Group shows that adoption in the next years is inevitable and will increase significantly, as we can see from the picture below:



Source: The Internet of Things: the future of consumer adoption", 2014 Acquity Group

According to this research, the most difficult barriers to overcome will be awarness and perceived value: companies need to sensibilize consumers with these new terms like "smart devices", "Internet of things", "interconnectivity".

Looking at IDC infographic on IoT market then we can confirm the forecasted growth: also here the expected increase in sales for IoT devices is exponential, from a market of $1,9 trillion in 2013 to a $3,8 trillion one in 2017 – nearly doubled – till a $7,1 trillion one in 2020.

[4] "The Internet of Things: the future of consumer adoption", 2014 Acquity Group

Trends for the future are certainly positive, and this is due also to the fact that WiFi is widely used and it is much easier to connect devices in our homes and cars.

This wide field called "Internet of Everything" includes many facets as we have seen in the graph above; we will briefly analyze the SCD world and then we will move to our interest area, wearables.

- SCD

Another interesting survey from IDC presents data on the purchase of SCD – smart connected device: smartphones, tablets and personal computers. As the name itself suggests, the aim is to have everything "connected" in order to control and monitor everyday activities – things are getting connected at the point that we can use the Cisco's term "Internet of Everything". This is in fact the function of wearable technology: everything could be connected to one of our device, or could be a device itself – like smartwatches – providing us information on what we need or would like to know. In the above mentioned survey SDCs experimented a +16,9% in 2013 and +10,2% in 2014[5], with laptops at the end of the list, while the selling of smartphones and tablet is increasing every year. These data have been taken analyzing the Italian market, but they reflect a positive reality fod SDC in all developed countries.

SCDs allow the development of machine-to-machine interconnectivity technology – that means, they are able to exchange information with other pieces of equipment. In particular smartphones will have a growing weight among these devices[6]; according to IDC data they could "outpace total PC shipments by more than 6 to 1 in 2018." Smartphones provide us more

[5] "Mercato SCD in Italia 2013-2014", idcitalia.com
[6] "IDC: smartphones will take over Smart Connected Devices' Market", D. Brecht, June 2014, iotevolution.com

and more services, and the large majority of wearable devices has to be connected to an appropriate application or it can be connected via Bluetooth with a smartphone.

The reason behind this "natural selection" is quite clear: smartphones are user friendly, more convenient than personal computers and less cumbersome than tablets. Moreover, they are easier than personal computers to connect everywhere and their market is gaining from relevant economies of scale, making us possible to buy a smartphone for less than €100, while it is quite difficult to do the same with a tablet or a pc. Considering the importance of smartphones we will analyze some wearable technologies that work with them in the third chapter; in the next section we present data on wearables in order to have a clear, if possible, view of this market full of potentiality.

- Wearable devices

Speaking now about wearables, IDC provides some data also on this: the selling forecasts point out an increase of 50% by 2019 – considering that during 2015 it has been estimated that 45,7 millions of wearable devices will be sold. Another infographic confirms this positive trend and shows that the expected growth in sales of these devices goes from 19 million pieces in 2014 to 112 million pieces in 2018: the market is expected to more than double its size every year.

Bracelets and watches will be ahead in this huge figure, followed by glasses and belts/clips. We found these data quite relevant, since many are skeptical for what concerns the future of wearables. For this reason we feel necessary to consider both faces of the medal by shedding some lights on reports that do not necessarily support these positive trends. To say it in other words, it is not exactly about negative trends, because otherwise what we said before would be meaningless, but more about considering

those trends not in a positive way. An article from The Guardian well explains this concept: wearable devices' future could be not to help us tracking activities, but instead it could be that of data collectors[7]. In particular developers should find a way to make collected data useful also for consumers, in order to support more purchases; there is no wonder that product abandonment and return rate have been quite high after the launch of fitness tracking bracelets as the Nike Fuelband, released in 2012. For the latter, consumers even started a class action in 2013 against Nike for creating higher expectations compared to what the bracelet really offers. During summer 2015 the settlement ended with Nike providing a refund of 15$ or a gift card of 25$ for those who bought the Fuelband between the 19th January 2012 and the 17th June 2015. This case, at the centre of many articles and media news for involving a colossus like Nike, is a mirror of the problems related to this world. At the beginning, products promised many appealing features and an innovation component never seen before: the chance to actually *wear* a computer or a smartphone, something that only 20 years ago was conceivable only in science fiction movies. Problems came very soon though, and there are two main reasons: firstly, we are not used to deal with these objects everyday; secondly, these same objects have to be improved in order to meet consumers real needs and ease of use.

In this dissertation we will follow a precise point of view: wearables are useful, but they are only the first step that will lead us to a revolutionary use of wearable computing. Since we cannot forecast this "revolution", we will try to understand the current situation and see, in the last chapter, the major factors that influence the success or failure of these first waves of wearables.

[7] "The future of wearable technology is not wearables – it's analysing the data", Gibbs S., 6th January 2015, theguardian.com

We can start with a classification, as shown in the image below, where complete and autonomous wearables will have a higher positioning than smart accessories and complex products:

Source: IDC infographic "Wearables: tecnologia da indossare"

One last category is represented by smart clothes: many researchers say that this field has a huge potential, since by now it has not been exploited properly. Moreover, until now the number of people who can benefit from a digitalization of clothes does not include, among all, children but also elders, that could actually benefit from a constant tracking of biological parameters: we have to remember that only in 10/20 years we will have "digitalized" elder, since many nowadays are not familiar with internet and its devices. An example of wearable clothing has been developed last year and will be launched during 2015: Asics, in collaboration with Cityzen Science (a French company specialized in smart fabrics conception), developed a connected shirt for runners. Like many others it will track

physical and physiological parameters, but the real innovation is that wires are integrated to the tissue and can be washed.

Despite all these positive trends in each field concerning IoT, a report from Akamai Technologies called "State of the Internet" remember us that there are still 4,4 millions people without access to internet. This shows that, even considering the great disparity in the distribution of welfare, there is still a lot of room for the explosion of this market – also considering that, among people who already have Internet nowadays, only a little percentage is familiar with the concept of Internet of Everything.
In the end, the whole concept above explained – and the vision of this dissertation – can be well summed up in a Cisco's sentence:

> "Technological limitations are receding exponentially.
> When billions of things are connected, talking and learning,
> the only limitation left will be our own imaginations"[8].

Now that we have presented some data and forecasts it is more interesting trying to understand what are the barriers to diffusion of these innovations. In order to do so and to find what variables have to be considered when analyzing success and failure cases, we will now introduce the theory behind innovation diffusion paths.

[8] Bhandari S., "Internet of Things (IoT) – the cool new world", cisco.com

2. Innovation diffusion

2.1 *Theory from the beginning: from Marx and Schumpeter assumptions to Rogers DoI*

In this chapter we are going to analyze the theory behind innovation diffusion curves; first of all, we can make a digression and consider briefly the work of Marx and Schumpeter, focused on technology, and then we will start from the first application of diffusion of innovation concept.

Among the wide body of fields of social sciences they covered, Marx' and Schumpeter's works as economists are relevant for this dissertation as they are two of but few experts that analyzed the role of technology at that time; in particular Schumpeter focused on the importance of innovation for economic development[9]. He distinguished between invention and innovation, considering the first as exogenous (that means, invention as a change that comes from outside the context) and the second as endogenous, so innovation is considered as technology introduced in the society. In the Schumpeterian vision, innovation encompasses both technical and market change; in his writing he referred to innovation as "new combinations" (intended as a shift in the production itself, not *along* the production). This complexity of possible combinations when dealing with innovation is among the reasons of his "struggling with the complexity of technological development" (Hagerdoorn). Anyway, this concept is too restricted, as it considers only already introduced (in the context) innovations; we can say that, compared to Marx, he came closer to economic reality because he stressed the relevance of both process and product innovation. On the other side, Marx gave explicit attention to technological development – he considered technology as endogenous.

[9] "The dynamic analysis of innovation and diffusion", Hagedoorn, 1989

For what concerns the concept of diffusion itself, the first who studied it in the late 19th century were Tarde, a sociologist, and Ratzel and Frobenius, both anthropologists; the study of diffusion was applied for the first time at the case of rural sociology in the United States in the 1920s and 1930s, when farmers were experimenting hybrid seeds and new techniques. After that application, diffusion of innovation has been applied to many fields, including health care, fashion, technology and knowledge management.

Even though Schumpeter was the first talking about this topic in the XIX century, the starting point to be considered is without doubts Rogers' research: he started with the first edition of "*Diffusion of Innovations*" in 1962. From this piece of work many authors started their researches on this field, and many modifications has been brought; the last version of the book is the fifth, edited in 2003. In the last 50 years innumerable papers have been published, in particular after 2000; we can see that Americans are at the first place for number of authors and articles[10]. It is worthwhile noticing that the abundance of paper increased with technologic progress: indeed this topic is strongly linked to the swift evolution pace of technologies.

In his book Rogers defined innovation "as an idea perceived as new by the individuals". Nowadays many innovations are the implementation of something already existing, in particular we will see in Chapter 2 that more than the perception of "new", people tend to buy objects and services that can simplify their lives. The study of diffusion patterns becomes extremely relevant in order to understand and possibly predict the future of new products launches; in order to do this, Rogers assumed that there are four main elements in the diffusion of new ideas: innovation, communication channels, time and the social system. Here there is an in-depth analysis of those four elements, integrated with new findings and

[10] Literature Analysis of Innovation Diffusion, Li and Sui, 2011

enriched with elements that are particularly influent in this years – it is important, when reading basic theory, to remember that many books were written between 1960 and 2000, so many everyday life aspects has changed since then.

2.1.1. Rogers four key elements

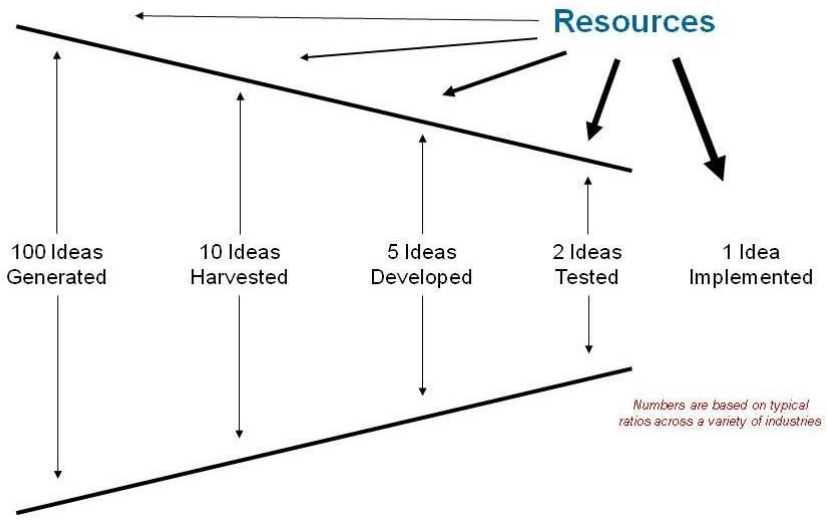
Innovation

Not every new idea becomes a successful product, indeed some can't even reach the market. This can depend on many variables: people in the community do not understand the innovation or they do not perceive it as a need, the pricing could be too high, the product can have the wrong name or design (bad advertising) and so on. In his book, Rogers brings an example about Perù (Los Molinas village) and the implementation of boiling drinking water to improve health and wellness levels. The central point is the knowledge level in the community: residents were not aware about the fact that water sanitation could reduce illness cases. During the campaign people were taught how to boil water, burn their garbage and install latrines. However, local culture saw boiled water as a negative distinctive sign and the campaign was unsuccessful.

In this case the "innovation" failed and did not spread because society refused to use the solution and also as a result of a bad use of communication channels: the sent message discouraged people to boil water because they thought it wasn't a "proper" thing. We can say that there are two aspects for any communication strategy: information and influence. Communication channels will be explained later.

Back to innovation and its origin, we can use the example of the funnel in the figure below, that is quite illustrative and helpful. Creativity is needed when employees are asked to propose new and innovative ideas, but

unluckily not all of those ideas can reach the market. Often the best ones come from individuals that are not experts in the field and from people that are not asked to have new ideas – creativity reaches its best when it comes naturally. An important role is played by technology clusters[11], because geographical proximity can help the formation of specialized industries: the concentration of suppliers and producer lead to knowledge spillovers, useful in order to have skilled workers with a high comprehension of the product – fundamental when innovation comes in form of improvement of an existing product.



Source: innovationcrescendo.com

There are many criteria to consider in order to explain the innovation funnel, beside resources; in particular, to have a successful launch there should be external conditions such as social proper context and timing (does the community need this object or service right now?). Also, if that one good innovative idea reach the market, it is not assured a success, could it be because of pricing, design or no specific function for potential users. In this last step, that means when the idea is become a product

[11] "Strategic management of technological innovation", Melissa A. Schilling, 2010

ready for the market, we have to analyze the rate of adoption, and in order to do this Rogers identified five relevant characteristics. First of all there is the **relative advantage,** that is the "degree to which an innovation is perceived as better than the idea it supersedes by a particular group of users, measured in terms that matter to those users, like economic advantage, social prestige, convenience or satisfaction" (Rogers). Every year it is more and more complex to make products or offer services with a big relative advantage because the average wellbeing of families has been growing in unprecedented ways in the last 50 years. This is a relevant factor to consider when speaking of technology and the difference between useful things and gadgets, as we will see in Chapter 3. The second characteristic is the **compatibility** with existing values and practices, since there has to be consistency with the needs of potential adopters. The third is **complexity**: users will buy something they can use, or that they can easily learn how to use. The last two are **trialability** and **observability**: innovation that can be experimented on a limited basis and give visible results will have a higher rate of adoption.
The above mentioned factors influence the speed of flow of innovation; as noted by L.Robinson, DoI theory "offers three valuable insights into the process of social change:

- What quality make an innovation spread
- The importance of peer-peer conversation and peer networks
- Understanding the needs of different users segments" [12]

The qualities considered are the five mentioned above, while the second point will be studied in depth in the next paragraph, since communications have changed deeply with the spread of Internet, blogs and forums where people can freely express their opinion about almost everything. The last

[12] "A summary of diffusion of Innovations", Les Robinson, 2009

point will be elaborated in the next chapter, explaining why wearable technologies didn't succeed, until now, in gaining a significant share of the market.

Communication channels

At the beginning, this theory considered mass media and interpersonal channels as communication processes; undeniably, still nowadays these are pertinent but lots have changed. Internet led to the development of new jobs and concerns, since companies have to be very careful both at what they sell and the consequences: one wrong product can generate a bad mouth-to-mouth review that can influence the overall reputation of the company.

Many researchers tried to analyze social networks – before and after the introduction of the Internet; in particular the term "social" prior to Internet referred to every communication spread with mouth-to-mouth communications inside the society. Recent research (Wear) shows that innovation can have a wider and faster diffusion in communities where inter-personal networks are stronger.

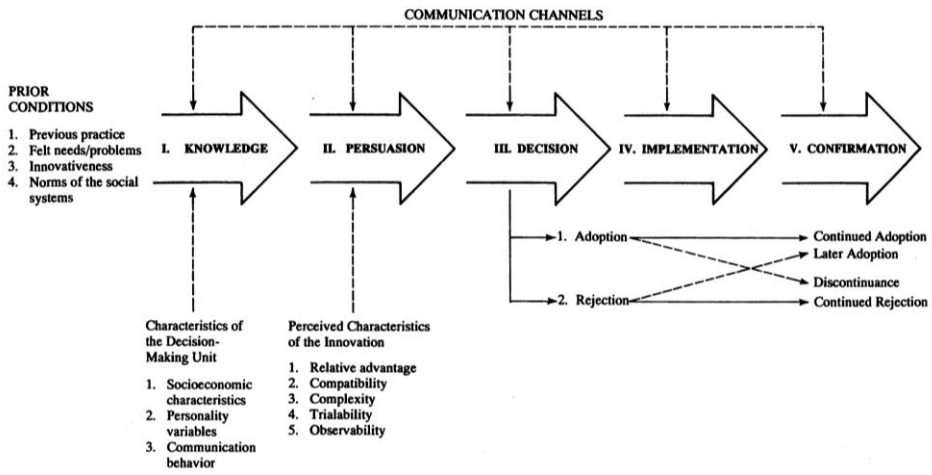
Concerning Rogers theory, he found that mass media channels are effective in creating "knowledge of innovation", whereas interpersonal ones are better for shaping and/or changing attitudes toward a new idea.

When communication between prior adopters and potential ones is not essential in the diffusion process, we speak about external-influenced models; there is also the so called internal-influence model (Mansfield, 1961, and Griliches, 1957, are the most cited two), in which the assumption is that there is diffusion only through interpersonal contacts. The latter works at its best when an innovation is complex and socially visible – which is happening at a always higher rate nowadays, since social visibility is a priority for many innovations, among all wearable

technologies particularly in the fashion industry, but we will see this case in depth in the next chapters. There is then the mixed-influence model (Bass, 1969), that comprehends both the previous models by representing internal as well as external influences, but we will not analyze in depth mathematical aspects.

Time

Time is, for every process, one of the biggest incognita: many good products failed because of a wrong timing launch. Regarding patterns of innovation diffusion, is relevant to analyze time under three circumstances: innovation-decision process, degree of adoption and rate of adoption. The first one is represented in the picture below, taken from Rogers "*Diffusion of Innovations*". As we can see, communication channels are involved in all the five stages; in particular, persuasion is what forms "an attitude toward innovation", and the consequent step is decision. This step will lead to the adoption or rejection of the innovation, so we can say that it is a process needed in order to decrease uncertainty about innovations' expected consequences.



"A model of stages in the innovation-decision process"

Source: Diffusion of innovations, E. Rogers (1983)

The second, and the most important, is the degree of adoption, or innovativeness, by which we can categorize adopters in five levels:

- Innovators – 2,5%
- Early adopters – 13,5%
- Early majority – 34%
- Late majority – 34%
- Laggadars – 16%

As suggested by the names, these categories identify individuals on the basis of their speed in adopting the innovation. Early adopters in particular are important because often they are opinion leaders and so they influence the success of the innovation in getting to the point of critical mass, that is the point at which the number of adopters have grown in a way that the innovation's further rate of adoption becomes self-sustaining.
The third way in which time is involved in diffusion is the rate of adoption, explicated in the speed with which an innovation is adopted by a certain number of members of the social system in a given period of time.

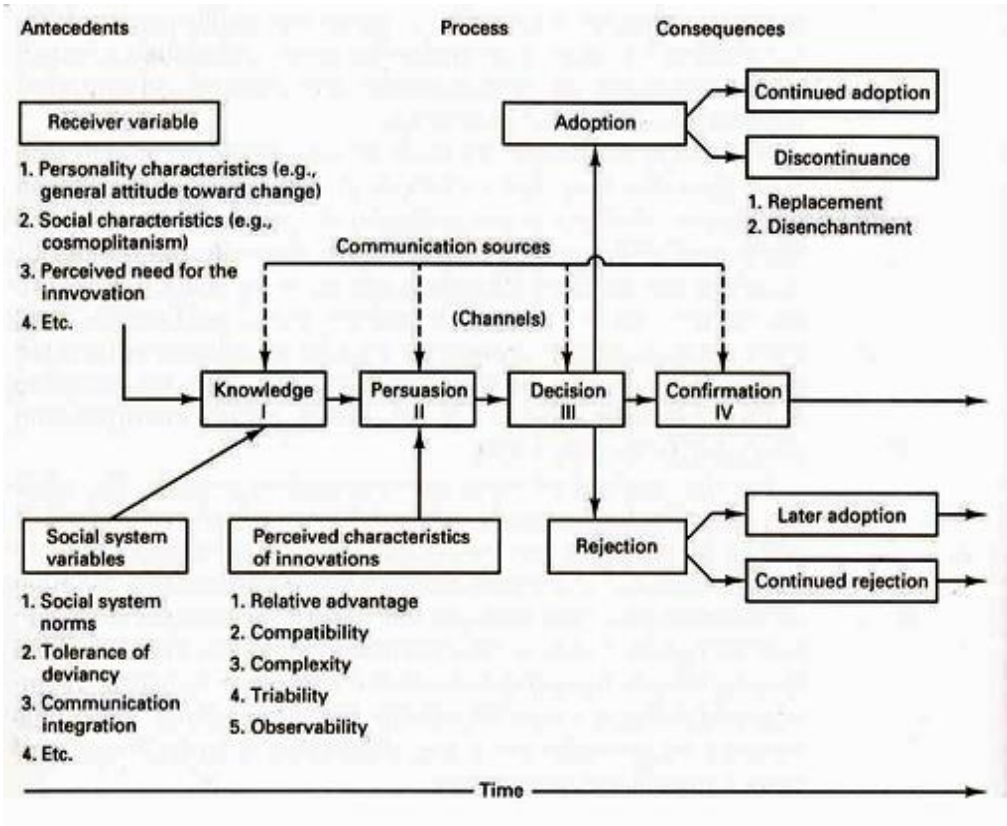
Social system

The social system represents the context in which the innovation flows and its structure can severely affect the diffusion process. Two factors are considered particularly important: norms and opinion leadership. The latter is the "degree to which an individual is able to influence informally other individuals"; nowadays there are two facets of medal, because yes, there are still influential people (for ex. Fashion blogger for what concerns current fashion), but nonetheless we can say that this leadership has softened a lot with the diffusion of Internet, since everyone has the resources to express their opinion. When considering opinion of these

leaders, consumers are particularly influenced during the evaluation stage of the innovation-decision process; broadcast messages are reinforced by a direct word-of-mouth and opinion leaders are present in every social category – in order to influence members of the same level. In this way research has shown that targeted advertising is the best solution in order to gain consumers that have already been reached by the chain of influence. The last point about this topic is noticing that the hierarchy of opinion leaders does not correspond to social one; on the contrary, elites are seldom innovators compared to outsiders.

As a consequence of the relevant role played by opinion leaders, many companies hire so called "change agents", people who attempt to influence clients' decisions toward the desirable (for them) way and who are often in contact with opinion leaders. Speaking of these, also Coleman (1966) studied the phenomenon, considering as change agents mass media communications, government agencies and salespeople.

Here by we can see the whole conceptual model proposed by Rogers, that incorporates what seen in the previous image. An aspect to consider for this dissertation is, among receiver variables, the need for innovation: over the years this variable has assumed different shades, because "need" is something real in pharmaceutical field (where people have a real benefit from the innovation process), but it is quite different for social fields: fashion and technology for example. Since we are going to talk about wearable technologies, it is interesting noticing that many products didn't have the hoped success because they are considered only as gadgets, so there is no real need for them. On the other hand need can also be created by those who produce, but this is process that can take years.



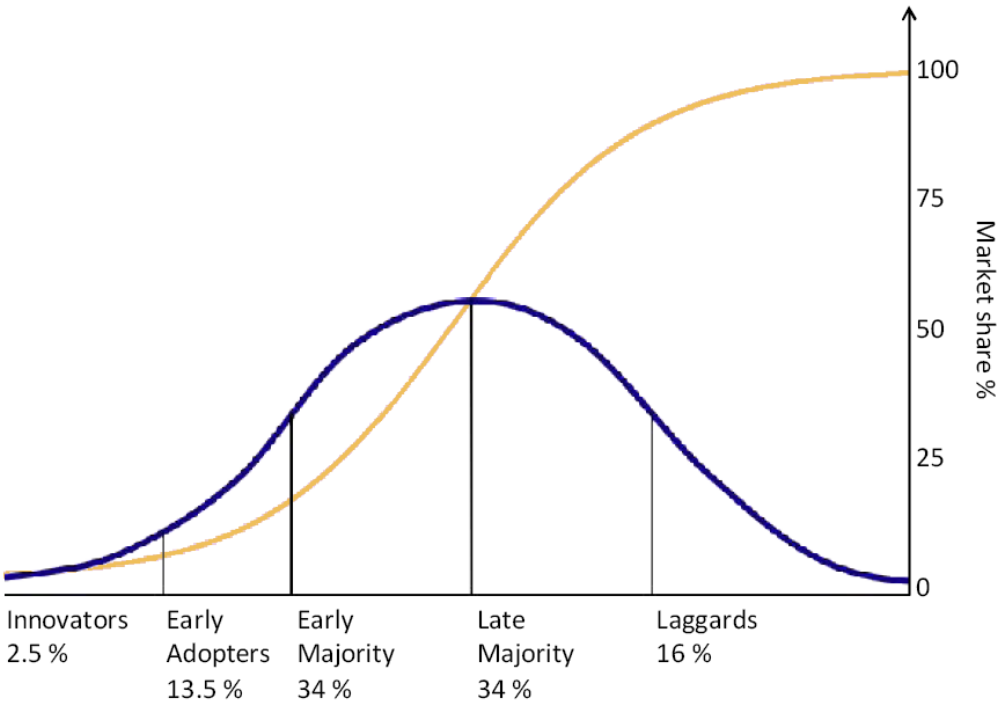
"Diffusion of innovation model"

Source: Diffusion of innovations, E. Rogers (1995)

After this analysis of the four factors that influence innovation diffusion we will see S-shaped curves, also considering the cases of continuity and discontinuity in innovation.

2.1.2 S-shaped curve

Rogers theorized and proved that there can be a rule on the possible diffusion of innovation: the S curve, so called because of the similar S shape – even though we know that the steep and the tipping point are different for every market category or even for every product. It represents the cumulative adoption by individuals, and this is why it is associated with the typology of adopters. Here we can see it – the orange one - in relation to the five categories of adopters – the blue line.



Source: lateralstrategists.com (based on Rogers "Diffusion of innovations")

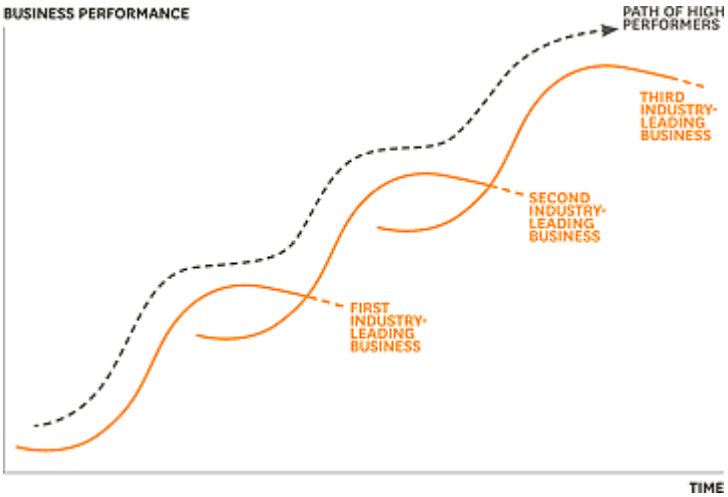
There are many factors that can influence the S-curve, expecially in the opening phase. Nabseth and Ray[13] listed some of them:

- At the beginning, few firms will try the innovation , because being among the firsts always bring some risk;
- If the firsts succeed, they will lower the risk for other firms;
- Information from users has a big influence, more than the one from the press or from suppliers;
- Modifications of innovations increase the superiority of new methods over existing ones;
- Often some products are in the market for a period of time that requires them to be renovated or replaced with innovations.

[13] Nabseth L., Ray G.F., "The diffusion of new industrial processes", Cambridge University Press, 1974

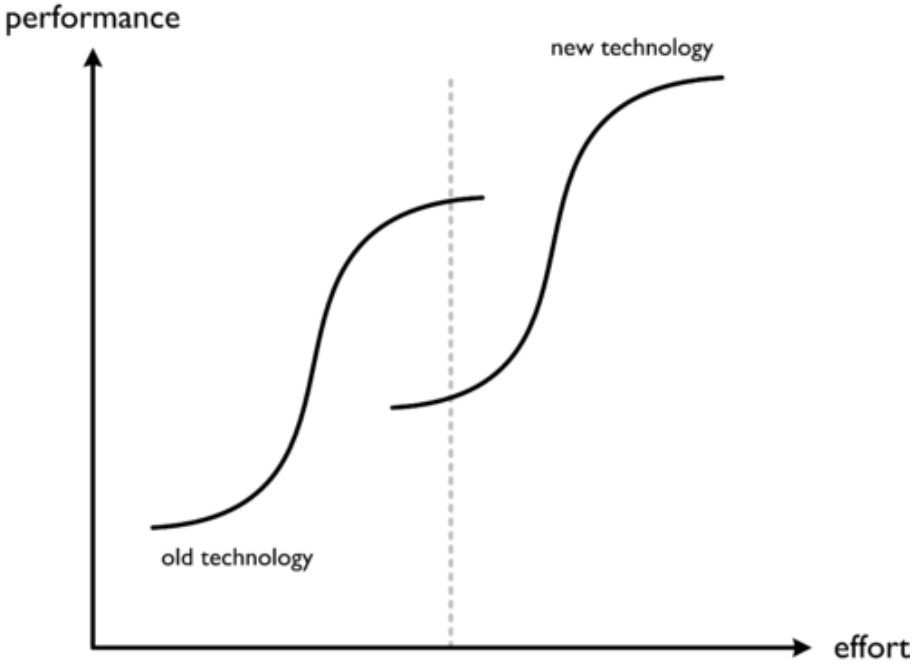
Beside these, we can analyze other numerous influencing factors, in particular there will be a focus on contemporary externalities in the next part of this chapter.

We can say that these curves represent both the level of **adoption** and the level of **improvement of technology**. As in the previous image, when speaking about adoption, the curve is obtained by plotting the cumulative number of adopters against time (even though in the image we can see market share on the coordinate axis). On the other hand, as in the image below, we can have the s-curve by plotting performance against time. Moreover, every improvement or change in the technology (second, third and so on) moves the curve higher and to the right, because the engineering effort rise and lead to new technologies over time, and we expect newer ones to have always higher performances – otherwise they will hardly continue to be kept or improve the market share. This below is the case of continuity; an example could be the one of creating a complementary technology for an already existing one.



Source: "Reinvent your business before it's too late"
Nunes P. and Breene T., HBR February 2011

There can be also technological discontinuity: when the innovation fulfills a market need by replacing a product using a completely new knowledge, we will have discontinuity, for example the switch from cassettes and compact discs to MP3 reader. In the figure we can see that the two curves are not in continuity like before, because the new technology has higher performance limit; moreover, the new technology starts when the other one is taking off, meaning that effort has to be continuative. Waiting until the maturity of a product for a disruptive implementation or another invention could mean losing the market if in the meanwhile someone else took care of thinking, implementing and using a newer technology.
Another case of discontinuity can be represented with a steeper s-curve.



Source: wikiversity.org

Speaking about this, it is interesting to see the different categories of innovation right in the next subchapter.

2.2 Types of innovation

Innovation has been categorized in many different types; in particular we now analyze the most diffused four dimensions[14] that compare two opposite kind of innovation each.

The first one is product innovation versus process innovation: the latter concerns the way companies organize their business, while the other is about the outputs, the final products. Often the boundaries are not so defined and these kind of innovations can occur together.

The second one is radical versus incremental innovation: the first is about suggesting something completely different from the previous solutions, while the second builds upon the prior knowledge and increment the performances and characteristics of the product. It has to be said that the level of radicalness of an innovation can change depending on who is considering it, in the way that what for a firm can look radical, for another can be just incremental or anyway not that radical.

The third dimension analyzed is competence-enhancing versus competence-destroying innovation, and it distinguishes from innovation that builds on an existing knowledge basis and those that use new knowledge – and as a consequence make the precedent one obsolete.

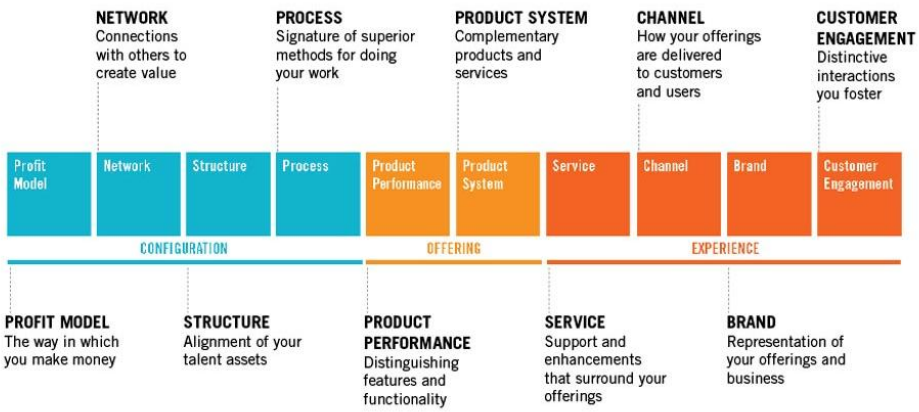
The last one is architectural versus component innovation and it refers to the degree of the comprehensiveness involved in the innovation: if it can change "the overall design of a system or the way its components interact with each other" we will consider it an architectural innovation, while component one implies that the change entails one or more components without affecting the whole system.

This is only one of the many proposed classification for innovation; more recent is the one made by Keeley, Pikkel, Quinn and Walters in their "*Ten*

[14] Strategic Management of Technological Innovation, A. Schilling, 2010

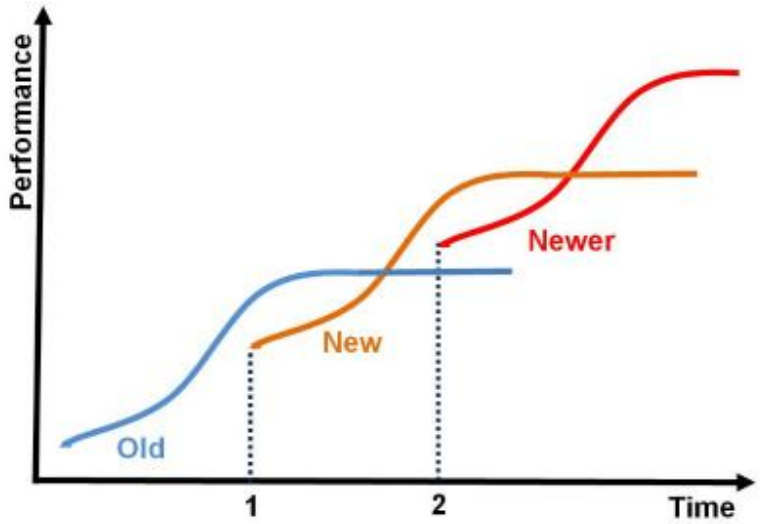
types of Innovation: the discipline of building breakthroughs" (2013). They analyzed innovation in the industry pattern – the dimensions above are always correct, but by changing the context and the application the authors tried to understand innovation deeply. In 1998 they took over 2000 examples of the then best innovations, like Toyota's production system and Dell's computer business, and some historical examples like Ford's T model.

As we can see from the image, they considered innovation from many points of view, in particular what really differs from the previous four dimensions are the consumer engagement and the profit model perspectives: these two are particularly important for the body of this dissertation in that wearable technologies are sensitive to consumer engagement and they cannot reach the market often for problems of profit (many objects are too expensive, both to produce and to sell). The focus of the authors in fact was that of answering the following question: "how do we get innovation to *succeed* instead of *fail*?". In the final chapter many cases of wearable techs will be analyzed in the perspective of this ten types of innovation, in the attempt to see if there can be a systematic approach to make innovation in this field succeed.



Source: "Ten type of innovation – the discipline of building breathroughs", Keeley L. et al.

In Geoffrey A. Moore's book, "*Dealing with Darwin: how great companies innovate at every phase of their evolution*", innovation is considered in the context of the product life cycle and so innovation types can be: disruptive, application, product, platform, line-extension, enhancement, marketing, experiential, value-engineering, integration, process, value-migration, organic and acquisition. When considering the product life cycle, innovation involves having always newer products and, as a consequence, products that after a certain amount of time become obsolete – see the figure below.



Source: "Dealing with Darwin: how great companies innovate at every phase of their evolution", Moore G.A.

At last, but not least, it is important to consider the change impact that innovation brings; we have already mentioned incremental one, but it is relevant to make a distinction between **disruptive** and **sustaining** innovation. The term disruptive was first introduced by Clayton M. Christensen in 1995, in his article "*Disruptive Technologies: Catching the Wave*"[15]. There he explained how over the years and in many fields

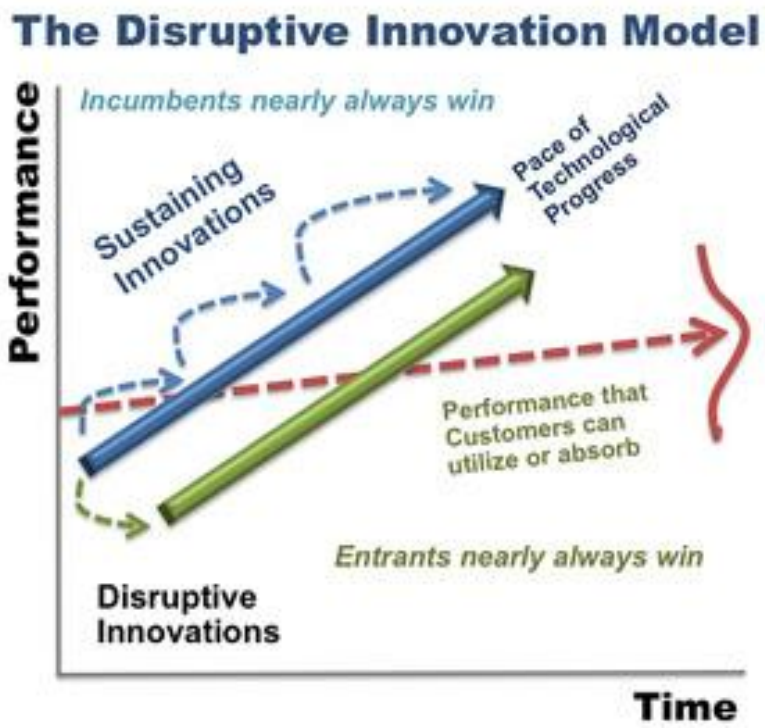
[15] Harvard Business Review, January 1995 issue. The topic has been later analyzed in depth in his book "The innovator's dilemma" (1997)

happened that new and unexpected technologies, from outsiders or anyway companies that do not follow the mainstream trends, have gained the market, making the other prior diffused products obsolete. Quoting his article:

> "The technological changes that damage established companies are usually not radically new or difficult from a *technological* point of view. They do, however, have two important characteristics: First, they typically present a different package of performance attributes — ones that, at least at the outset, are not valued by existing customers. Second, the performance attributes that existing customers do value improve at such a rapid rate that the new technology can later invade those established markets. Only at this point will mainstream customers want the technology. Unfortunately for the established suppliers, by then it is often too late: the pioneers of the new technology dominate the market."

Then he made a clear distinction between sustaining and disruptive technologies, saying that the firsts "tend to maintain a rate of improvement", while the seconds "introduce a very different package of attributes from the one mainstream customers historically value".
Initially disruptive technologies are used only in new markets and applications (so creating the chance for the emergence of new markets) and only after that point, when the technology is established somewhere, customers will want it either.
In the figure we can see the model of Christensen; incumbents will benefit from a sustaining innovation strategy, but entrants who use a disruptive technology will provide customers with a higher level of performance they can absorb – as we can see, the green line meet the red one on a higher

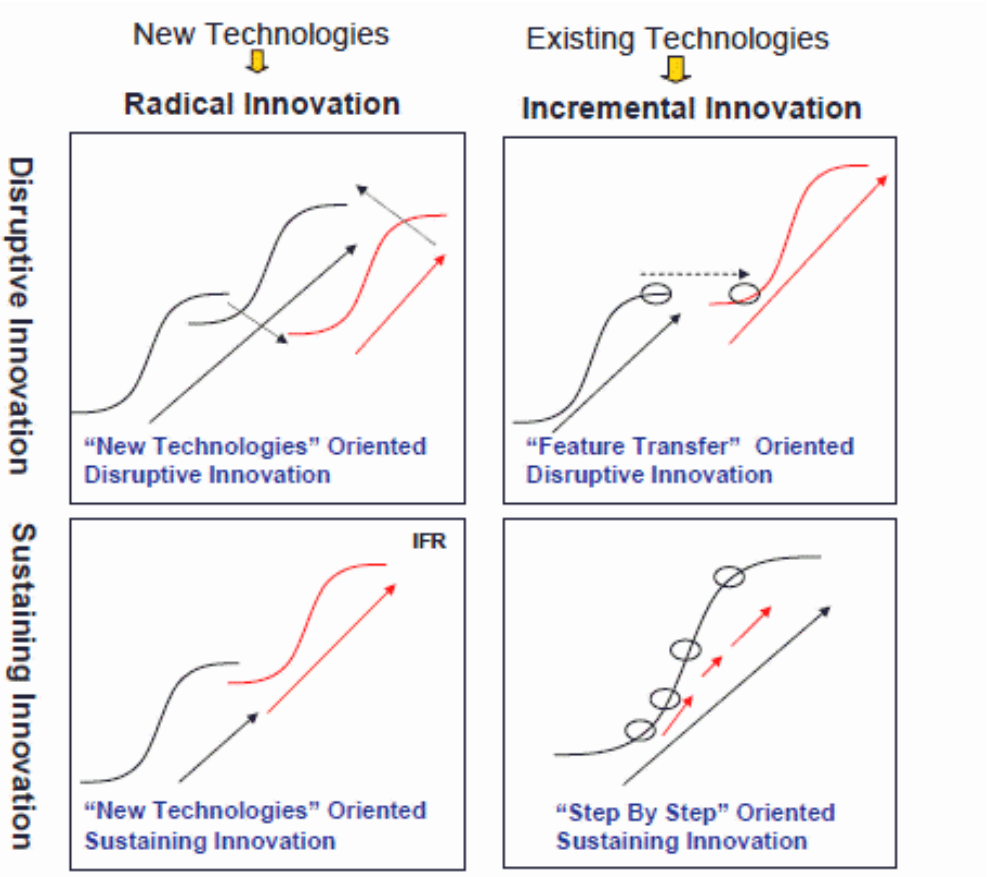
point than the blue one. Once disruptive innovations reach the market of sustaining ones, the latter will "raise each architecture's performance along steep trajectories – so steep that the performance available from each architecture soon satisfied the needs of customers in the established markets".



Source: innosight.com (firm co-founded by C. Christensen)

Back to the S curve concept, we can integrate concepts and see four innovation patterns: we can say that sustaining innovations can be both discontinuous (radical) or continuous (incremental), and the same can be for disruptive ones. The natural path suggests that sustaining should be paired with the term "incremental"; this is the so called "step-by-step" innovation, and it is the most chary way to proceed. Real situations though have shown that being cautious not always lead to market success, because the best innovators are those who "break ranks".

These four options are shown in the image:



Source: Osaka University, osaka-gu.ac.jp

2.3 *Influential factors and the role of externalities*

Now that we have seen the major basis of innovation diffusion theory, we can go further and think about the factors that can change, in some ways, those established paths. We will consider also externalities, that means consequences of an economic activity that have an impact on a third party: in our case technology is having a huge impact on everyone's life, so there are lots of externalities, that can be positive or negative. The purpose of this section are two: to understand what are the major influential factors that can shape diffusion curves (like learning curves) and to think about

relevant externalities that have to be handled carefully when designing and launching a wearable device.

Nowadays the variety of scenarios and the fast at which technological change occur have brought new externalities that can influence the diffusion of innovation. As already known a major role is played by network externalities, that means the influence of peer to peer opinions in order to review positively o negatively a product. With the expansion of technology to everyday life aspects, from healthcare to home automation, the role of these externalities is more important than ever. The question rises naturally: what are the new variables to consider? Many will be proposed case by case in the last chapter; here there is a brief overview of the current situation, in particular in order to see how externalities can affect the diffusion path.

The first question that naturally comes in mind is: what are the processes and dimensions that affect innovation diffusion? By considering them we know that every variable that can change them will therefore change the diffusion of innovation; trivially for example, if a certain kind of process is patented and the only company allowed to use the knowledge cannot reach the market, the innovativeness can be lost.

We can consider Sobrero's intuitions[16]: when we analyze the diffusion phenomenon from the company's perspective, in order to have an innovation there have to be two starting points: the generation of a new idea (what we referred to in the first subchapter) and the individuation of commercial opportunities in order to make profits from the new idea. The latter is what we will focus on: in the end a successful, profitable product is the one that can reach a significant diffusion among markets, so the focus of this dissertation is trying to understand what can make an

[16] "La gestione dell'innovazione", Maurizio Sobrero, Carocci Editore 1999

innovation successful or not and how these factors affect the diffusion curve in the field of wearable technologies – presented in the next chapter. In this way, we consider every variable that have an impact on both demand and offer sides – since innovations can come from the company (technology push) or from outside the company (demand-pull). In order to know what mainly affects innovation – both in terms of helping or hindering it – we can reflect on three factors: learning processes, open innovations and privacy issues, explained here below.

1. LEARNING PROCESSES

In the first subsection we analyzed innovation and invention (the idea funnel) but we didn't explain how, without invention, there can be innovation. Often can happen that the source of innovation is not always an idea, but a learning process. There are many ways in which companies can develop learning processes internally:

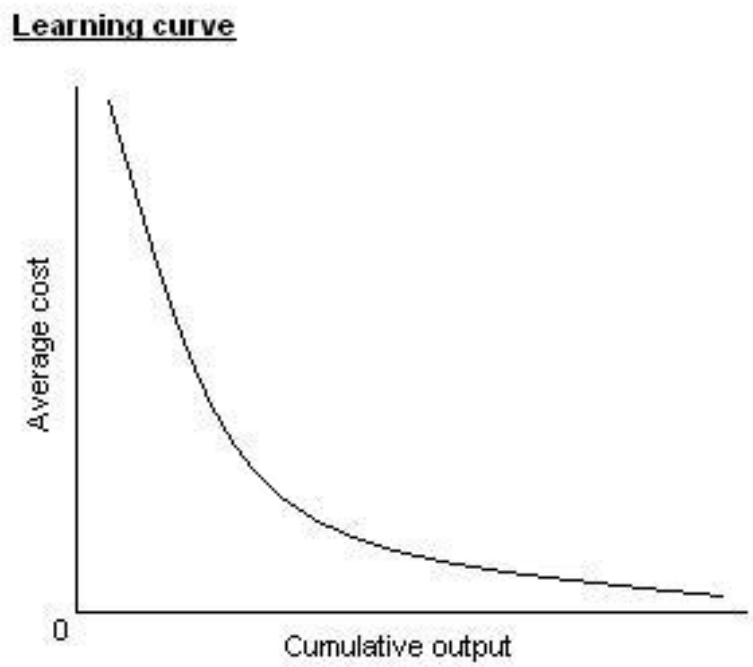
- learning by doing;
- learning by using;
- learning by searching;
- learning by interacting;
- learning by monitoring.

Those processes highlight the relevance of R&D departments and how it is worth to have skilled workers. There can be also external forms of learning, like R&D on commission, recruitment, technological acquisitions and transfer agreements. At this stage we can introduce learning curves, characterized by cumulativeness and multidimensionality; in fact the resources required to support the innovative activity of a company are multiple, like vision, financial resources, time, human resources and technological ones. Knowledge is usually one of the most critical asset, since it can be tacit – so, difficult to track and to "copy", not replaceable

with market transaction and not a public domain: often there are patents in order to protect it.

Here we can see the classical shape of a learning curve and its variables. The average cost of a product will be lower when there is an innovation in processes and a reduction in production time.

Considering also the role of learning in innovation process implies that externalities are also those who can affect the processes mentioned above.



Source: "Learning curve: an important modern concept in economics", Guru S.

2. OPEN INNOVATION

Another way we can mention in order to improve innovation is that firm combine externally available knowledge with internal one, and this is defined as open innovation[17]. The thesis presented in the paper

[17] "Externalities of Openness in Innovation", working paper No. 116 April 2012, Roper, Vahter and Love

"*Externalities of openness in innovation*" is that (quoting) "the more widespread is the adoption of openness in innovation, the greater will be the potential for knowledge diffusion". This paper is very suitable for what we are trying to say, or rather that nowadays diffusion is influenced by many variables that no longer depend only on internal innovation process of the company. Considering externally available knowledge means that diffusion will depend on factors like:

- Patents
- Technological agreements
- Breadth of linkages
- Establishment age
- Governmental support for product innovation
- 'High-tech' sector dummy
- Open innovation spillover
- Sector level average of importance of lack of partners as barrier to innovation

These are only few of the many variables proposed – we will not see them as in depth as in paper – and we know that each one is affected by externalities and can affect back the diffusion of innovation. For example, speaking of the breadth of linkages: the role of intermediaries is fundamental in building networks and providing facilitation services, like facilitate the exchange of knowledge between partners. When there are no intermediaries the exchange of knowledge between distant firms can become very difficult if not impossible. And similar reasoning can be made for the other variables related to openness, since nowadays everything is going global, even knowledge; in fact, benefits regard both private and social spheres, or as the authors say:

"The failure to acknowledge these externalities of openness is likely to lead to a socially sub-optimal level of investment in promoting open innovation, an example of a policy failure"

The externalities that come from openness in innovation can also push other firms to invest in their R&D department. Besides what we have said, there could be for each sector some fixed characteristics that can shape the performance and the spillovers between firms: further we will analyze the scenario for wearable devices.

3. PRIVACY ISSUES

One of the most modern issue concerning innovation and in particular the cyber world is the privacy issue. In addition to computers and smartphones have come also wearable technologies to threat people's privacy and security. Nowadays the normal habitat is always more digital, also home appliances will in few years be connected to Internet in order to ease our routine. The problem is that doing everything with a connection implies a track down of habits, tastes and lifestyles. Companies have had more data in the last years than ever in the past centuries; maybe not everyone can realize that we are constantly observed, and often with our own consensus – in the end it is our choice to download tracking fitness app, to install appliances linked with Internet and so on.

A clear example is the fact that many applications, for example those that track our fitness progresses, ask for the sharing of localization. In January there has been a convention in Rome "*Il pianeta connesso. La nuova dimensione della privacy*" (Connected planet: The new dimension of privacy) precisely on this topic – the 28th Jan. is in fact the European Data Protection Day.

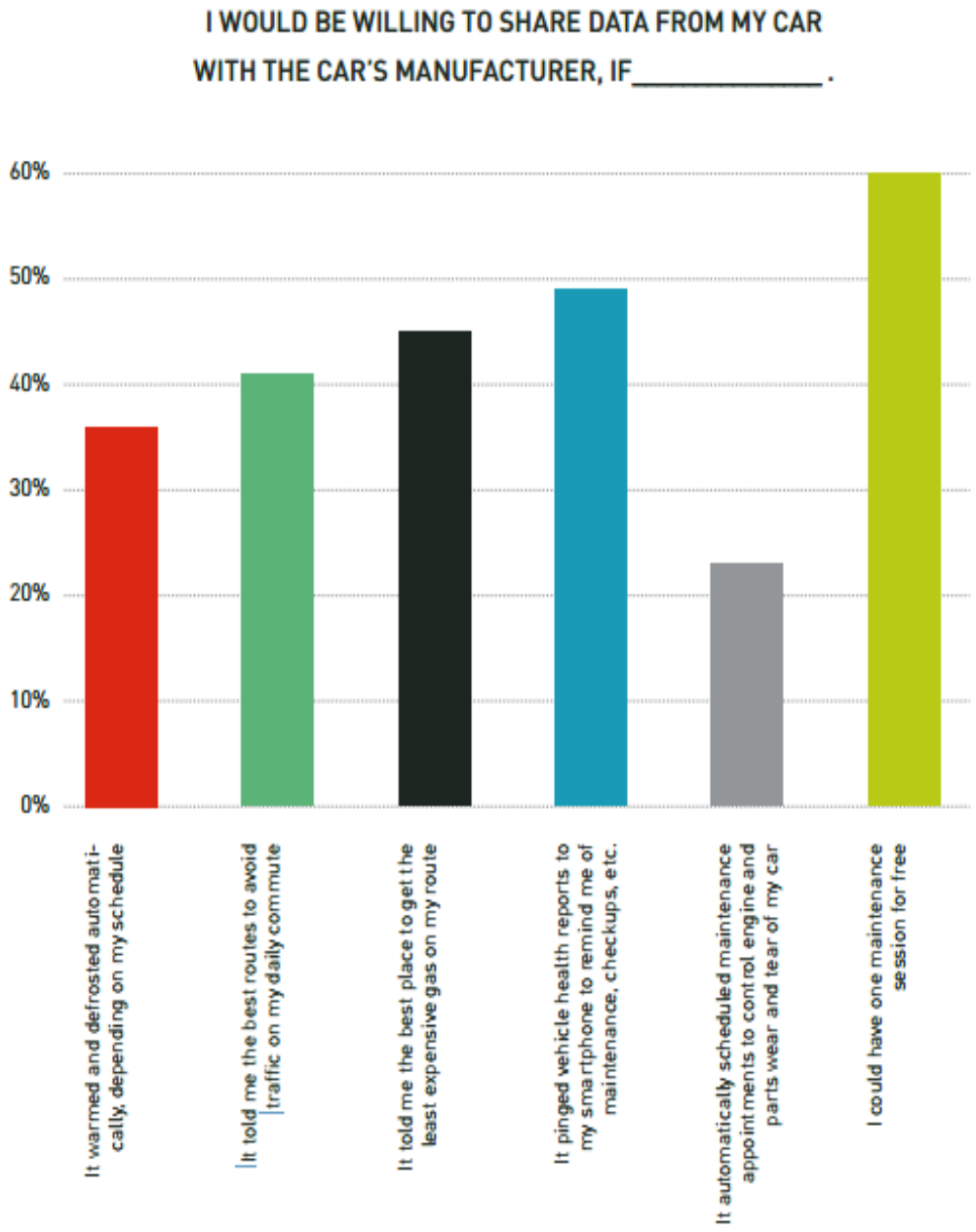
What emerged is the ambition of the data protection authorities to seek a balance between technical feasibility and legal acceptability, arriving at a model of security and data protection built into each device, from the moment of its design.

Looking at the problem from consumers perspective, Acquity Group made a study called *"The Internet of things: the future of consumer adoption"*, based on more than 2000 surveys among U.S. consumers, about the value people give to their information.[18]

Source: Acquity Group study "The Internet of things: the future of consumer adoption"

Here we can see the percentages about people's concerns on wearable devices during 2014: the higher one, 30%, is the lack of perceived value. Only 19% have concerns with privacy, and this can be explained by the fact that, during the survey, lots of consumers stated that they would have given their data in exchange of coupons, offers and benefits. For example, they asked consumers what was the "price" of their data towards their car's manufacturer, and these were the results:

[18] This same study has been used for the part of statistic data and scenarios.

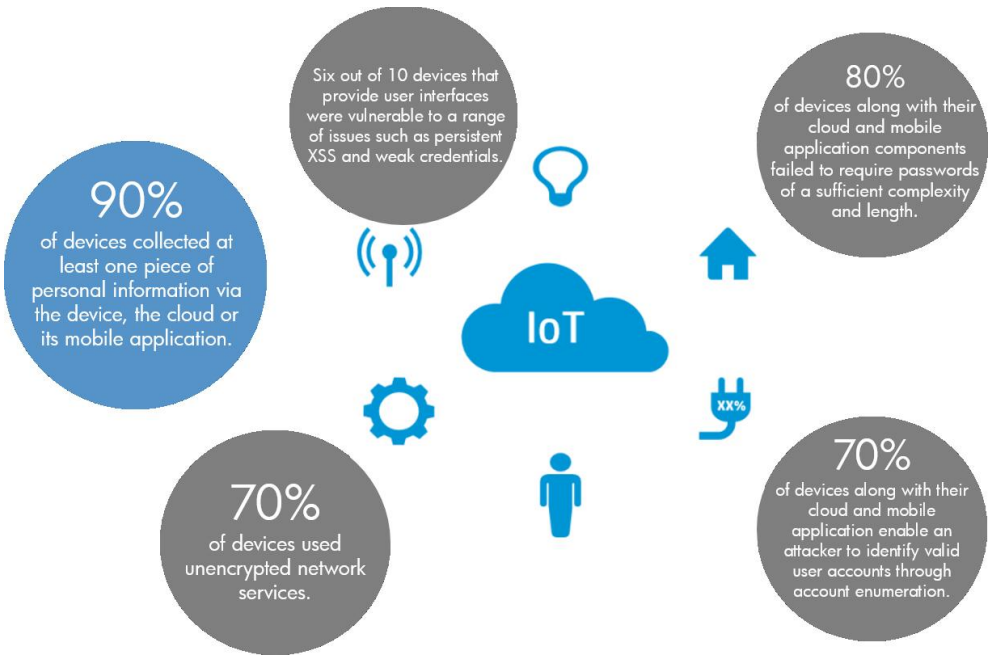


Source: Acquity Group study "The Internet of things: the future of consumer adoption"

Università
Ca'Foscari
Venezia

Besides privacy then there is security to be considered, because consumers need to know not only where their data go, but also if anyone with a fair experience with computer and server can track them. It is important to be aware of the fact that there are multinational corporations that can use our information in order to build data on consumers' habits (and this can be acceptable or less depending on the person we are speaking with), but it is equally important to understand that our data may have poor security over the whole Internet, and this is certainly not acceptable – reason why authorities are taking care of this issue.

From an HP study "*Internet of things (IoT) security: state of the Union study*" emerged that more than 70% of the devices are vulnerable and 80% of them fail to require password of sufficient complexity and length making accounts not so hard to attack.



Source: HP study "IoT security: state of the Union study"

In the end we can say that legislation plays an important role in the success of certain innovations and their diffusion, and it is at this exact point that knowledge spillover and openness in innovation can be useful: if producer A launch an app that is not completely aligned with security legislation maybe producer B can innovate its process and strengthen security systems.

Many wearable devices don't have security systems yet; by now the only things producers focused on was the innovative character of objects and services, in order to make them more desirable for consumers. This year and the next will be crucial because those who will be pioneers in mixing innovation, benefits and security could gain a significant market share. In the next chapter we introduce the field of wearable technologies.

3. Wearable technologies

3.1 Introduction and definitions

In the previous chapter we had a deep insight in technology and innovation diffusion processes. The field in which we will apply the theory is the one of wearable technologies: a very fashionable topic, indeed from many years it looks like "the next year is going to be the boom of wearable", but until now it never happened. Why? What didn't work in building a profitable market and in promoting a wide diffusion of these objects?

First of all, we can define "wearable" every technological component that can be worn or applied to portable devices (for example bags). These objects usually included tracking information or fitness activities, but there are many innovative products coming out at this time: bracelets connected to home automation system, jewelries with tracking device that send one's position in case of danger and many others. Another important area that has been using these technologies for years is healthcare. We will see few examples for each application field in the third subchapter. In fact, considering the wide breadth of the devices we will see, we can use the term "wearable computing" in order to consider the whole area.

One of the major problem of these devices is that many consider them "just gadgets". In order to argue this sentence we can use Sobrero's thoughts[19]: he analyzed the different stages of product and process development, where many areas have to be considered and only one is led by technology, intended both as innovation of product and process - there are many other aspects to keep in consideration. In particular, the needs guided area is useful for our purpose: if, when weighting criteria, we give a

[19] "La gestione dell'innovazione", Maurizio Sobrero, Carocci Editore 1999

high score to consumer needs it becomes quite clear why many devices didn't have the hoped success until now. Even Christopher Mims, technology columnist of the Wall Street Journal, expressed his opinion in this direction by saying:

> "I have little doubt that there is a market for these objects, but I have serious doubts about how loyal those customers and investors will be once these products are delivered. "[20]

He supports those who think that wearables are only gadgets, but – and this is a big but – he also confirms that these objects are leading us to a new way of perceiving and living "things" surrounding us, integrating them into our everyday lives.
We have now three points of view related to the central topic, there are those who are against and those who are with wearables:

AGAINST	DOUBTFULLY WITH	WITH
Wearable technologies are only gadgets, and despite every prevision they are not going to have a long lasting success on the market.	Like C. Mims said, these technologies are not always very useful but they serve for a greater purpose and, through their development now, we can achieve goals and benefits in the future.	Every start-upper mind – it is their job and they can't do anything but support their creations. It is also the attitude of backers, funders and early buyers.

[20] "Dumb 'Smart' Gadgets: The Bubble Is Set to Burst" C. Mims, Wall Street Journal, 3rd May 2015

Of course the purpose of this thesis is not to predict the future - nearly impossible mission - but instead we would like to have a journey through this complicated and new world that is trying to change our lives, and at the end we will try to define some factors that affect the chance of success or failure.

3.2 Innovation strategies

We introduce now the role of firms and their strategies. Innovation and creativity are of course needed, but it is fundamental to enter the game with a proper plan, setting goals and deciding the right target. There are many innovation strategies that can differ between sector and company's size. Freeman[21] proposed this classification:

- Offensive: the firm aims to achieve both technological and market leadership through "quick internal technological diffusion, keen exploitation of new combinations or a combination of both";
- Defensive: for companies that tend to follow radical innovating companies;
- Imitative: imitative companies are more distant from leaders than defensive ones and they rely on imitating the innovation while having advantages for some factors of production;
- Dependent: usually for subcontractors;
- Traditional: for companies that do not have a compulsory need for innovation, due to the field in which they operate;
- Opportunist: these strategies "reflect the search for particular market niches by imaginative entrepreneurs".

Dependent and traditional strategies seem to be not much suitable for the case we are dealing with, while instead it seems logical to associate

[21] Economics of industrial innovation, Freeman and Soete, Routledge, 1997

offensive and opportunist ones to our case, even imitative one in the case of firms that look for fast-follower advantages.

Every innovation strategy differs substantially from common business ones because many analysis tools (for ex. Porter's five forces) are less and less useful as uncertainty increase – and this is typical for innovation, as no it is difficult to predict the success or failure of it, therefore we have high uncertainty. Key elements when operating in a high uncertainty context are responsiveness and search, in order to help firms tracking down possible paths of evolution and considering unforeseen events (Courtney, Kirkland and Viguerie, 1997).

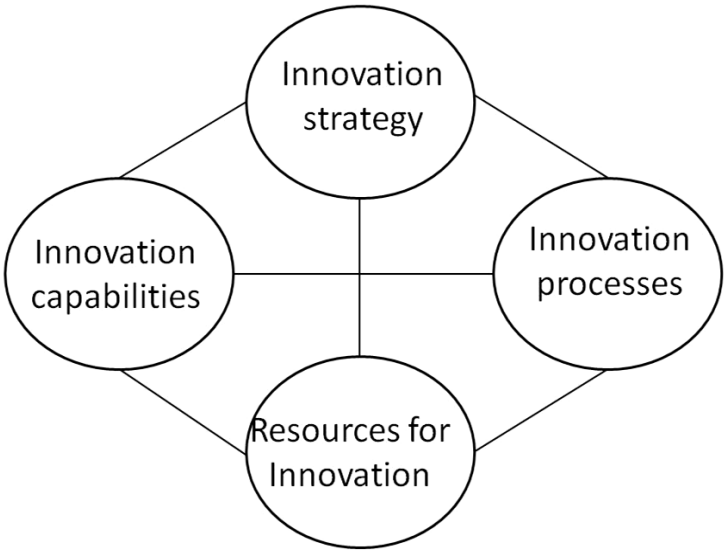
Another interesting categorization is made in the book "*The Management of Technological Innovation*" [22], where the authors state explicitly that it is rare to find firms that follow the path described by a strategy type. In fact, they speak of "ideal" types of strategies, that are more broadened than those proposed by Freeman. In particular they distinguished between:

- Proactive: typical of firms that are experimenting incremental or radical technological innovation and that therefore accept high risk projects. These firms have technological and market leadership.
- Active: usually not the first to innovate, so they take medium-low risk projects. These firms aim to exploit fast-follower advantages.
- Reactive: here innovation is only incremental, there is no willingness to undertake high risky projects that are radically innovative. The low risk propensity is linked to a "wait and see" behavior.
- Passive: usually firms that adopt this strategy will follow the demand of customers or dominant firm; in this way they don't take any risk.

[22] "The management of technological innovation", M. Dogson, D. Gann, A. Salter, Oxford University Press, 2008

There are cases of successful firms for each category, so whether to be passive or reactive is a choice that companies do basing on their resources and capabilities. In particular there are four elements to keep in mind simultaneously when dealing with innovation strategy: resources, innovation capabilities, innovation processes and the strategy itself of course.

In the image below the authors summarized how those four concept are mutually linked to each others.



Source: "The management of technological innovation",
M. Dogson, D. Gann, A. Salter, Oxford University Press, 2008

We have already spoken in the previous chapter about the importance of resources: financial, human, organizational, networking, marketing and of course technological ones. We haven't spoken yet about innovative capabilities, that is the set of capacities a firm need to have in order to "purposefully create, extend or modify its resource base"[23], like searching, selecting configuring, deploying and learning. Finally there are processes

[23] Quoting Helfat et al., 2007 - from the above mentioned book

and the strategy itself, decided among the most suitable for the firm's context and targets.

This discussion on innovation strategies lead us to wonder what could be the best strategy for firms that sell wearable computing devices. As we will see in the cases, the most relevant factors that can change the probability of success of a wearable device are utility, design and brand. We will not go deeper on the analysis of resources because many companies are big enough to not consider this problem (Apple and Google for example) and for small companies we will see cases of smart products that are waiting to be funded (often through fundraising) or objects that are on the market thanks to affluent funders or partnerships (like Tory Burch for wearable jewelry).

Before presenting some cases we consider briefly an important statement: wearable technologies are a particular kind of objects to put on the market, and often the right strategy is a mixed one that does not follow predetermined paths. We can considered wearables as *hybrid* innovations for their nature: we will explain in depth this concept in the next subchapter.

3.3. Hybrid innovations

"Hybrid" has become a very fashionable term in the last few years: hybrid cars, hybrid engineering processes and so on. The characteristics of these are that they mix up two different kind of technology; *au contraire* in this dissertation we will consider "hybrid" the nature of wearable technologies, because they use an already known technology – for example Bluetooth device – with an everyday object – for example a bracelet.

The theoretical link between diffusion and hybrid has been presented by Clayton Christensen, the same who introduced the concept of disruptive

innovation, in the paper "Is K-12 blended learning disruptive? An introduction of the theory of hybrids"[24]. Here the authors referred to hybrid as

"a combination of the new, disruptive technology
with the old technology that represents
a sustaining innovation relative to the old technology".

The disruptiveness in the case of wearables consists in a totally new the use of an already known technology. In the paper the K-12 blended learning method is analyzed, stating that nowadays and in the future children will have a blended education: a mix between online learning and "brick and mortar classrooms".

We can argue our initial definition by using the parameters written by Christensen:

How to spot a hybrid

Hybrid innovations follow a distinct pattern. These are four characteristics of a hybrid:

1. It includes both the old and new technology, whereas a pure disruption does not offer the old technology in its full form.
2. It targets existing customers, rather than nonconsumers—that is, those whose alternative to using the new technology is nothing at all.
3. It tries to do the job of the preexisting technology. As a result, the performance hurdle required to delight the existing customers is quite high because the hybrid must do the job at least as well as the incumbent product on its own, as judged by the original definition of performance. In contrast, companies that succeed at disruptive innovations generally take the capabilities of the new technology as a given and look for markets that will accept the new definition of what's good.
4. It tends to be less "foolproof" than a disruptive innovation. It does not significantly reduce the level of wealth and/or expertise needed to purchase and operate it.

Source: "Is K-12 Blended Learning Disruptive?
An introduction to the theory of hybrids", Christensen

[24] Christensen C.M., Horn M.B., Staker H., "Is K-12 Blended Learning Disruptive? An introduction to the theory of hybrids", Christensen Institute, May 2013

In order, we have that:

1. Wearables includes both new and old technology;
2. They target customers that already use objects in which technology will be installed;
3. This third point is a "yes but no" situation since objects like bracelets and shirts have no pre-existing technology, but for sure with the addition of a technologic component the "job" of each object is preserved and indeed extended to new functions;
4. Wearables usually have a basic technology like Bluetooth devices or they can work with applications – but in this last case we can take for granted that potential buyers are already familiar with smartphones and the app world.

Can we say that wearable technologies follow the path of hybrid innovations? Yes, if not totally there are for sure some stages in the diffusion that can be brought back to this hybrid theory. Who is writing goes quite along with the opinion of Christopher Mims: we are now at an intermediate stage that could lead us, in the next few years, to a completely new way of living and experiencing objects around us. In this perspective it becomes fundamental an in-depth analysis of the current scenario, as in the first chapter, and an overview on the principal fields of utilization, as we will see in the next subchapter.

Back to hybrid theory though, there are few more concepts to add. First of all, we can sum up what we said when speaking of innovation strategies concluding that with the nowadays accelerating pace of technological evolution there are few cases in which a fixed strategy model can fit a new technologic product, also because the life cycle of these is shrinking and we have an ever-changing product landscape. It seems more appropriate to think of everything in evolution: both products and strategies. The term hybrid is also used when mixing different types of strategies, so it fits

perfectly the situation of wearables. Focusing on products then, there is the consumer point of view to analyze. Researched features may overlap among products, since nowadays they are installable in many more devices – smartphones with camera, mp3 players with GPS system and so on. When dealing with such kind of products what arise is the so called "single category belief" problem, that can seriously affect product attitudes[25]. This issue consists in the natural habit of categorizing products in order to simplify the selection process, and as a consequence to choose what to buy; the problem is that hybrid objects can have features belonging to more than one category. Often when we think of a category we have some clear adjectives or quality performance in mind, so when looking at one of the first smartphone with camera consumers probably were expecting low quality performances from the camera, since "if it is a smartphone it cannot work as a real camera". And this is happening still nowadays with wearables: despite design and price (about which we will speak later) there is also this variable to keep in mind. When considering smartwatches, a recurrent phrase is "if I already have a phone with apps, what do I need them in my watch for?". And this reconnect with the beginning of this chapter, when we said that a big obstacle for wearables is that many are considered just gadgets and products without a long life utilization. Of course there are exceptions and also limitations to the application of the single category beliefs: the study proved that hybrid products are accepted more easily when one of the two main features is not well known – for example when there is an offer and you can buy a great hair dryer that has also ironing functions but you have short hair so you think it's not relevant as a second feature. On the other hand there could be exceptions when we take in consideration hybrid products that

[25] Burnkrant R.E., Rajagopal P., "Consumer Evaluations of Hybrid Products", *Journal of Consumer Research* Vol. 36, No. 2, August 2009

we use daily, so our mind has already accepted that they can fit two different categories.

This consideration about categories and hybrids can partially explain us why many people are skeptical about buying wearables. Beside that we can consider another related issue: how can companies try to smooth "negative" feelings of consumers regarding hybrid products?

Of course we hope that skepticism will lower during the next few years; one solution – that can be a positive support even when customers are already positive toward the product – is to give customers a guarantee, both in terms of warranty and in terms of privacy and security, since this is one of the biggest issue as seen in the previous chapter. Moving in this direction, many interesting options has been presented at Ces 2015 – the "Consumer Electronic Show", one of the biggest tradeshow at international level – where hybrid products and innovations are key words. It takes place every year in Las Vegas and we found it relevant because the 2015 edition focused on wearable technologies. In this occasion the world known company Intel has presented "True Key", created to replace the use of passwords with facial recognition or fingerprint: it is not the first attempt but the relevance lies in the fact that when big companies will start adopting these security measures, worldwide diffusion will be easier and faster. Regarding warranty than we already know that consumers are prone to buy in the safest manner possible, and this is even more important when dealing with hybrid products, about which consumers may be uncertain and skeptic. For example, quoting again the study "Consumer Evaluations of Hybrid Products", if the product to sell is an MP3 player with voice recorder functions too, consumers will value first of all the consistency of MP3 player qualities compared to those of its competitors. Then, if they are not familiar with the voice recorder market, they will probably think that its quality inside another device like an MP3

should be lower than that of a proper voice recorder. In this case providing good warranty conditions can help in the final choice for buying the product.

Having said the problems of "single category belief" and warranty for hybrid products, and also the security issue for wearables, we can say that there are still many ways in which companies can try to shape consumers' mind about these new products. Considering wearables only, we will see in the last chapter what are the factors that determined the success or the failure of wearable products in specific cases. Now we introduce application fields, providing some examples, in order to understand the variety of this new landscape and its potentialities – a quite relevant fact if we consider that many people are still not aware of how wearables can change our lives in the next years.

3.4. Application fields

We are now going to present some relevant examples of wearable technologies, considering the fields that can be involved. It is useful to remember the statistics presented in the first chapter: these objects are evolving at an incredible pace and they already have a substantial relevance in healthcare, field from which we start. We will then see the two fields that are more subject to the "gadget" discrimination: fashion and fitness, adding in the end an insight of wearable technologies at a corporate level. When this kind of technology will enter the corporate routine the "gadgets prejudice" will likely be overcome. Even Michael Bell[26], engineer for wearable devices at Intel, expressed his opinion supporting what we said before, that wearables are now at an

[26] Ferrario A., "Il futuro dei wearable? Prodotti attuali lontani parenti", tomshw.it, 26th September 2014

intermediate stage that will end up with "frictionless" objects, autonomous and more useful. In fact, everyone when thinking about wearables suddenly link the term with objects such as Google Glass, Apple Watch and Nike Fuelband but actually the landscape is much more wide: from smart fabrics that can track athletes' performances to sensors that can be applied directly to skin and measure heart rate, body temperature, UV exposure and hydration level (like BioStamp) to devices that will help people with disabilities.

3.4.1. Healthcare

We start with healthcare market because it is one of the most difficult to penetrate but at the same time there are huge potentialities. First of all, every reader needs to keep in mind that healthcare is mainly governed by large corporations; it happened and it will certainly happen again that useful (in terms of practicality, cost and result) devices are not financed or not allowed to enter the market because they could threaten the existent business model. In one of his many papers Christensen, already known for his studies on disruptiveness, explains that this "resistance to low cost alternatives is understandable, but it's not in the best interests of the industry or of the patients it serves" [27]. This is the first and maybe the biggest barrier for wearables when entering the healthcare market. Since the purpose of this paper is not finding ways to change such a huge system, we would like to see some examples of wearables in healthcare, just keeping in mind that the situation nowadays may be a restricted scenario due to the resistance we explained here above.
The first distinction to made is between wearables used in hospitals and those used at home.

[27] Bohmer R., Christensen C.M., Kenagy J., "Will disruptive innovation cure healthcare?", Harvard Business Review, September-October 2000

An example of the first situation is explained by Ashley Simmons, Florida Hospital Celebration Health Director, in the interview for Bloomberg "How wearable tech could improve hospital efficiency": they gave nurses a wearable device for mapping their path through the hospital in order to decrease patients wait time and to collect data for improving the overall organization of work time. Moreover, as Ms. Simmons said, they had no way to "monitor or know what was really happening though the care team during work shifts"; with this little device they can now improve efficiency and organization, both for patients and for employees. Another important point of view to consider is that of doctors: also in this case there are many examples of how wearables help, it could be by assisting doctors in the operating room or by providing real time access to electronic health records. Afshar well explained the potentiality of this field:

"Consider how this can become the healthcare equivalent of how Google Maps displays traffic; showing healthcare patterns based on real time reporting of anonymous data from healthcare wearable devices"[28].

With the word "device" we include sensors, smart fabrics, multimedia devices, wireless communication networks, software for data capture and processing. We report an image from the paper "Smart wearable systems: current status and future challenges" in order to show that wearable systems are really helping and have the potential to be very useful in healthcare field. The chart lists a series of vital signals that can be tracked with a wearable device; many are already known from all of us, but we didn't see them as "wearable systems", like for example skin electrodes for electromyogram. Considering them we can say that wearables' aim is to improve and continue along this way, so they don't have to be seen as

[28] Afshar V., "Wearable Technology: The Coming Revolution in Healthcare", Huffingtonpost, 5th April 2014

something modern and inappropriate in healthcare, indeed. Here we can see the list :

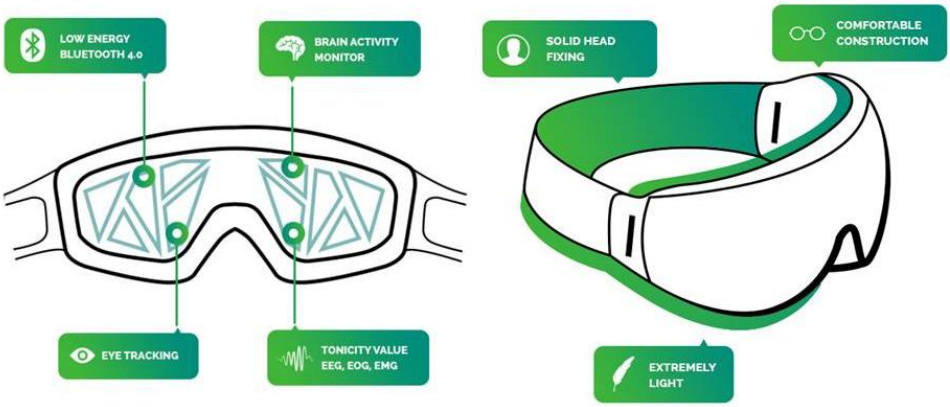
List of vital parameters assessed using wearable systems.

Type of vital signals	Type of sensor	Signal source
Electromyogram (EMG)	Skin electrodes	Electrical activity of a muscle
Electroencephalogram (EEG)	Scalp-placed electrodes	Electrical activity of brain, Brain potentials
Activity, mobility, fall	Accelerometer	Gesture posture/limb movements
Respiration rate	Piezoelectric/ piezoresistive sensor	Inspiration and expiration per unit time
Heart sounds	Phonograph	Record of heart sounds, with a microphone
Blood glucose	Glucose meter	Assessment of the amount of glucose in blood
Oxygen saturation	Pulse oximeter	Oxy-hemoglobin in blood
Body or skin temperature	Temperature probe or skin patch	Body or skin
Galvanic skin response	Woven metal electrodes	Skin electrical conductivity

Source: "Smart wearable systems: current status and future challenges", Campo E., Chan M., Escriba C., Estève D., Fourniols J., Artificial Intelligence in Medicine 56, 2012

Beside doctors and care teams, these data can come mostly from people all over the world while using wearables – and this is the second point of view to be considered. Important steps has been taken in this direction, even though for some devices there is still a prejudice and a certain difficulty in diffusion. The most famous ones are fitness trackers, relevant in the way that they can measure heart rate, blood pressure and also patient's O2 saturation – as presented at CES 2014 from LG and Garmin. Many fitness devices have implications in design and fashion, so we will see some cases in the next subsection. Other examples, excluding fitness purposes, regard devices that help people monitoring continuously their own health, and this leads to a more personalized approach since after a period of monitoring at home doctors can find the most suitable cure or medicine for each case. Just to name one interesting device, that won the award at LeWeb 2013 (French contest for start-ups), we can talk about

Neuro:on, a sleep mask proposed by the Polish company IntelClinic. The mask has been funded on Kickstarter.com (at the beginning of June 2015 it reached $438.573) and the company forecasts to see it on the market for the third quarter of 2015. The revolution it brings to people that have bad sleep or that would like to improve their sleep and efficiency throughout the working day is the possibility to switch from a monophasic to a polyphasic sleep: this means that the mask is linked with an app to a smartphone and, by tracking parameters during the night, the app elaborates a personalized time schedule for optimizing sleep. In particular polyphasic sleep is a technique that involves breaking up the sleep path into smaller fraction in order to spare time. As said by the company on Kickstarter "apparently Da Vinci, Tesla, Churchill and even Napoleon used this technique to rest", justifying the whole concept of the device: having less sleep but calibrated for our own needs could assure us a great spare of time and give us more energy to use during the day. They explain in detail how this mask works, here are some explicative images:



Source: Kickstarter.com

Moreover, the mask measures biological signals as "brain waves (electroencephalography), muscle tension (electromyography) and eye

movements (electrooculography)"; another plus is that it completely substitutes alarm clock by creating an artificial dawn. It is safe in the sense that data are sent to the app via Bluetooth, but only when the mask is not touching user's face. Of course this is not an accurate description of the technology behind this device, and this is just one of the many examples we could provide: just think at the many applications there could be. For instance, a young boy in America reached the Google's Science Fair final with a wearable sensor that sends an alert to the caregiver's smartphone in order to stop a patient with Alzheimer from night wandering.
The final aim here is to explain how far we can go with wearables and their importance, or better their potential, in healthcare.

3.4.2. Fashion

For what concerns fashion we need to underline that it is the field that experiences the most the use of the term "gadget" relative to wearables, and this is due to a simple fact: in the past technology was never associated to fashion. Barriers are several: skepticism for this new association, preserving the aesthetic of fashion while incorporating technologic elements and trying also to maintain the same ease of use than before.
Making a quick example of these barriers experienced in real devices bring us to the Google Glass project: they do not preserve the ease of use of a simple pair of glasses, instead they look quiet bulky, they surely have not a good level of aesthetic and many are skeptic, mainly because of privacy issue. The project of Google wasn't a successful one, but we need to remember that they were the first to try something so revolutionary: nowadays many other companies are offering similar alternatives on the market, like ReconInstruments with ReconJet Sport Glasses, a product that has less claims than Google's one and offers itself as a technological

version of sportive sunglasses (even if there is the possibility to connect it to a smartphone, but this is not its primary purpose).

Speaking about real fashion, so primarily fabrics and accessories, many interesting options are being developed in these years. The most known devices are for sure bracelets, since they go from fitness use to USB, charger and localization uses. In the last chapter we will have a look on the case of Cuff, an American company that sells bracelets, necklaces and rings with smart technology incorporated and we will link it to design as a possible factor of success. For the moment we can think to Nike Fuelband, Jawbone UP24, Fitbit Flex and Misfit Shine for what concerns activity trackers. For example the Jawbone UP24 has 7-day battery life, built-in vibration system, it is splash resistant and it tracks also sleep. With its application people can set up time and food schedules in order to have a reminder that vibrates at wrist whenever they have something to do, like standing up after 60 minutes and so on. From merely fitness tracking products these devices are evolving to life tracker. No doubt evolutions in this field are numerous, even if bracelets are only an intermediate product: just think at smartwatches, they can do the same job as fitness bracelets and lots more. Near to smartwatches there are smartphones; the CEO and founder of RunKeeper Jason Jacobs supports the "intermediate stage" assumption, saying that "doubtless there will be place for very specific fitness trackers, but for mainstream usage, fitness tracking will be handled largely by general purpose devices, like smartphones or smartwatches"[29]. This is relevant just because it brings time for reflection: 10 years ago no one would have ever believed that they were going to track activities with their phones: what happened instead is a complete revolution of how we

[29] Jacobs J, "Why Wearable Fitness Trackers Are Just A Fad That's Going To Die", 8th May 2014, Businessinsider.com

live with our phones and what we use them for. This process is not ended yet, and smartphones could perform many more tasks in the future.

Back to fashion and besides these bracelets, the attempt of the fashion world to approach technology uses also more elegant, high standard alternatives; Rebecca Minkoff and Case-Mate is an example of partnership or we can think at Ralph Lauren that developed its own Polo Tech, a bio-sensing shirt for athletes.

In particular this one is quite interesting, because researchers are working on smart fabrics from years but this is one of the first case that involves high fashion– it has also been used at tennis US Open 2014.

Considering the importance of reputation and brand this could be an excellent way to launch these kind of products in everyday consumers' life. We all know that, even considering significantly better products in term of capabilities, it is hard for a startup or for an high tech brand to have the resonance of a big like Ralph Lauren in the fashion world. In order to follow the purpose of this dissertation, it is interesting for us trying to understand what is the current state of smart fabrics and which are the most relevant attempts. In this way we can show that some products can hardly be called "gadgets", at maximum we can say that it is hard to see a market for them right now. A product that match this description is the Transformer Dress of Hussein Chalayan, a dress that modify itself on the model's body. This can happen thanks to the presence of sensors that shape the fabric basing on the body shape they perceive. An example like this of course is futuristic and it involves not only fashion and technology but also art; we won't go any deeper in this way, and the same goes for

those fabrics that have only aesthetic purposes, for example those that can light up or change color. We consider more relevant instead fabrics that are "performance enhancing"[30]. Possibilities are endless, from fabrics that can release medicine, perfume or moisturizer to those that can regulate body temperature and control muscle – and these can be really helpful in sport and military industries. The tipping point will be the design, in order to have more friendly user products that can also include technological characteristics. As said before and as seen with the Google Glass project, the technologic industry puts first technologic features and then the consumer perspective. Moving along this way we can name Grado Zero Espace, an Italian company active in research and prototyping of new, smart accessories. They operate in various field, from clothes and accessories to medical and sports equipment, where they act as a connector between the product and the innovation in technology. Their mission is to create new products that will improve everyday life; an example is the LQ Jacket, a motorcycle garment that becomes hard when it has a strong impact, or the Hydro Jacket, designed for firemen with a fabric that works as heat dissipater and thermal barrier.

Even though until now the technology for smart fabrics has been applied to interior design there is room for it in the fashion industry; many big names such as Michael Kors and Ralph Lauren say that they are ready to invest in technology. Things in the future will be different if world known brands start to support smart clothing.

3.4.3. Home automation systems

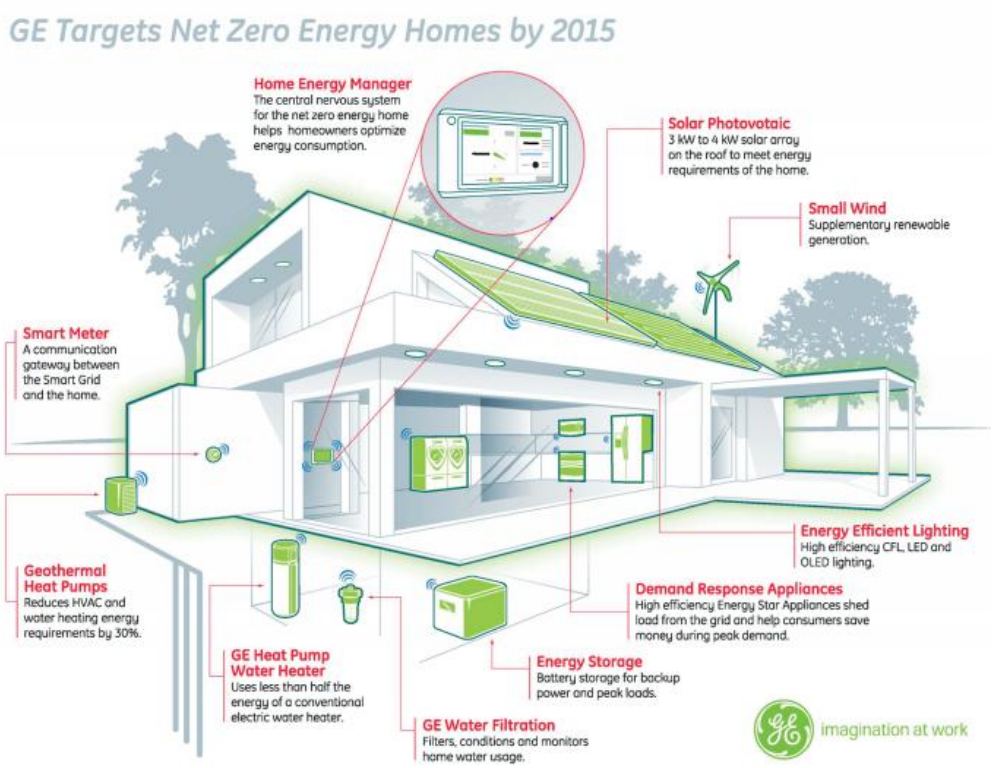
After fashion and healthcare, a little room has to be dedicated to house appliances: if these innovations involve what we wear, they will surely

[30] Gaddis R., "What is the future of fabric? These smart textiles will blow your mind", 5th July 2014, Forbes

involve also what surround us at home, in our cars and in the working environment (and we will speak about this in the next subsection). Technological application are not a new idea for us: the word "smart home" is already quite known. But what are the most wanted features, and why should we desire to make our homes smart? An interesting survey from Icontrol Networks[31] shows that security is a critical point, both in terms of family, like fire detection, and in terms of protecting valuable things, like advanced alarm systems. After the security issue another fundamental point is energy management: we already have smart cities, why not bringing these kind of regulation in our homes? By doing so there would be a better life for everyone in terms of pollution and this would also help sparing money and wastes. Other less relevant features could be pet monitoring and an entertainment monitoring system, but these were not considered much valuable among the people interviewed and the reason looks quite simple: they bring little convenience and they perform tasks that can be easily done by people. Besides devices that can be part of our homes, there are also objects becoming smart, like plates and pans. An example is the Navigenio from AMC, a "high-tech hotplate with integral radio module that controls the whole cooking process in radio contact with the Audiotherm – fully automatically"; Audiotherm is one of the sensor included in AMC pots, with Visiotherm and Sensotherm – so Navigenio is a device designed to work and communicate with its "similar". In other words, it is like having an autopilot in the kitchen, because people can set time and temperature in the morning, or they can send an SMS at 11.30, and when they come home at lunch they will find boiling water or a prepared pot of rice. It surely has an important price, but AMC is world known for the quality of its products, and as many German companies, it hardly fails to satisfy costumers.

[31] "2014 State of the smart home", icontrol networks, icontrol.com

Back to homes in general, few examples will show interesting and innovative solutions, as shown in this image from General Electric: these devices that our homes could "wear" can monitor water filtration, energy storage and, if everything is connected through the smart grid, a home can reuse its own wastes in energy – or as the name itself suggests, there is zero net energy consumption (on annual basis) because the total amount of energy used is more or less equal to the amount of renewable energy created. In this case General Electric interests lie in offering systems that have to be connected, so they, as a company, can provide the whole system that works as an energy manager; this includes partnership and joint ventures in order to fulfill every sector.



Source: technologyreview.com

This (and the next) paragraph are related to wearable devices in the way that home automation systems send data to our wearable devices, like

bracelets, smartwatch and of course smartphones. Even when far from home, we can have information and we can monitor temperature, alarm system and other variables. A clear example are bracelets made for home automation system, so that who wears it can control lights, music, windows, alarm, energy and so on. Of course as said before there is always the security issue, in particular in this case since controlling the alarm system of a house is a much more complex problem when it ends in the wrong hands; this is the reason why producers are focusing on strengthen privacy and security with always more accurate recognition methods.

3.4.4. Corporate level

In the end and in order to have an insight of how wearables can be used in various field, we are now going to explain how they can be exploited to maximize efficiency at a corporate level. Many already support this scenario; Angela McIntyre, research director at Gartner, made an example while speaking at CES 2014: ""if a smartwatch can make profit on consumer market when it will be both a fashion and a technologic accessory, a watch or a bracelet with a smart component used in the working environment could provide a real support, for example when checking the availability of stock". The next step then is to think how the efficiency would increase if workers could perform their tasks with free hands, maybe because they have a video showing them how to repair something, or just think at the speed of information and at the possibility for every employee to have a real time access to data. These are only examples, that anyway give us a glimpse on the potential of wearable for companies.

According to the paper about the so called "Wearable Enterprise" from Accenture Technology Labs, the real end user of wearable technology will be enterprises, because consumers are attracted to fashionable devices

that can simplify their lives but they will not commit easily to this new world, while on the other hand enterprises could really gain in terms of costs, time and overall efficiency. The term used in the research is "valuable": for enterprises wearables can have more added value than in the case of consumers. Here you can read an abstract from the paper that well explain this concept:

"Consumers are fashion conscious, impressionable, price sensitive and admittedly dependent on their tablets and smartphones, which can do many of the things beta-model wearables can do for a fraction of the cost. For these reasons, consumers are much more likely to adopt wearable displays once their price and aesthetic are indistinguishable from prescription lenses, sunglasses or jewellery. In contrast, the value proposition for enterprises and employees is enormous and much more immediate. Wearables can help improve employee efficiency, enhance training and ongoing communication, reduce non-productive time and rework, shrink decision time frames, minimize exposure to hazardous conditions, decrease travel time and more" [32].

Concluding this chapter we can say that many wearables, especially the first models launched in the market, may be seen as gadgets, but in reality there are numerous application for them, and their potential, if supported with the right infrastructure, is really outstanding. In the light of this we now see some real cases of wearable technology success and failure, trying to understand the major causes of failure and strengths of success cases.

[32] Accenture Technology Labs, "Putting Wearable Displays to Work in the Enterprise" 2014

4. Case discussion

4.1 Methodology

Before starting some case analysis we explain the criteria used, or better the methodology followed. As already said, there are three fundamental features that needs to be balanced: utility, design and brand. Regarding utility we have shown in the previous chapter that there could be many interesting, useful application of these technologies. Moreover, utility will depend also on consumers' attitude: 20 years ago no one believed that we would become so Internet-dependent in the future. Technology is more and more integrated with our lives, in ways we couldn't even imagine in the past. Analyzing the scenario with this mindset, the consequent thought that arise naturally is a question: why not? Why do not think that wearables will *really* lead us to a new way of improved living? Despite the pro wearable attitude, we also need to face reality; as in almost every field, first trials and products have to face risks and failures. This natural process leads to a continuous improvement in products – their features but also their production processes.

We have already mentioned the book "*Ten types of Innovation: the discipline of building breakthroughs*" (2013, Keeley, Pikkel, Quinn and Walters) while analyzing different types of innovation. This book uses ten categories in order to understand why some innovations succeed while others fail, confirming that it is important to focus not only on products, but also on other variables. Moreover, companies need to choose some areas of innovation, because the best outcomes are the result of a smart combination of few among the ten categories. In particular we will refer to the image proposed here below, made by the same authors of the book in question, in order to explain every case. Here every type of innovation is explained and an example of a successful company is provided.

		HOW YOU...	SUCH AS...
CONFIGURATION	Profit Model	make money	Gillette
	Network	connect with others to create value	TARGET
	Structure	align your talent and assets	WHOLE FOODS MARKET
	Process	use signature or superior methods to do your work	ZARA
OFFERING	Product Performance	employ distinguishing features and functionality	OXO
	Product System	create complementary products and services	scion
EXPERIENCE	Service	support and enhance the value of your offerings	Zappos.com
	Channel	deliver your offerings to customers and users	NESPRESSO
	Brand	represent your offerings and business	Virgin
	Customer Engagement	foster distinctive interactions	Wii

Source: Keeley L. and others, "The Science of Innovation", Bloomberg.com

Companies listed nearby are only examples, because actually companies can and often should innovate in more than one way; quoting the authors:

"the rule of thumb is that any team that uses five or more types when it innovates can produce game-changing innovations that amaze customers and confound competitors"[33].

In the next sections we will analyze some success and some failure cases, trying to scoop some determinant factors for the adoption of innovations by using also the guidelines provided in the over mentioned book.

[33] Keeley L. and others, "The Science of Innovation", 7th May 2013, Bloomberg.com

Besides that, we will use several references from books and articles on the issue. We will analyze four areas, respectively smartwatches, armbands, jewelry and eyeglasses.

4.2 Smartwatches

Introducing the wide field of wearables, we have already explained the reason for this definition; in particular we underline now the use of the term "smart" related to watches.

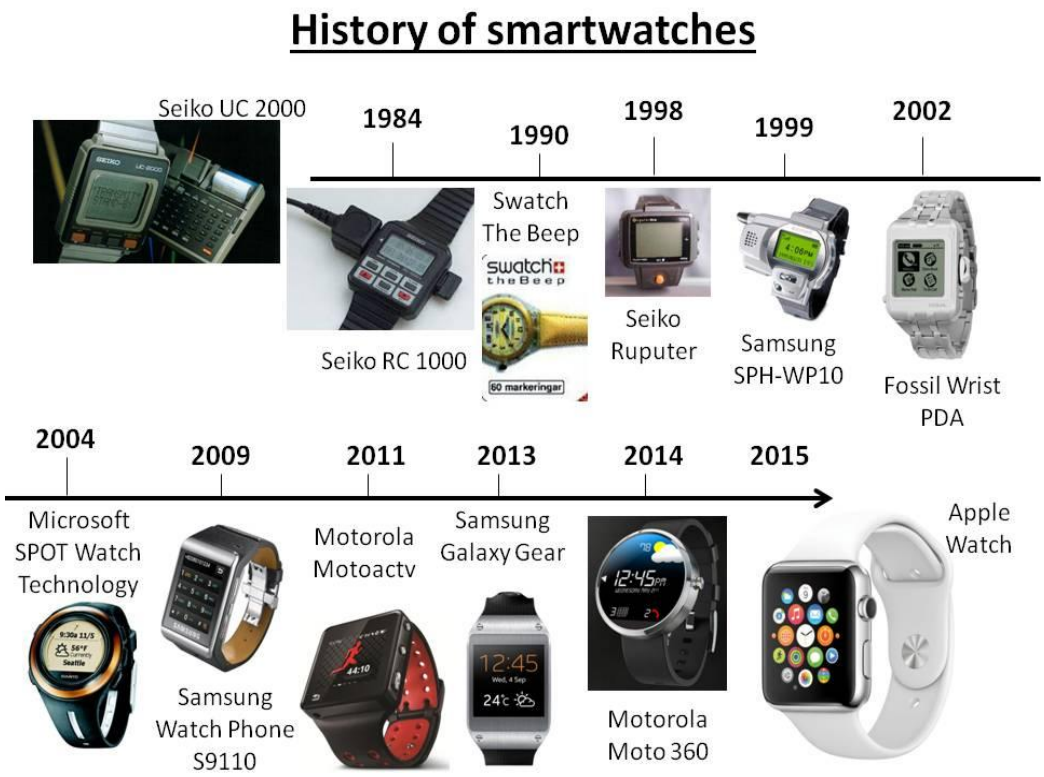
The reason behind the use of this term is intuitive: we define a watch "smart" when it can perform many tasks beyond that of displaying time, for example by tracking fitness parameters or working as a Bluetooth device.

Moreover, smart is associated to the term "connected", meaning that one of the essential characteristic of a smart object is that of providing a connection – both to other device of the same person and to the external world.

They are one of the loudly announced products of the last few years, in particular during 2015. The main reason is called Apple Watch: before its launch in 2015 the market already knew examples of this kind of product – and at lower price, with good features too. Anyway, they were not labelled "Apple". Even though they were the Moto 360 or the Pebble, we haven't seen a commercial on TV; on the other side, every time that Apple announces a new product launch it really creates expectations and

suspense – and this is not something we are arguing about, just an observation on the relevance of brand on consumer engagement. In this section in particular we will analyze the factors that brought many smartwatches to failure, also including possible factors of success, comparing many variables and presenting in the end the Apple Watch case - even though it is a little early to decree whether Apple's idea will be a success or not, since we do not have data on a long period sales. What we can already say instead is that the watch of Cupertino is the start of a new wave of wearables.

Keeping the focus on smartwatches, here there is a brief sum up of the historical panorama[34], from the first "raw" models – that anyway at their time were considered innovative – till the last watches proposed on the market:



Source: own elaboration

[34] Data and info from smartwatchgroup.com and portalesmartwatch.it

As we can see, the first models were created in the 80s. Of course the features included in these devices have evolved a lot: starting from Pulsar and others Seiko, watches were too bulky - just think at the Seiko RC1000, a 1984 model. In order to transfer data from watch to PC it needed a cable, and this process had to be done quite often given the reduced memory capacity. First big steps were made with Seiko Receptor and Swatch The Beep, that allowed a wireless connection to the world by being used also as pagers. Fundamental in every category of wearables was the passage from cables (and so dependency on having always the necessary object near) to wireless connection. In particular, this moment was also signed by the introduction of the Bluetooth; in fact, SPOT (smart personal object technology) technology provided by Microsoft to companies like Tissot, Suunto and Fossil, never hit a big success because it was projected to work with FM waves, with users paying an annual amount of money, from $39 to $59 depending on the kind of yearly subscription. Then after 2010 a lot of companies entered this market providing watches that could track fitness parameters: we have to underline that in the last few years the fitness market has gained importance and popularity, making fitness a very fashionable lifestyle. Given that smartwatches that worked as a phone were already on the market (the first was the Samsung SPH-WP10, 1999), the step forward was to put together, in one object, these features: phone, watch, fitness tracker. Not to mention that smartphones nowadays can absolve all these tasks, so who better than companies that already produce smartphones to enter the competition in the smartwatches industry? And here we are with Apple Watch, and before it Samsung, Motorola, Lg. In addition, there are significant examples and partnerships also in the not phone-related market side, like the most famous Pebble and all the projects in which Google is involved. Another interesting thought regards the fact that if many big companies entered the smartwatch market we

would suppose that this could be due to previous cases of success, while in fact this is not true – as we can see looking the image reporting the history of smartwatches, since many of them are forgotten or even unknown by the majority of people. We will now see two cases of smartwatches failures and other two that can be defined successful, trying to find an innovation pattern understanding which areas are more involved.

I'm Watch

An Italian startup called "I'm SpA" tried to put on the market a model of smartwatch, the "I'm Watch". Probably the majority of people never heard about it, in fact the company has failed and the watch is out of production since the 1st October 2014. In an attempt to move up big companies like Apple and Android, two entrepreneurs Manuel Zanella and Massimiliano Bertolini, with the financial help of Ennio Doris (Mediolanum), proposed the first "real smartwatch" – as claimed in their website imsmart.com – that comes with a touch screen and is capable of connecting with one's phone via Bluetooth (and therefore to the web).

Source: imsmart.com

The model could connect via tethering Bluetooth with Android, iOS and Blackberry phones; every app was designed for the Watch and it had its proprietary app store, I'm Cloud. They launched it in 2011, and in few days they already had 10.000 orders; after two years from the launch, they sold

watches for nearly €4.2 million – that means less than 15.000 units, against the forecasted 200.000 – facing losses for €4 million circa[35]. Eventually they were forced to leave the market for two main reason. The first was the overestimation of profits and the underestimation of costs, while the second reason, as explained by the company itself in a public statement[36], concerns the entrance in the playfield of multinational companies like Apple and Samsung. After having introduced the situation properly we can now try to analyze the product using our "table of periodic elements" of innovation.

Reviews on the product let us know why profit and sales didn't reach the forecasted figures. These in particular were the most criticized features:

- price too high (€350 for the standard model);
- design too bulky;
- unresponsive touch screen;
- no text message alerts;
- poor call quality;
- high power consumption;

On the other hand I'm Watch also had some positive sides, starting by the fact that it was easy to use, it had one headphones slot and Android/iOS/Blackberry neutrality. Moreover, they also tried to enter high-end markets with I'm Jewel line, luxury version of the watch made with precious elements like gold and rose gold.

We can now understand what led I'm Watch to failure, using Keeley's table we would say that I'm SpA focused on innovating the offering side, in particular the product performance since this case is considered a pioneer in the field. Lack of configuration and experience though signed the end of

[35] Favero G., "Finisce l'avventura dello smartwatch finanziato da Ennio Doris", corriereinnovazione.it

[36] Imsmart.com, http://www.imsmart.com/it/contatti/press-centre/nota-stampa-im-spa-19092014

its journey. The Italian alternative available on the market since 2014 is Exetech XS-3, quite useful since it's a standalone product, that means that it can work without connecting to smartphones. After the presentation of the other cases we will use some images to show the types of innovation used and compare the cases, seeing who innovated where.

Kreyos Meteor

Another example of smartwatch that we can consider a failure is Kreyos Meteor by Kreyos. This product was supposed to be launched after a crowd-funding campaign during summer 2013 on Indiegogo, where it was announced as "the only smartwatch with voice and gesture control". After having reached a sum more than 10 times bigger than what they asked, they started (late) to ship the product to early backers.

Source: Indiegogo.com

First reviews showed many issues but, most of all, almost none of the promised features were included or well functioning. This was a bad experience for backers, since nothing had been refunded, and it shows us how many and which features are appealing to costumers (just think at the exceptional funding they received in only few months: $1,5 million against the 100.000,00 they were asking). In particular, what was really

tempting about this project were few features, or better promises: a battery life of at least 7 days, flawless voice control, waterproof to five feet, a low price ($100-$140, half or more less than many competitors) and, for the first time, gesture control. In the end, after almost one year, many backers didn't even receive the product, nor a refund; those who had the luck to receive the product, found it really disappointing, reviewing that, due to its necessity of connection via Bluetooth, the watch couldn't even display the right time if it lost connection. A smartwatch that hardly works as smart and not even works as a normal watch can doubtlessly be called a failure. The company officially closed in October 2014, stating the project failure.

After these two cases of failure – and not to mention the enormous variety of competitors that, if not failing, aren't having a smashing success either – we can see the most relevant characteristics of two of the most rated watches: Pebble and Apple Watch.

Pebble

The beauty of smartwatches proposed by Pebble is that they cover a wide range. They go from the basic Pebble, black and white screen, 7 days battery life, to Pebble Time, the second generation that comprehends Time Steel, accessorized with colour E Ink display and has a battery that can last 10 days, it is smaller than the sport model and has a more elegant and classical design (in the image below three variants). It is one of the most famous smartwatches for several reasons; one of the most important is that they succeeded in breaking the edge and getting a world known brand. The first model was launched in 2013 after a crowd funding campaign on Kickstarter (April – May 2012). For what concern sales data, during the first year, nearly 400.000 units were sold. Recently the CEO,

while interviewed, revealed that they shipped the one millionth watch on 31st December 2014.

Some of the winning features are without a doubt the compatibility with both Android and iOS, the affordable price and the long lasting battery.

Source: businessinsider.com

The price range from $199 for the basic one to $299 for the Time Steel model. Price is a big factor of differentiation between this and Apple Watch; we will now introduce the latter and see if the higher price reflects in better features and usage.

Apple Watch

Finally landed on the market in April 2015, the smartwatch proposed by Apple is one of the most discussed model. Few first impression: as typical of Apple, the design is essential, simple and rather elegant; battery life is only less than a day (estimated as 18 hour long lasting); it has a colour touch screen and ranges from $349-$399 for the Sport edition up to $17.000 for the gold Apple Watch. It is relevant to mention though that price likely won't be the discriminating factor because the company already has a well known price standard; it would have been naive to expect this product to be cheaper than Pebble.

Source: apple.com

What differs between versions are both the case and the band: the most precious the material, the higher the price. Every edition has two prices since Apple had the smart idea of producing two measures for the case, making this smartwatch the most unisex product on the market by now. The overall price is one of the most relevant factors, besides all the positive experiences of usage possible, because the watch only works with iPhone 5 or later model, so in case there is also a smartphone expense to consider.

It is quite early to make statements on the data of Apple Watch, since it has been on the market now less than a year, but Apple already announced the next version of this Watch. Probably, as we can read on Forbes, using the words of Ewan Spence, "the first Apple Watch will be used to align Apple's ideas on wearable technology with the public"[37]. Nearly what happened with iPhones: the real success began with the third model, and now every model has more and more success; considering this we can doubtlessly say that for Apple another relevant variable is Costumer Engagement.

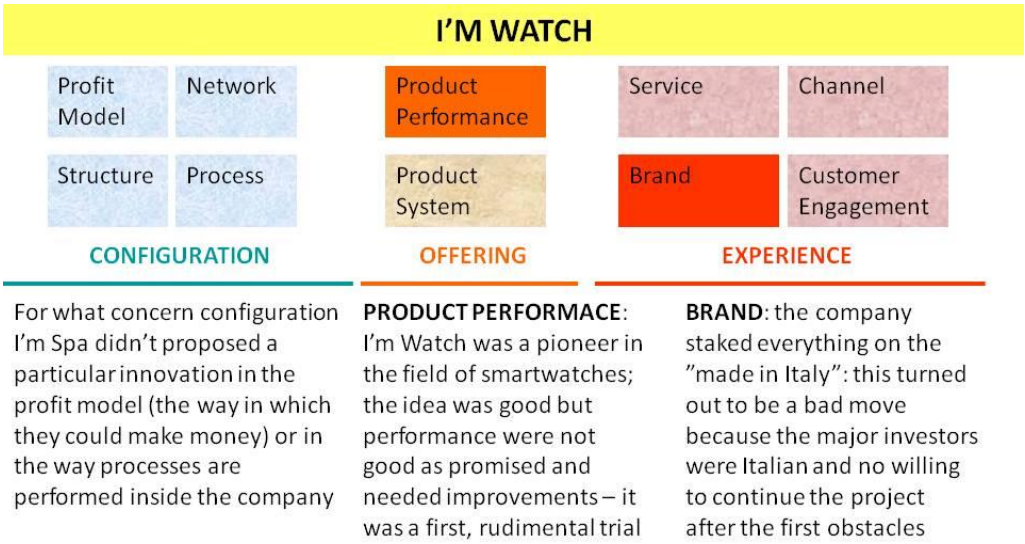
[37] "Apple Watch sales figure do not matter", Spence E., 13th April 2015, Forbes

Speaking about market and sales analysis, we can read in Fortune's website data concerning the closing of the second quarter; since Cook and his team are not proffering a word on data, the magazine asked 27 analysts to make an estimation. In the end, they forecasted that Apple Watch sales could be a bit under $4,1 million (19th July 2015)[38]. Anyway, there is one fundamental conclusion to keep in mind: the real fortune for Apple is not the profit for what concern Apple Watches, but what it gather in terms of information and usage data.

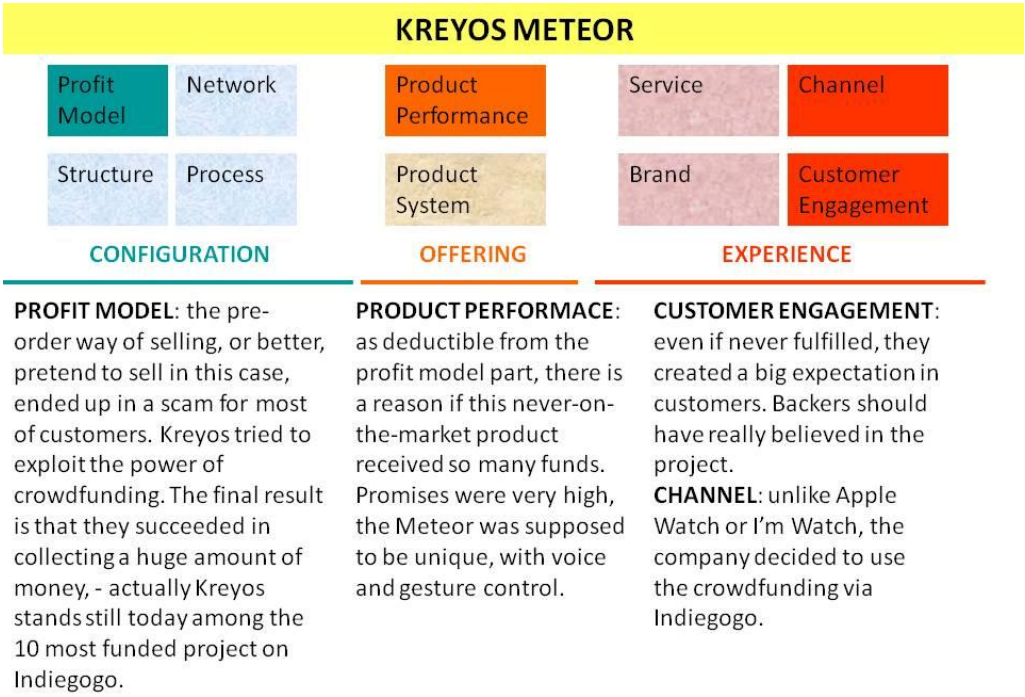
Comparison

In conclusion, considering features and processes of these four smartwatches, we tried to analyze them with an innovation lent in order to trace a pattern for possible success. In the next pages we sum up the main features and types of innovations used by each company, explaining why they might fail or succeed.

Here we can see in order the cases:

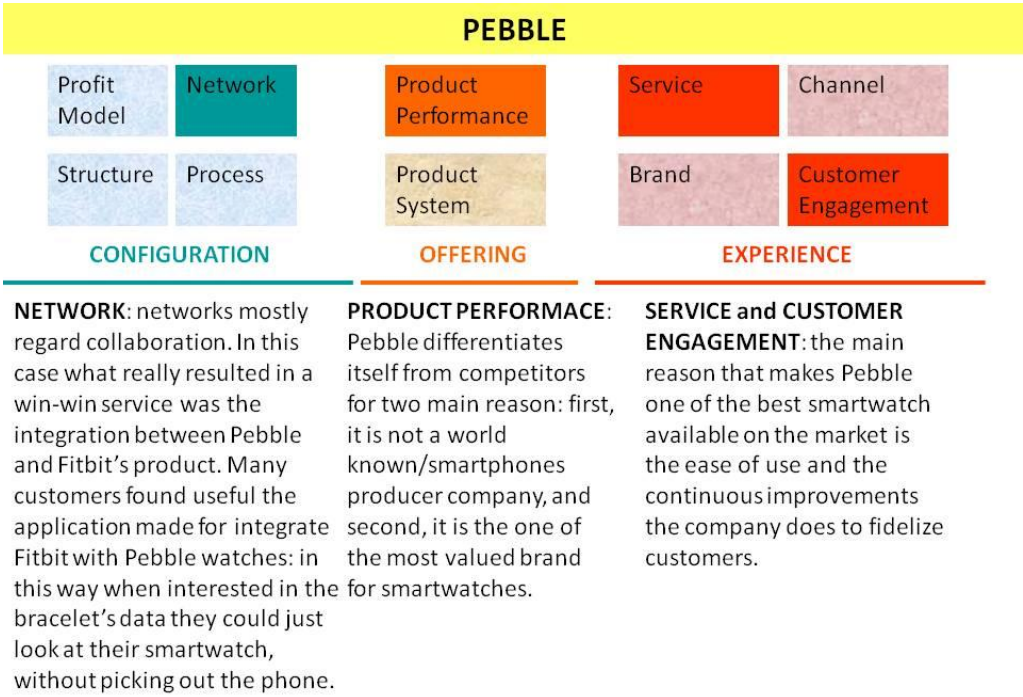


[38] "How many watches did Apple sell last quarter? Second pass", Elmer-DeWitt P., 19th July 2015, fortune.com

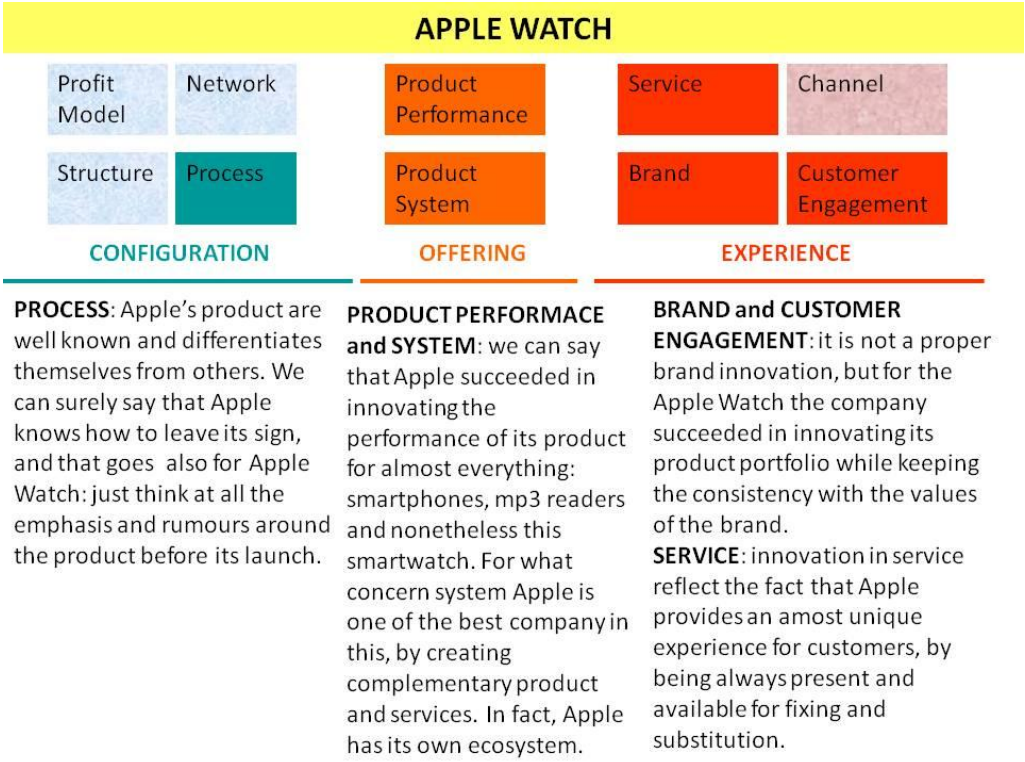


In the end both cases ended up in a failure, so innovation types chosen are only representative of the way they chose to start their business. Totally different reading of the charts has to be done for the next two cases, that resulted in outstanding products thanks to the way they innovated in determined field. In particular we can see the big difference between I'm Watch and Apple Watch: both are intended to be high end product, but the Italian one failed in innovating outside product performance. One of the factor that could, in these months of sales, contribute to a success for Apple is in fact its knowledge in consumer experience and configuration of products. The launch of Apple Watch has to be analyzed considering the past of the company and its reputation; if it were the case of an unknown company, starting with such high prices and claims, we doubt that the end would have differed much from I'm SpA case. It is fundamental, when considering innovation paths, to make a trade off between the different variables: in order to justify high prices, if we are speaking about a new

product, it has to be almost an ideal one; there is no space for flaws and first trials, because otherwise consumers could not be willing to invest that much. On the other hand, as in the case of these first failures, we know that companies need to cover their investments and cost, making also some net profits in order to continue their activity. We can see here the charts for Pebble, that can be considered a very successful case in this panorama, and Apple.



We have to remember that what makes a product successful and unique, hardly replicable for competitors, is the way types of innovation are mixed up, not just one type of innovation. Apple for example is known especially for the innovation they put in experience area: there are consumers who would buy only Apple products, from mp3 player to smartphone to smartwatch. It is a different planet: they make consumers feel "exclusive" with their products. The innovation proposed by the company is not only on one single product: they are building through the years an innovation experience, fidelizing clients and being consistent with their promises.



To be honest it would be inappropriate to make a comparison between Pebble and Apple as companies, since they have totally different backgrounds and reputations; in the case of smartwatches we can compare the features – as listed in every case – but it will be up to customers chose which one to buy. They are both great products in terms of services and quality; after all, everyone has its preference.

4.3 Armbands

After the discussion on smartwatches we will now see the case of smart armbands, jewerly and glasses. The decision to consider glasses comes, as predictable, from all the hearing and talking about the famous Google Glass. In particular the two main points of the next three subchapter are giving an answer to questions as: why such futuristic products as Google Glass failed with the first launch? and why instead others like Fitbit Charge bracelet are more and more present in the market?

Few of the cases presented while debating on these products are taken from the paper "*Enterprise Wearable Technology Case Studies*" (Kaul A., Wheelock C., , white paper from Tractica, 2015). After many research and case reading we can state that up to now the major form of utilization for wearable technology is represented by smartwatches (already seen in the previous subchapter), armbands and in piloting cases glasses. Even though we have mentioned the importance of wearables in the fabric industry as well as in the home automation systems, a reality check proved that consumers are now getting used to the idea of tracking and monitoring accessories, while for the clothing for examples it could take a while for average people to buy them – even if shirts that can work as fitness tracker are already used, but mostly in the professional competitive world.
Having explained the main contents, we will now present features and use cases, ending with a confrontation as in the smartwatches subchapter.
The field regarding armbands spaces from the over spoken fitness tracker to health related products and to accommodation solutions. We will use few yet very clear examples, starting from the fitness world.

Fitbit

Among many, we picked Fitbit for two reasons: the variety of models proposed and the fact that it is by now a world known brand. Another factor that helped the diffusion of these kind of product is the evolution of the fitness world; the purpose of Fitbit accessories is in fact to help people keeping an healthy life style, controlling calories, work outs, sleep quality and they work as "motivators", so people will see if they have reached their goal or not. For the latter usage comes useful Fitbit app, where everyone can set goals and keep track of progresses.
First launch on the market goes back to 2008 with the Fitbit Tracker, basic version as springboard for the following upgrades and improvements.

During the first quarter of 2015 only they sold 3,9 million devices, with a net income of $48 million: the company itself and others that work on market research state that approximately Fitbit controls from 75% to 85% of the fitness tracker market[39]. On the 18th June 2015 Fitbit also went public.

In the image we can see the latest model available in the market: they go from simple activity and sleep tracker (Flex) to models that, besides these functions, can also display time and incoming calls when connected via Bluetooth to a smartphone (Charge and Charge HR, where HR stands for heart rate monitoring).

Source: Fitbit.com

The strengths are doubtlessly the design, simple and unobtrusive, the easiness of usage since it is a standalone product (and for the latest model with incoming calls ID displaying, they work with any phone) and it synchronizes wirelessly with the associated smartphone. Moreover, battery life can go up to 5/7 days. On the other hand, many people still think that this kind of devices is useless, considering also their price ($100-$150). This issue though regards more the way of living and perceiving the integration of technology into our lives than the product features per se. In some cases this integration has been promoted by

[39] Levy A., Tausche K., "Fitbit offers a rarity for tech IPOs: profit", 17th June 2015, Cnbc.com

companies that give for free (or at a discounted price) a Fitbit bracelet to employees , in order to address them to an healthier lifestyle. Usually these companies have interests in doing so, for example many big ones, like British Petroleum, Redbull and eBay, have their own medical plan – so it is in their interest to motivate employees by setting goals and offering lower insurance premiums whenever a goal is achieved. Others, like Oscar Insurance, chose instead to set rewards (instead of providing discounts) for achieving targets.

Smart VIB

Even if most people consider them only fitness-addicted accessories, these armbands have a big potential also in healthcare, since they are now evolving to measure several biological parameters; not only, we have found other cases of utilization also in the hospitality sector. The Palladium Hotel Group decided to use smart bracelets in two of its most famous hotel, the Ushuaïa Ibiza Beach Hotel and Hard Rock Hotel Ibiza.

Source: smartdestination.net

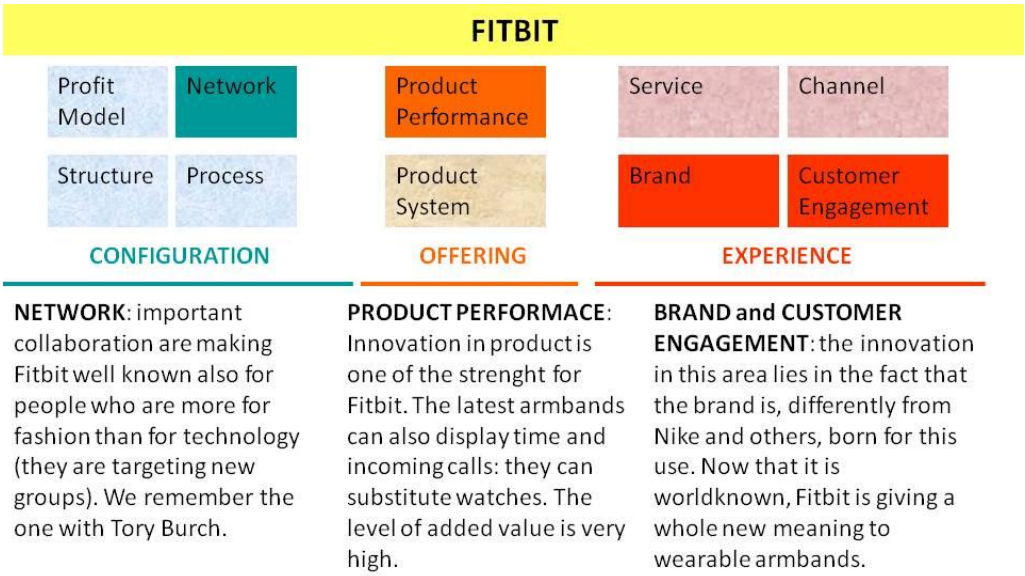
Here the so called Smart VIB has many ways of usage, like payment in shops and restaurants, room access key and personalization of offers for every client (packages can be loaded in the bracelet).
Even though the scenario is full of small competitors who couldn't survive, there is a bigger issue for such devices: every each of these accessories,

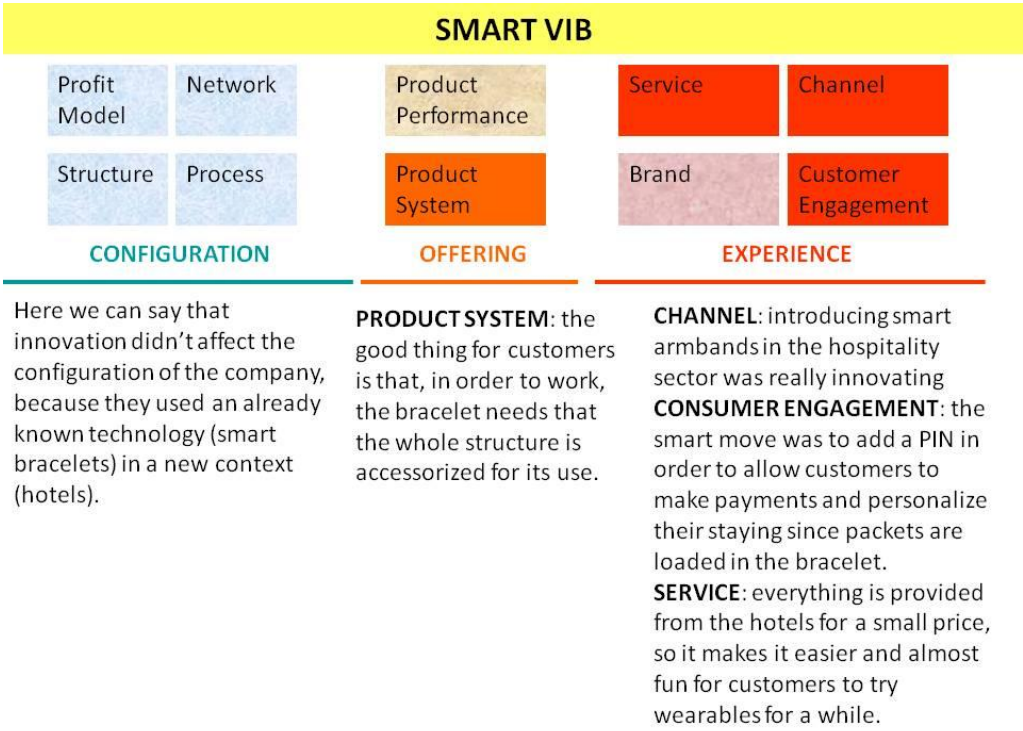
even when considering successful cases, presents some problems. The bigger one is privacy: Fitbit was even suited for this reason. And for what concern bracelets that enable payments, how can one be sure to be hacker-safe? Here is, in the opinion of who is writing, the major problem: lack of innovation in privacy protecting systems. Within few years this bug will eventually be solved, but it is a problem that creates a strong concern for consumers. We will address in deep this topic in the last section.

Comparison

In the field of smart armbands (and this works also for jewelry and glasses) customer engagement is a fixed type of innovation needed: since many people still consider them "useless" it is fundamental to innovate in this area in order to buy the loyalty of an always higher number of customers.

As done in the previous subchapter, we will see the types of innovation used in the two cases presented:





As we can see from the charts, only by changing the context there are new combinations of innovation. In these and the following cases, until proved wrong as in the case of Kreyos, we will hardly speak about failure. Between Fitbit and Smart VIB we can only see how by differentiating their innovation types mix they ended up with completely different results: since fitness is an increasing reality, Fitbit is really known and is keeping on innovating. On the other hand, for what concern the hospitality sector, customers cover all age groups, making it difficult to spot a target that would love to be on holiday and dealing with new devices at the same time. This could be an explanation of why smart bracelets and hotels are not already a matched pair.

4.4 Jewelries

A totally different perception of wearables concerns the field of jewelries. What appears to be the most relevant problem in this case is a lack of

innovation needed to buy consumers' engagement; the main reason could be that fashion and technology are two terms that did not go along well for quite a long time – until now. People will need time and opinions of early buyers in order to consider the purchase, not to mention a considerable improvement in design: "one size fits all" watches and bracelets are not much appealing for women. In this field we try to understand what are the main difficulties to overcome bringing few cases.

Cuff

As a starting we present Cuff, an American brand that produces smart jewelries with incoming calls or texts alerts and security services: in case of emergency, the wearer could press the bracelet for 2-3 seconds reaching the chosen contacts and sending them the physical position (GPS coordinates).

CLASSIC PACKAGE SIGNATURE PACKAGE DELUXE PACKAGE

Source: cuff.com

It vibrates when there is an incoming call or when the owner walks away from the smartphone. There is no display, and this already compromises its functions because when receiving an alert for an incoming call, the wearer has to take out the phone in order to look who is calling. Besides this, the other features seem to be well studied: elegant and female-taste design, small Bluetooth device that can connect to Android and Apple either and that is interchangeable among their line of jewels, the charge

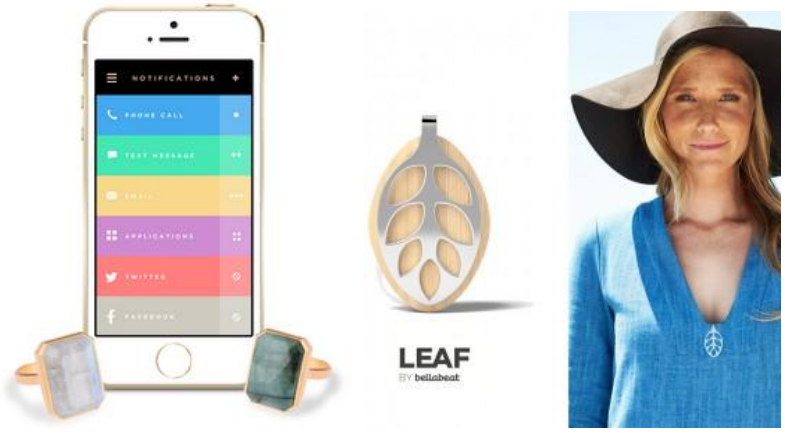
can last months. Here was the first big inconvenient for customers: during the first months of 2015 the pre orders included a Cuff module that could be recharged. Now, at fall's beginning, they will ship a Cuff module that "will last 6-12 months with regular use"[40]. And then people need to buy a new one. It could be compared to the case of Meteor Watch: many promises but no evidences so far. Cases like these represent a real threat in the market: they disappoint costumers and investors, making the whole environment difficult to believe in. In fact, this is even more evident when searching for Cuff's products reviews: none.

When dealing with emerging fields like smart jewelry, companies like Cuff slow the pace of innovation diffusion. We are not saying that this is failure yet, even because in their website it states that pre orders will be sent during fall 2015. Consumers who are waiting from 6 or more months only have one option: waiting and hoping that the companies will actually ship. We believe that start ups like Cuff are worthy, but planning and strategy are an important part of the deal; moreover, when experiencing delays at least an excellent consumer care would be needed.

Bellabeat's Leaf

Other cases, without the downsides of Cuff, ranges from Ringly, that like Cuff vibrates for calls or schedule reminders, to Bellabeat's Leaf, a pendant that monitors sleep, fitness activity, heart rate and even period (particularly useful for women that want to get pregnant, even though its forecasts on ovulation are useful only for regular women – we can say that it is a rudimentary feature this one).

[40] cuff.com



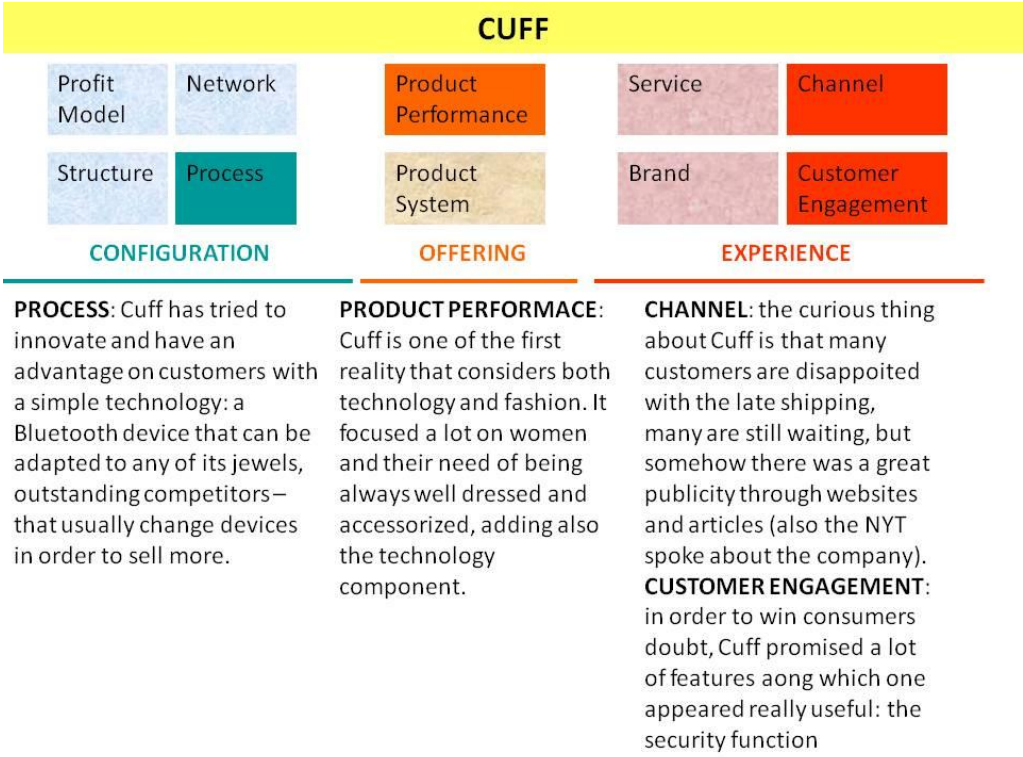
Source: ringly.com / bellabeat.com

Here we can see the design of these two devices; simplicity is a winning when dealing with objet that has to go well with every other piece of the outfit. Moreover, the Leaf from Bellabeat is versatile since it can be worn as a pendant but also as a bracelet or a clip. The company started with another product, the Shell, that allowed pregnant women to monitor the baby's heart beat. Founders followed one of the most important signal for innovation: they searched for a gap in the market and filled it. No one before produced wearables for women in general, not to mention pregnant ones. Figures reflect this success: the first 10.000 Leaf sold out in 48 hours. We can say that innovation in offering was a key point for the company, and also its strength because it succeeded in being the early mover in a very specific market segment: in Berlin they won the Pioneers Challenge (2013), then they raised $4,5 million from Silicon valley investors and now (fall 2015) they are producing the third batch of Leafs. We have to say though that there has been complains about late shipping (even 2 months late): a general sentence can be made for startups, and it is that those who are faithful to what they write can gain extra points on consumer engagement – and, in the end, the last word for product success or failure always comes from users' experience. Moreover, considering

bugs and little issues, it is relevant to keep in mind that these are first generation products: they will be improved with updates and changes during time, shaping on market needs.

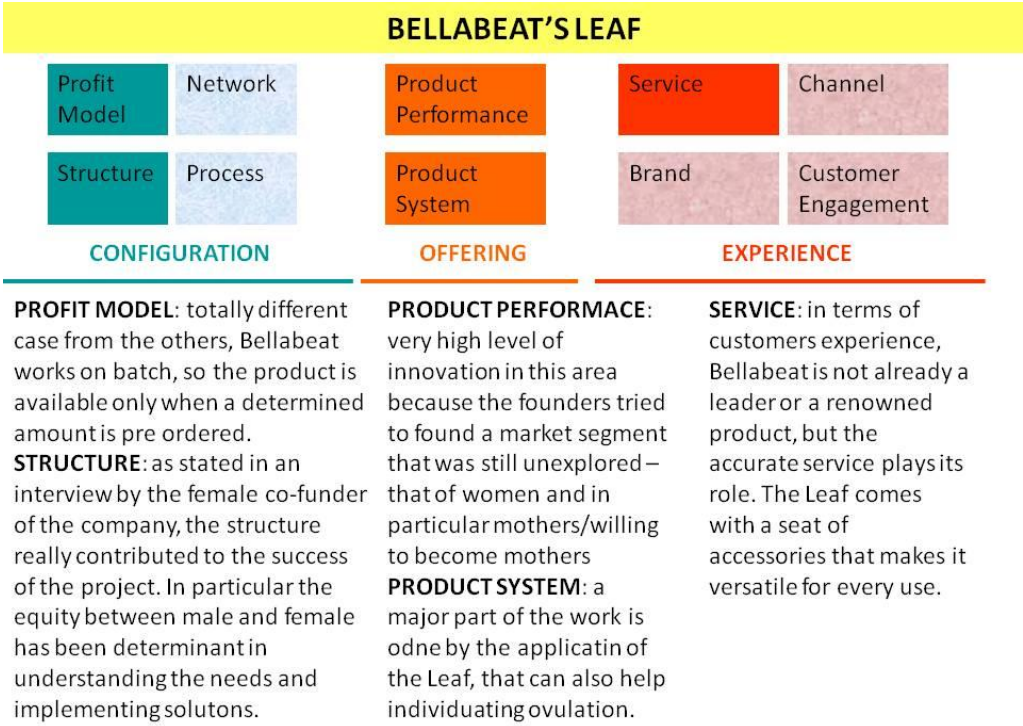
Comparison

In the case of jewelry, Cuff presents many similarities to the case of Kreyos in the smartwatches subchapter. Anyway, since the company is still updating devices and answering some clients' complaints, we can't already say that it is a failure; we only suggest that the starting was not the best of all. We can see now both the cases analyzed through the same chart used before:



Many customers find themselves very disappointed with the company and the not-receiving-product issue, so innovation mix showed in the image here above is less relevant than the other cases because the idea of

innovation could be right, but if the implementation of it is not appropriate the whole value might be lost. Totally different consideration goes for Bellabeat's Leaf case, that is quite explicative of how mixing the right types of innovations could be the right starting for everyone: the founders are a Slovenian girl and a Croatian guy who met casually. It took time, trials and the help of experienced people to get where they are, but when the mix of innovation types is right, chances of success can only get higher.



In order to compare the two cases, we can say that service, in the consumers' experience area, is a key point. We are always more surrounded by products, many of which in some cases are totally useless, so what will weigh more and more in the future is making something that can be useful and that is perceived as easy to use, compatible with different devices and reliable in terms of product quality, guarantee and customer care.

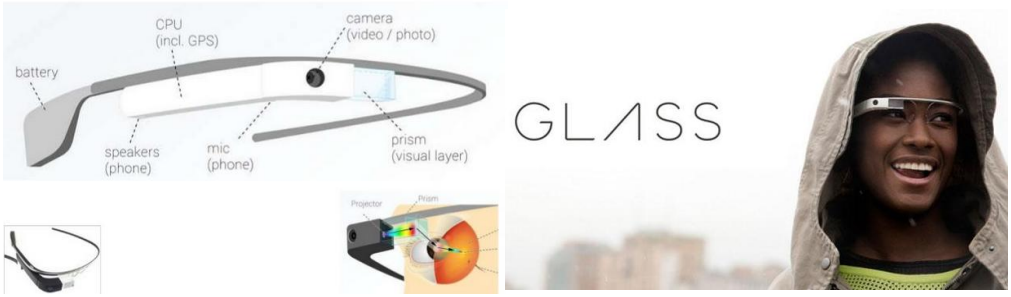
4.5 *Eyeglasses*

At last we speak about the project that made "wearable" an everyday term: Google Glass, and more in general smart eyewear because there are already few competitors in this market. We have already mentioned in the previous chapter, while speaking of wearables in the fashion world, some reasons why this project was not a big success among private customers. More than failure here we can say that Google took a step back and will proceed by trial and error. After two years of rumours, they launched an Explorer version during 2014, firstly reserved for staff members and the American market. After that the product landed in England, where it had already been banned from usage while driving. At the end of 2014 many businesses banned the product, because it could violate the privacy of clients; the 19th January 2015 was the last day to get the Google Glass Explorer edition[41]. By now we can't have sales figures on this product because the company is not releasing a word; we have also to consider that people who bought Google Glass are not, in any case, average consumers, but people who would like to be part of the development process by providing Google feedback on their use experience.

For the moment Google will work on improvements and updates, and for the next launch the company should be careful in order to avoid a rise and fall like this. Considering features, many factors were basically "wrong": design too bulky and cumbersome, high price, privacy issues, a battery that can last up to one day only, lack of a solid data protection and potential health damage – Google itself suggested not to use them intensively for longer period: the consequences on eyesight are still unknown.

[41] "Great expectations: the rise and fall of Google Glass Explorer Edition", Mick J., 16th January 2015, dailytech.com

These issue are fundamental in the purchase process for consumers, but they can be overcome when considering the corporate level, where design is no problem and the glasses are used only for working related issues – so in the majority of case they only look at machineries, making privacy and face recognition an irrelevant problem.



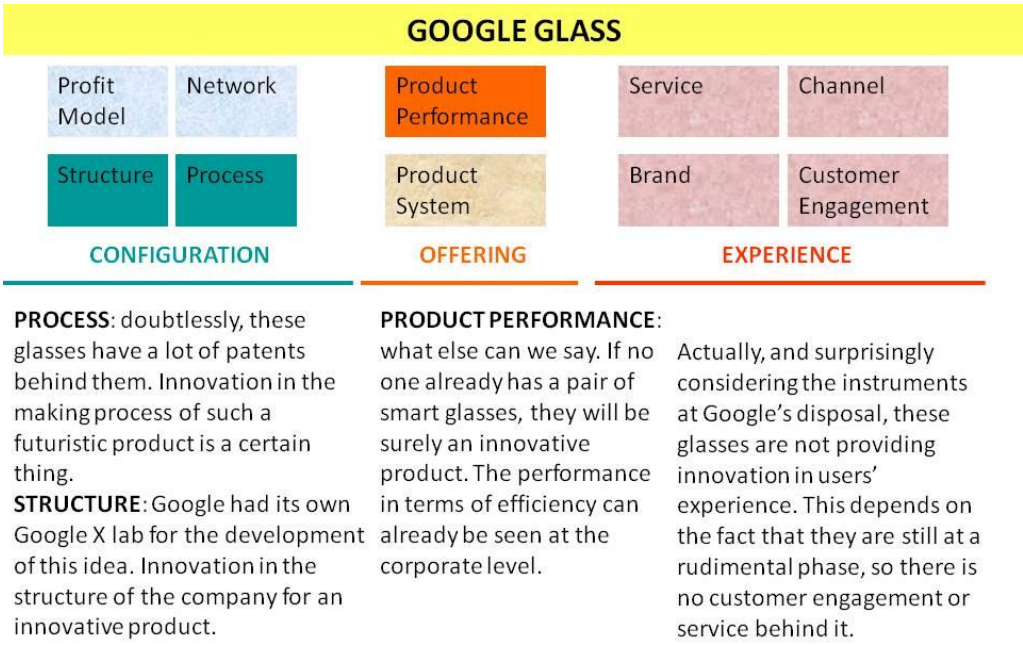
Source: slideshare and google.com

In fact there are many companies that started pilot programs with Google Glass or other brand of Augmented Reality glasses. Companies are trying to integrate the newest technologies in their production processes. Volkswagen gave some employees in its Wolfsburg plant Google Glass to replace barcode scanners: in this way they had free hands and could perform their tasks more efficiently and quickly. Since the trial has had positive outcomes, the company could extend the project to other plants in the end of 2015. Another example comes from Lee Company, an American business that works on building maintenance; a large number of skilled workers are about to go on retirement, making it difficult for new inexperienced ones to know what to do – we have to consider that often the maintenance is performed while climbing on a roof, that makes it quite difficult to read a manual or keep a phone while working. For these reasons, the company decided to try smart glasses, so young workers could show, through a camera on the glasses, what they were doing to skilled one and receive real time feedback and tips. Lee Company found

this solution really beneficial in terms of efficiency, reduction of delays and new workers training: by now they decided to equip 300 out of 800 employees with smart glasses.

These are only few examples of how glasses could be used: there are cases in healthcare and many other fields of production where they can substitute barcode scanners, guide storage processes and, more in general, help with works where having both hands free while already reading info or collecting data could really give a twist to the system.

In this case we didn't find useful making a comparison with other brands that are working on smart glasses due to the initial phase at which this product still is. Actually the only thing we can spot as a mistake for sure is timing, since there were big expectations on a futuristic product that in truth was only at an experimental phase – and this misunderstanding justifies customers' disappointment. Regarding innovation types then, we can look at the chart:



4.6 *Success or failure: key factors*

Conclusions of this chapter summarize some key factors that can determine success for wearable devices, ad also some of the major issues. Here we list some of the most relevant factors that affect the probability of success for wearables:

- **Lack of supporting infrastructure**

As we have seen in the case of Kreyos Meteor Watch, providing its own app sometimes is not enough: people need to have devices that can be easily connected with their phone (whatever their operative system is) but also that can work as standalone product when needed. A great compromise for watch is, for example, being able to gather workout data, display time and work as an alarm clock but also having the possibility to connect with the phone and register every data in order to have a weekly, monthly or annual base to see improvements.
In general we can say that there are three factors regarding infrastructure: there should be strong software support, good integration with other devices and third-party developer support. When carefully integrated and developed, these features are a positive support for the diffusion of innovations such as wearables.

- **Privacy issues**

Linked to the previous point, privacy is a big issue. For glasses it conceived the problem of face recognition, and for this reason many people could be bothered while talking to someone who wears them. For watches the problem of privacy regards more the fact that all those data on consumers' life could be used by companies for marketing and market analysis purposes, without consumers knowing that this is happening. More

generally we can say that being always more connected comes with a cost: little by little, there is a shrinking of privacy for everyone. Being connected means that others may know where you are, what you are doing, with whom. A lot of work is being done by regulators in terms of privacy protection, and also producers are trying to find the appropriate system, but in any case everyone knows: you can't be connected and pretend to be invisible for society. Hackers will always try to find a way to bypass the system and steal data, and for how much software developers try, with the help of national and international legislations, connection has a price and there are always some risks. A great help for the widest diffusion of innovations will be represented by development in the privacy issues area.

- **Design and product quality**

Also this point can regard all the cases presented: when costumers pre ordered Kreyos Meteor they were expecting a device that could display the time, basic function in every watch. Product quality is fundamental to win consumer engagement. Design plays a big part in this too because these devices are supposed to be part of our everyday life, as accessories for our body: while it is not a problem if the phone is a little too big (we have pockets and bags), it could be a problem to carry at our wrist a bulky product. The real difference lies in the term wearable: this is the big reason why no one would ever use Google Glass if they look as a paranormal object. Developers should think at integrating technologies with objects that look like things we already use.

- **Utility**

Last but not least, utility is the maximum concern among average consumers. Why spend so much for objects that often are cumbersome and in the end they also could turn out to be useless? Until wearables will

perform real needed tasks they will not see the so loudly announced boom. On the other hand we need to underline that many scenario are changing: the most explicative of all it's the world of fitness. So for example, since fitness is becoming a lifestyle, activity tracker are performing a real needed task.

Dealing with these problems can positively change the future of wearables and their diffusion; even though real life practicality is essential, there are also smaller features to keep in consideration, like battery duration and price. When wearables will be durable and affordable for average consumers selling could increase dramatically. In the end we can say that many are already trying to improve in these directions, launching products that are always more similar to everyday use objects. Improvements in this field are happening every day.

Conclusions

The purpose and starting point of this thesis was trying to spot the most relevant factors influencing the diffusion of wearable technologies. After having explained the fundamentals of Diffusion of Innovation theory in the second chapter, we have presented wearables in the third one, classifying them as hybrid products, given their characteristics. Considering this last statement, the measure of their diffusion can vary a lot depending on existing product beliefs: jewelry for example is, at the moment, a market hard to penetrate with smart, technological objects due to the specificity of characteristics consumers are already used to demand, as design, beauty, femininity and practicality. We have seen in fact that Cuff is not a truly successful case for now, or at least it is surely not as successful as Fitbit or Pebble ones. This is due to the fact that the hybrid nature of these products affects diffusion patterns, in particular the already known component, in this case the objects we use every day, have some specificities that weights in the final evaluation from customers (reference to the concept of "single category belief"). Another example is represented by clothes: as seen in the third chapter, there are many innovations in this field, but the fashion component is too strong for the solutions proposed until now, because designers still have to find a way to harmonize fashion and technology.

What emerged, in particular in the last chapter, are four key points that have to be handled carefully by companies when entering the wearable technologies market: infrastructure, privacy, design and utility. Since diffusion is influenced by these variables, the diffusion pattern of wearables will likely reach the take-off point (the inflection point in the S-curve) when companies will give costumers smart solutions in order to solve such issues; moreover, there will be different patterns and speeds

depending on the country and the product launched. As we have seen in the last chapter, Fitbit bracelets already have a good diffusion among customers; the company is trying to keep its products' portfolio innovated (few months ago they launched a smartwatch, entering so a new competitive market).

For what concern market saturation, that means the point at which the S-curve is almost flat, we can make few reflections. Regarding the whole wearables market, we can think of the continuity case: many S-curve that succeed one another but without significant interruption in the diffusion. Since the products on which a wearable component can be applied are countless (just think at the Intel project "Make it wearable"[42], everything can be part of this process of integration and connection), when smartwatches will reach their maximum diffusion there will likely be an alternative ready to substitute them. On the other hand, regarding single product category, diffusion will eventually reach saturation, but we have to consider that this wave of wearables is only at the beginning, so we don't really know the magnitude of changes that can be introduced in order to innovate a same product.

Among variables that will influence the diffusion patterns it has to be included consumes attitude. The examples proposed in the last chapter are mostly first editions, for a consumer market that is still uncertain and immature. A recent survey from PwC[43] shows that the majority of people consider them useful tool for everyday usage but not intended as long life products. Just a few numbers: among 1000 interviewed, 20% are wearable devices owners, but 33% used it for less than a year. This well reflects what we already supposed: by now, the market is not fully formed and also products are, because they can't offer a long lasting value.

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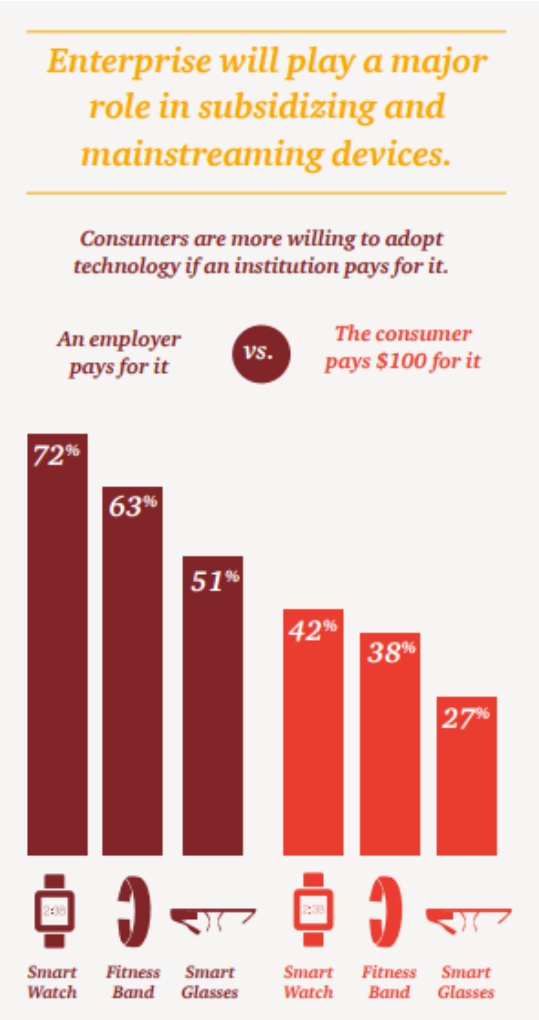
[42] This was a global challenge more than a project, announced at CES 2014, in which innovators, using Intel Edison technology, could propose their project.
[43] "The wearable Future", 2014, pwc.com

On the other hand, near the consumer market, there is also the enterprise one: here wearables are more used, companies are willing to try and improve their productivity and efficiency with technology. Moreover, as seen in the case of armbands for employees' healthy, enterprises can also be part of the adoption processes by consumers when they provide workers some devices. Here there is an image from the above mentioned paper that shows the big difference between buying as a private or receiving as an employee.



Source: "The Wearable Future", PwC

Price, even if one of the biggest factor to consider, is not the only one: many consumers are not willing to use their money on wearables because they don't know features, ways of use and utility – and this reconnect to the concept of immature market.

Another consideration on wearables concerns the age of users, that is certainly an obstacle to the diffusion by now. While nowadays there are grandmothers/fathers that are not familiar with internet, smart objects and technology in general, in few decades children will learn to live with technology from 6/8 years old and their grandparents will be equipped and informed on everything as well. Age and a not so wide diffusion are two barriers that can be overcome during the years: as already said, we can just think at the Internet and how much it is part of our lives, while in the 90s all the expectations and forecasts were considered only as an hype moment on something fancy and unrealistic.

In conclusion we have seen the possible pattern of diffusion for wearable technologies, considering factors that will sustain or hinder this process. Now it's up to companies improving their offerings in order to make these products appealing for customers.

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