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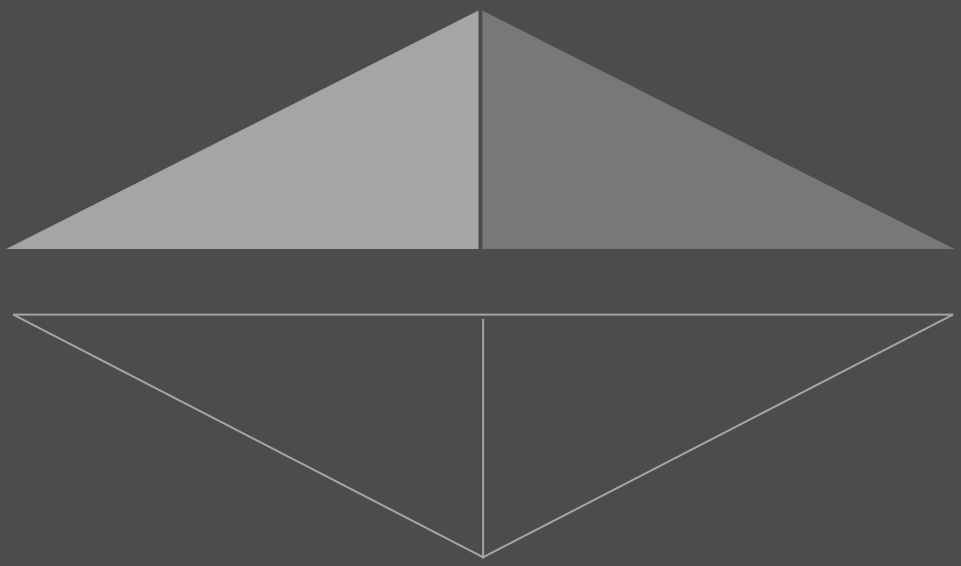

PSSD Approach for unveiling the "hidden" potential of technoglical changes

Interpret and connect new technological ecosystems
to propose new meaningful product-service systems

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Master Thesis
A.Y. 2016/2017

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I hope that my project will help PSSD practitioners
to project as a people for people,
giving a meaning to technology
instead to follow technology as a meaning itself

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ENGLISH ABSTRACT

Nowadays people do not buy technological products just for their performance and features, but for the meaning in which they are embedded. Recent literature about the relation between technological and meaning innovation, suggests to apply the design-driven innovation strategy to exploit the hidden opportunities behind new technologies. The product language innovations is considered as one of the main drivers to communicate the so called "technological epiphany".

Until now this interplay it has been mostly studied with a Product Centric perspective. There is not a single study about how other design approaches could be used to obtain a "technological epiphany" innovation. Considering the lack of literature, in my thesis I wanted to explore the relation between technological innovation and Product-Service System Design Approach, with a focus on the fast paced technological industries. For doing so, I found interesting to observe the consequences of the digital transformation of the single-lens camera market. This case study was analysed both from an industry and a company level.

From the industry perspective emerged that the new digital cameras overlapped to the already existing compact-camera models market, without relevant product language innovations. With the introduction of the action camera typology the strategic direction of the industry changed. This product is the result of a technological architectural innovation that brought a new market characterized by radical new languages, unlike the existing digital compact cameras. However looking at the action camera market leader, GoPro, results that it did not base its competition on a product language innovation strategy. To understand how this company differs I decided to analyse the entire Product-Service System of the most relevant action camera brands.

The results show that GoPro differentiation and success could be related to its ability to leverage the technological innovation through complementary products and service accessories. Besides, its Product-Service System is enabled through a complex and coherent ecosystem reliant on external systems. I have then elaborated a strategic meta-design tool to face technological innovation. I mapped the existing design strategies and proposed two new ones, that could be applied on incremental technological innovation. The first proposes guidelines on how to make a topological innovation, leveraging on product languages and complementary products diversification. The second on how to make a "technological epiphany" without product language innovation, but leveraging on the new technological ecosystem that radically innovates the Product-Service System.

ABSTRACT ITALIANO

Oggigiorno l'acquisto di prodotti tecnologici è guidato, non solo dalle particolari specifiche e prestazioni che li caratterizzano, ma anche da una forte attenzione ai significati che negli stessi si riconoscono. Il linguaggio di prodotto è considerato uno dei fattori chiave per la comunicazione di suddetti significati. Studi recenti, riguardanti l'interazione tra innovazione tecnologica e di significato, suggeriscono che, applicando l'innovazione "design-driven" su nuove tecnologie, venga favorita l'individuazione di opportunità "nascoste" in grado di generare "epifanie tecnologiche".

Sino ad ora, tale interazione reciproca è stata prevalentemente studiata attraverso una prospettiva Prodotto Centrica. Non vi sono infatti, studi nei quali viene analizzato un approccio di design alternativo per ottenere un'"epifania tecnologica".
In considerazione dell'assenza di letteratura al riguardo, nella mia tesi ho voluto esplorare la relazione tra l'innovazione tecnologica e l'approccio "Product Service System Design", con particolare focus sulle industrie ad elevato ritmo di innovazione tecnologica. Ho ritenuto interessante osservare le conseguenze dell'evoluzione digitale avvenute nel mercato delle fotocamere con lente non intercambiabile. Ho scelto di analizzare il caso studio sia secondo una prospettiva generale di mercato, che di azienda.

Per quanto riguarda il primo livello di analisi è emerso che le nuove fotocamere digitali hanno sostituito le già esistenti categorie di prodotto, note come fotocamere compatte, senza alcun cambiamento rilevante di linguaggio del prodotto. Ciò nonostante, con l'introduzione dell'action camera, la direzione strategica dell'industria è cambiata. Questo prodotto, risultato di un'innovazione tecnologica architetturale, ha generato un nuovo mercato, caratterizzato da nuovi linguaggi radicali.
Tuttavia, il leader di mercato del settore "GoPro" non ha basato la sua strategia competitiva sull'innovazione del linguaggio prodotto. Per riuscire ad identificare quali siano stati i fattori critici di successo che le hanno permesso di differenziarsi, ho portato avanti un'analisi del sistema prodotto-servizio (PSS) dei brand action camera più rilevanti.

I risultati rivelano che la differenziazione di "GoPro" è attribuibile all'abilità di far leva sull'innovazione tecnologica attraverso lo sviluppo di prodotti complementari e di servizi accessori. Inoltre, il suo PSS è abilitato grazie ad un ecosistema tecnologico dipendente da sistemi esterni. Sulla base di tali evidenze ho elaborato uno strumento strategico di meta-design, utile per affrontare le innovazioni tecnologiche. Per far ciò ho inizialmente mappato le strategie di design già esistenti e ne ho proposte due nuove, applicabili in caso di innovazione tecnologica incrementale. Nella prima propongo come sviluppare un'innovazione topologica, facendo leva sul linguaggio di prodotto e la differenziazione dei prodotti complementari. Nella seconda spiego come realizzare un'"epifania tecnologica", senza innovare il linguaggio di prodotto, ma facendo leva sull' ecosistema tecnologico per innovare radicalmente il PSS.

INTRODUCTION

We are living in a period in which many companies base their competition on their ability to continuously deliver technological innovations. Scholars agree on considered these innovations as a primary means for value creation. Furthermore, in this dynamic and crowded context firms need to create also new values to disrupt the market competitive status quo and differentiate themselves from competitors.The delivery of new radical technological innovation is not always enough. In recent studies Verganti (2007) explained how companies could get a higher competitive value discovering radical new meanings embedded in new technologies to develop new disruptive products (or a services or a product-services) defined as "technology epiphanies".
To relevance of new radical meaning proposals is typically related to the sector recognized as design-intensive industry. However in this industry technology was for long considered as exogenous variable or even an invariant on the creative process if the industry was particularly stable. However nowadays technological innovation became the norms also in this sectors. Companies have started to recognized it as an important input for new meanings proposals. On the other side, in industries recognized as fast-paced technology the success was typically related to the functionalities and performances improvements. Here the design have been relegated to a minor role related to aesthetic issue. Nowadays in these industries the strategic role is changed and it is applied to discover and propose new meaningful products and services inside the market. There are no more clear boundaries between these industry sectors. These changements opened an interesting contamination between their different methods and the strategic approaches.
Design discipline it is often related to the evolution of socio-cultural models and is interesting observe how traditionally design-intensive industries, as fashion and furniture, are directly related with people every day life. Since technologies is more and more present in our everyday routine, design is going to have a central role in translate the "inner soul" of theologies in meaningful products that are going to really improve and change people life.
However many fast-paced industries, competing in this technological run, are still follow the technology innovation without questioning what technology will mean for people. I think that the role of designers could be fundamental also in these industries to make technologies more meaningful without consider technology innovation as meaning themselfs.
For that reason I think it is important to better understand the complex technological dynamics to find the right strategic design opportunities behind them. I decided to start my literature research with the following questions:

"What design approach better fit with technological innovations?"

"How the Product-Service System approach could be better applied to getting value from technological innovations?"

1 THE INTERPLAY BETWEEN TECHNOLOGICAL INNOVATION AND PRODUCT-DESIGN INNOVATION

1.1 TECHNOLOGY CHANGES: CONTINUE AND DISCONTINUE TECHNOLOGICAL INNOVTIONS

CONTINUE AND DISCONTINUE TECHNOLOGICAL INNOVATIONS

We are living in a period characterized by continuous technology shifts in witch innovation is considered as a primary means for firms' value creation. In a such dynamic and crowed context the role of product innovation has a crucial role in terms of adaptation to the market changes and technological conditions (Eisenhardt & Tabrizi 1995). Generate new value through product or service is crucial to disrupt the market competitive status quo and differentiate themselves form competitors and consequently understand "why" people buy things is became crucial for firm strategies.
The "why" people buy products can be found behind their meanings and design plays a crucial role in the generation and development of product meaning. It is clear that companies that deal with innovations have to be strategically able to use design and they need to understand the profound link between meanings, innovation and design itself (Verganti, 2009). This is the reason why firms are increasing their design investment and are involving design firms in their innovation process (Nussbaum, 2004).
First of all I think that before analyse the winning linkage between the already cited three factors it is important define, starting from literature, what technological innovation it is.

In this first part of the chapter I will analyse what the technoglical innovations dynamics. This is going to be important to better understand later witch design strategy fits better with each technoglical lifecycle phase.
This first part of this chapter is structured in this way: explanation of how it is possible define a discontinue or continue technoglical innovation, understand the difference between them, discover witch strategies are nowadays use in case of radical innovation.

Product innovation is strictly related with firms' market share (Chaney and Devinney 1992) and survival (Tripsas 1997b) and it is composed by different factors as market conditions, socio-cultural regime and technology conditions (Eisenhardt and Tabrizi 1995). We will enter in deeper in the analysis of this last factor recognized from academics, practitioners and governments as one of the most important source of potential innovation. Already in 1989 Abetti talked about technology as "a body of knowledge, tools and techniques, derived from both science and practical experience, which is used in the development, design, production and application of products, processes,

systems and services". This definition it will be useful to understand how this kind of innovations can be turn its potential in tangible product or services thanks to the generation of the right design meaning. In terms of innovation the technology discontinuities are considered particularly important (Verganti, 2009) for this reason in this first part of chapter I will explain how it is possible categorize and recognize different types of technoglical innovation according their discontinuity with the past.

The first kind of technology innovation that I will describe take in account the level of impact that the technology introduction changes have on the performance of product and processes. We are talking about radical innovation in the case of deep changes in the technoglical trajectory that destroy the previous one. This type of innovation transform the structure of the related industry going beyond the existing rate of progress (Gatignon et al. 2002). On the other hand, if the technology innovation brings to an improvement on performance exploiting the existing technology, keeping in the same evolution trajectory, we are taking about incremental innovation.

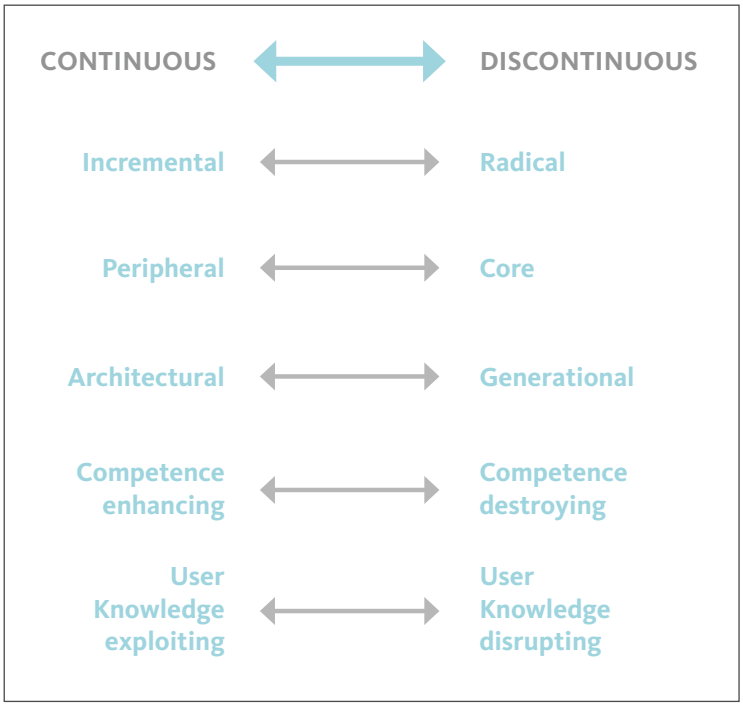
The second level of technology criteria evaluation is based on the locus of the innovation. To understand that we should considered technology as structure composed by a hierarchy of subsystems. If the technoglical innovation affect as a cascade effect the entire technoglical system it means that it involves the core technology that is interconnected with the other subsystems. If the technology shift regard only a limited part of the system it means that it involves only peripheral technologies.

If the innovation involves the linkage of these subsystems it is called architectural and if the changes involved the subsystem itself, without changing existing linkage, it is called generational innovation.

The next changes that technoglical innovation can bring are related to the competence that a company needs to develop. If the innovation required to manage a totally new set of competences relinquishing the pre-existing once we are taking about competence destroying innovations. Its consequences are the twisting of existing industries structures and the change of power distribution among incumbents. If the technoglical innovation is based on the improvements of previous competence possessed by incumbents we are talking about competence enhancing innovations.

Looking at prospective of users, the technology innovation can affect also their related knowledge. When new technologies reinforce linkage with existing customers we are talking about user knowledge exploiting. In this case, the know-how of users need just little adjustments to fully exploit advantages of new products. On the other hand, If the technoglical innovation is stronger it makes obsolete user knowledge and they need to be engaged in new process of learning. When technoglical disrupt or substitute these linkages with to fully exploit the benefits from the new technolgy we are talking about user knowledge disrupting technologies (Abernathy & Clark, 1985).

To organize them I will use a categorization (image n.24) developed by Cabirio and Simoni (2013) that group these different criteria that are not strictly correlated to each other's, but that can be positioned in two main broad categories that define their level of innovation:



graph. 1 Continuous versus discontinuos technological Innovations

1) **Contiguous innovation tech. introduction** that "will mainly occur in case on incremental innovations, they will occur at the level of peripheral innovation, they will be architectural in that they do not alter the knowledge of the technology and they will essentially be competence-enabling and reinforce existing know-how" (Cabirio & Simoni, 2013).

2) **Discontinuous innovation tech. introduction** that "will mainly occur in case of radical innovation, they will occur at the level of core innovation, they will be generational in that they alter the knowledge of the technoglical and they will essentially be competence destroying and destroy or substitute the existing know-how" " (Cabirio & Simoni, 2013).

This two levels of technoglical innovation are related in a consequential way and they cause different consequences inside the industry. The impact of a discontinue technoglical change can open a ferment era of new functions and performance with strong modification within an industry. In this phase, the competitors try both to solve technological problems and to find the most effective product architecture. When this innovation speed decrease, the innovation became incremental and industry waits for the next technoglical discontinuity that can bring radical new technology. Of course, many of the innovation fall between these two extremes (Henderson and Clark 1990).

Innovation Strategies used for Getting Value from Technological Innovations

In technology managerial field technoglical discontinuities are considered crucial because their embodied innovative potential is widely recognized as source for competitively. Many strategy were developed and deeply studied to getting value from these discontinuities:

a) **Performance leadership**: firms aim to be unique in their industry, trying to make their product the best in market. They have find a valuable dimension for costumers and they work on it to always finding the most update theology in term of performance to lead the market on that dimension

b) **Cost leadership**: the technoglical discontinuity in this case is used to lead the company to produce the lower cost in its industry but still keeping a level of performance comparable with the competitors' products.

c) **First-mover strategy**: many scholars have talked about first mover advantages at it is considered a valuable way to beat competitors. The companies that adopt this strategy have the possibility to create a trust relationship with costumer when there are no still competitors. In that way, they can than develop a strong brand loyalty generating a reputation advantage. It is also possible that costumer that invest time and money on firm's product do not want to change it. Finally they can also lead to paten making difficult for other competitors entering in the new market (Bright, 1949; Bresnahan, 1985).

d) **Complementary assets management**: when a radical innovation arises, it is important for firms to be able to understand also the impotence of the change of the environments in which product will be use. Indeed it is suggested by scholars that the firm success depends on the complementary assets controlled by the firm as: complementary components, distribution channels, production, service (considered as distribution, market places and storage) and complementary technology.

e) **Influence on regulations and standards**: lows and regulation can be a competitive advantage for companies if they are able to use features that lawmaker or regulator control, influencing the standard setting process.
For example groups of companies that have a special interest in a technoglical development can create industries lobbies able to influence policy markets and government choices (Grossman & Helpman, 1992; Damania & Frederickson, 2000).

As we said before all these strategies are well affirmed and studied and they can generate profit from technology discontinuities, and a company can decide to apply one or more together. Anyhow more recently Buganza, Dell'Era, Pellizzoni, Trabucchi and Verganti (2015) prove that there is another strategy that can be apply in case of radical innovation to generate a competitive advantage: the design-driven innovation.

1.2 THE DESIGN-DRIVEN INNOVATION AS A STRATEGY TO DEFINE NEW MEANINGS AND APPLICATIONS FOR NEW TECHNOLOGIES

Design-driven Innovation introduction

In this paragraph I will explain the relation between technology innovation and design innovation. I will start with a short recap about how design is manly considered nowadays by managers, I will explain accordingly to recent studies the strategic potential of design meaning related to technology and finally I will describe different ways to use product meanings with a focus on design-driven innovation and the ability to discover unveiling potential for technologies.

The most consolidated paradigms about innovation it is related to "technology-push" or "marketing-pull" strategies, where traditionally technology innovation is considered an advancement of product performance and functionalities (Abernathy, 1978; Abernathy and Utterback, 1978; Abernathy and Clark, 1985; Christensen, 1997; Freeman, 1982; Nelson and Winter, 1982; Nelson, 1994). However in management discipline as organization and marketing the study of the strategic application of design it is studied (e.g. how brand value may be created by understanding the evolution of cultural models in society), few investigation was made from technology management field and they concern design as product development and concept generation. As a result most business people continue to associate product design with beauty and is not a case if in R&D department design have a minor role, especially in technology-intensive companies (Verganti, 2009).
But the linkage between technology and design is something deeper and as Eisenman (2012) said technology cannot exist without its physical embodiment. Rindova and Petkova (2007) starting from the definition of Griffith (1999), that state that innovation is not something that can be referred to technologies generally but it is a "constellation of features", affirm that product form design it is the way in witch these features are organized as product with their own appearance. They have also stated (2007) that differently of what most model states the costumer evaluation of product is not based on attribute-by-attribute comparison, but is based on cognitive and emotional response suggested by product configuration involving a design choice related to functionality, symbols and the aesthetic dimensions. These scholars stated that design have a key role to manging the apparently novelty of a product because product innovation based on novel technology emerge only when majority of costumers recognize the potential value of the innovation. Following these statements design can be considered strategically important in case of radical innovation to adjust the related product system

value.
Scholar as Verganti (2009) and Cautela, et. All (2014) go also further saying that strategic role of design arise especially in technology intensive industries in witch new technologies arise with an unveiling potential that can be tapped thanks to the creation of total new meaning manging to the interplaying between technology-push and design-driven innovation. The same Verganti said: "Begin the first to launch a new technology is less important than being first to envision its greatest untapped market potential" making clear that propose a product design with the right meaning is more relevant than the technology itself. In this way design innovation can differentiate the market offering according to emerging social and cultural trends and also coping with demographic, social, cultural and economic changes (Berkowitz, 1987). Doing that it is possible make total new proposal to costumers. I want to remember that when I am talking about design I referred to a process that coordinates all factors of consumption (functional, symbolic and cultural factors), productionn and distribution.
Some companies had understood this strategic design potential and in these firms industrial designers contribute to visualize and understand mechanisms of new technologies; are involve in the product, costumer and marketplace planning. It is the case, for example, of Sony where the Design Center has acquired a high level of credibility and top level support (Uzmeri, 1995).

According to that, technology with its functionality and performance is not valuable itself, but it can be considered a potential opportunity that open a new space for the proposal of new product language and meanings. They prove its validity analysing the success of different case studies that act on a market structure that could not be linked to none of the standard discussed strategies. There are companies that take advantage to their ability to exploit the full value of the new technology, discovering their uncovered new meanings. This strategy give to design a new central role for its ability to understand and generate new mining from discontinuous technology innovation and not just as an act of differentiation in mature industries (Abernathy & Utterback, 1978; Foster, 1986; Tushman & Anderson, 1990, 2004; Utterback, 1994; Christensen & Rosenbloom, 1995; Christensen, 1997). Usually design importance was considered by manager especially in incremental phase for the generating of new second order meanings to extend the potential functionalities of a technology, while during new technology introduction firms were more concentrate on find the most effective product architecture and solve technical problems (Abernathy & Utterback, 1978; Foster, 1986; Tushman & Anderson, 1990, 2004; Utterback, 1994; Christensen & Rosenbloom, 1995; Christensen, 1997). In this phase, the strategic use of design attributes was to explain to users what a new technology can do and how it can be used (Eisenman, 2012). Indeed, if a user is not able to understand the new technology it can be a problem (Rindova & Petkova, 2007) because it can disorient costumers generating negative feelings as frustration (Mick and Fournier 1998), on the other hand if the incongruity is resolved costumer recognized the potential of new technoglical and they prove positive sensation that can easily move them to buying the product (Rindova & Petko-

va, 2007) . This is one of the main reason why incremental innovation of meanings occur more often than breakthrough and companies just update and adapt language of product according to the dominant meaning in the market (Verganti, 2009). However, as we said before there are also companies that tried to propose totally new meanings to companies applying design-driven strategy and generating technoglical epiphanies. Proving the value and repeatability of this strategy means move the importance of design, as a meaning creator, from the incremental innovation stage to the moment of radical innovation arise.

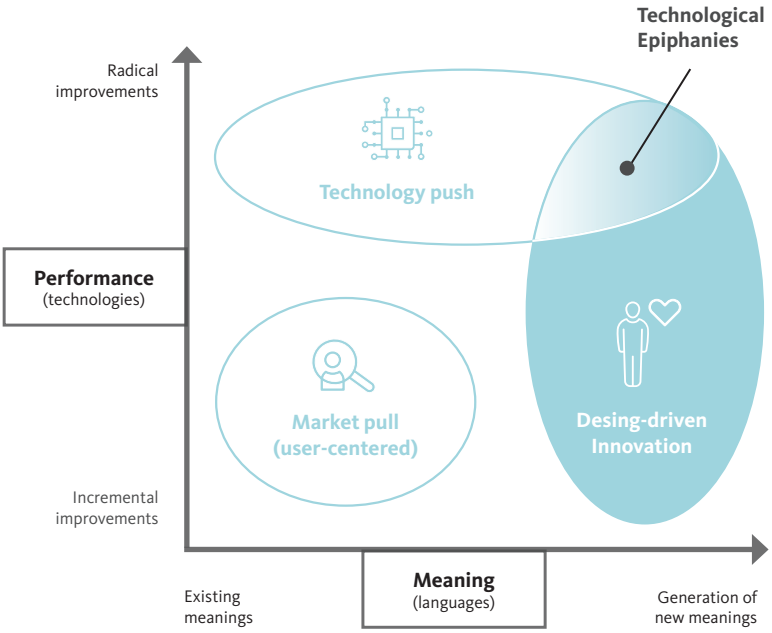
To understand how to use technoglical epiphanies as a repeatable strategy it is important be aware of social meaning changes and known that they work in a similar way of technology change evolution, with cycle of incremental and radical transitions (Verganti, 2009). To master that strategy of meaning proposition it is important look at design-intensive industries methods where design-driven innovation has been for long time one of the main competitive tool. That theory indeed put together technology base innovation and design-driven innovation, two strategies that for long have been considered not related because considered to pertain to different industry sectors.
Verganti (2008) studied how Italian manufactures were able to recognize, explore and propose future meanings from sociocultural trends influencing customer behaviour and preferences. Traditionally in this design-intensive sector technoglical innovation were considered as something rare and the proposition of new meaning through new language proposition it was the best way to generate new value for products. Their innovative process like directly involve costumers and as Dougherty (1992, 2001) observes there are different cycles of learning the involves both costumers and producers. During the introduction phase of a novel product users are not immediately able to articulate their needs and they often change more they learn how to use the product. A new market can be considered emerged only after producers and costumer share the same knowledge structure (Rosa et al., 1999). For that reason for these firms the market is not given a priori as in the structural prospective (Porter, 1980) but using design-driven innovation they create a dialog aiming to a strong modification of it (Verganti, 2009). The cited firms were masters in evaluate sociocultural model that they translate in vision and proposal of radical new meanings, indeed their R&D had also the role to detect and influence socio-cultural model that are shaped by society. This detection was possible thanks their immersion and management of a distributed network of different actors and interpreters from different fields. Let's take the example of Alessi Family Follow Fiction (image n.25). Looking at cognitive and changing sociocultural context, company understand a new meaning for products (Verganti, 2009). They were inspired by various interpreters from different fields as psychologist and paediatrician. They understood that children have in daily life some object that help them to became more autonomies, they are called transitional objects. Children associate feelings and meaning to these objects and adults continue to have in this kind of transitional objects in different forms. They do not look at users, but at people. They proposed a total new meaning for household products, making them playful and giving them anthropomorphic forms. It

was a success for it emotional impact and compatibility between products (Verganti, 2009). They do not make radical technoglical innovation, but a radical innovation of meaning being broking different languages. Thanks to their research made with a larger network of interpreters they decide to use typical childhood languages on adult objects. It was a success because they understood that adults still have transitional objects, and then they propose playful households.

graph.2 Family Follow Fiction: a case of design-driven innovation

Design-driven Innovation and Technological Innovations to obtain "Technological Epiphanies"

The language innovation dynamics can be mirrored to the ones of technology innovation. Thus, meaning innovation process can be explained as a parallel of the technoglical innovation: as technoglical performance can be generate both incremental or radical improvements, the semantic dimension of product can change in bot in radical or incremental way (Verganti, 2008). The same Vergnati (2008) states that an innovation may concern the innovation of theology and its functionalities , the innovation meanings, or both. It is possible mapped both strategies in the same Cartesian diagram (Verganti, 2008) to easily understand the differences between them and also the seen how an interaction between these two strategies can generate technoglical epiphanies (image n.26).
In the case of incremental innovation of meanings, the companies use



graph.3 The interplay between technology-pudh and design-driven innovation

languages that are in line with the current sociocultural models (Verganti, 2008). These strategies can be place in the left corner of the diagram and they correspond to market-pull innovations and user-canter innovations. User-centre innovations can be considered a more advanced approach in terms of language proposition, because it allows to better understand why and how people give meaning to products. Instead that approach can lead to more innovative concept in comparison to market-pull approach it still operates taking in consideration existing sociocultural regimes (Verganti, 2008). On the right side of the diagram we can place design-driven innovation that propose radical new meaning that implies a change in sociocultural models. The innovation of meaning is radical and a new product language is proposed and the costumers need to reinterpret the meanings of the new message proposed (Verganti, 2008). This strategy depend on the ability of firms to innovate starting from the comprehension of subtle and unspoken dynamics in sociocultural models that redefining costumer value (Verganti, 2008 &2016). On the up part of diagram we can place technology push innovations that are the result of technology research and advancements. If we considered the left corner, we are talking about radical innovation they still address problems and needs recognized on marketplace (Verganti, 2016). Instead the overlapping of technoglical push innovation with design-driven innovation generate breakthrough technological changes, the up-right corner. Verganti (2008) state that radical shift in technoglical paradigms are often associated to radical innovation in product meaning as well as shift in socio-cultural regimes. On the other hand it is also true that radical innovation

of meanings are possible after the availability of a new discontinue technoglical that works as an input for new meaning generation.
It is important underline that all these models of innovation if are taken singularly are not unware of other, indeed a technology pull innovation to be successful need to understand market dynamics, as well design-driven innovations needs to analyse users and explore the new technologies; the strongest different it is the starting point (Verganti, 2008). Mastering these strategies and combining the ability to generate new radical meaning with new technoglical radical innovation it can be the key of success for many companies in the fast-paced technology sectors, as well in design-driven sector in witch the pace of technological change is also dramatically increasingly and technoglical radical innovation can be the base to generate inputs for new meaning creation.
Companies as Alessi, Artemide, Bang & Oulfsen, Apple and Sony are the prove that belonging to different industry sectors design can be applied not only on the development process, but it can be used as a strategic factor for the creation of new consumption patterns, that emergence of new customer segments, the opening of new market niches and the reconfiguration of the competitive driving forces (Capaldo, 2007; Ravasi and Lojacono, 2005; Verganti 2009). The role of design seems to be a key role as until the market is continuing to become a "conversation" among companies, stakeholders and users (Levine et al. 2009). I want also to remember that meanings and product values are in continue evolution thanks to the necessary and continue dialog between costumer, product and producers.
I want to enter in deeper on the explanation of this last strategy that from mine point of view is the one that better had understood the complexity of design and exploit its role of meaning creation.
I also strongly believe that design have a central role in the evolution of socio-cultural models and since technology is more and more present in our everyday routine, design is going to have a central role in translate the "inner soul" of theologies in meaningful products that are going to really improve and change people life. The design-driven innovation proposals do not just add more layers to what already exist, as in a frenetic run where it seems that companies are blind in following technology innovation, but they questioning what technology will be for people, making technology a means of meaning and not a manning itself.
As Buganza, Dell'Era, Pellizizoni, Trbucchi & Vergnati (2015) said posting the claims of Giampaolo Porni (2007): 'Technologies offer opportunities which are of course not infinite, but are greater in number than those imagined by early developers'. In case of technology discontinuity this strategy it gain more value for its ability to exploit technology potential with the creation of different needs in comparison to previous generations (Buganza, Dell'Era, Pellizzoni, Trabucchi & Verganti, 2015).
Its efficiency is proved by the success of many technology companies as Philips, Swatch, Nintendo and Apple that were able to untapped the market potential for many technologies. These companies have win where other companies have lost: "understanding the importance of why and not what people buy". This awareness make them able to propose new reason why people could buy thing creating new completive position and product ca-

tegories. The radical innovation of meanings cannot be done with innovation tools as analytical screening models, and codified processes usually recommended by experts in technology industries (Verganti, 2009). They work well when innovation is purely technical but cause to their cultural neutrality they fail in the propose of meaning innovation (Verganti, 2009). To do so these technology firms used design languages in a similar way to design intensive industries does.
I will explain better how design driven innovation applied to technology can produce the breakthrough innovations called "technology epiphany".
To realized this kind of innovation two kind of radical innovations are needed both:

1) **Radical Innovation of meaning** that solicit profound changes of sociocultural regimes (Cautela, Simoni & Zurlo, 2014)

2) **Radical technological innovation** that solicit profound changes in theological regimes (Cautela, Simoni & Zurlo, 2014)

Of course understand the hidden potential of a new technology is not easy, and it is often found some time after the technoglical shift. Also the ways to exploit that potential are many and there are two main firm's behaviours that explain how to merge these two strategies to generate the technoglical epiphanies (Verganti, 2009):

a) **A company can understand that a radical new meaning can emerge on the market and then they open they research to the right technology to use to display that meaning**. Often that companies used theologies that competitors have screened off (as in the already discussed example of Nintendo that used MEME for the generation of the Wii). In the graph this dynamic is represented by the diagonal arrow (image n.33).

b) **A company have already a new radical technology and it want to try to find a new, more powerful meaning that can exploit all its hidden potential** (as we will show later with the Swatch example). In the graph this is represented by the horizontal arrow (image n.33).

The relevance of radical innovation of meanings difference relevance in the competitive dynamics of different industries. In design-intensive industries the product languages are considered more relevant for competitive dynamics in comparison to product functionalists to drive user preferences. In these sectors meaning of products change very fast and the radical change of innovation are rare. I will mention Verganti (2008) to explain how meaning evolution works in furniture industry: "[The] innovation of meanings is incremental when a product adopts a design language and delivers a message that is in line with the current evolution of sociocultural models. Users would probably perceive this product as "'fashionable" and maybe stylish as it conforms to existing definitions of beauty (i.e., with a style that relies on accepted languages). However, innovation of meanings may also be radical, which happens when a product has a language and delivers a message that implies a significant reinterpretation of meanings." The design-driven

innovation process in some ways mirror with the one of radical technology innovation and this is particularly important because design-driven innovation have been subjects of studies just recently but it can rely on decades of research on technology management (Cautela, Simoni & Zurlo, 2014).
On the other hand, in business to business industries for example the product languages are considered as marginal factor to influence costumer choices. In these sectors the pace of product design language is slow and products keep the same language configuration for longs periods of time. In this sector technologies are embodied in few languages that soon became taken for granted and is not even considered the idea to find new possible languages (Cautela, Simoni, 2013). However t nowadays this trend is changing and the importance of product language is increasing also in sectors in which was inexistent few years ago. Fast-paced technology industries are proposing new product language and meanings related to the evolution of social cultural models in similar way furniture industries doing. When these companies' success in the creation and affirmation of a new radical meaning during radical technology shift an epiphany is done (image n.23). This process that usually is conserved the result of a "rare eureka moment", according to Verganti (2011), can be systematically produced by either suppliers of new technologies and from companies that incorporate them.
Buganza, Dell'Era, Pellizzoni, Trabucchi & Verganti (2015) tried to identified the process that companies can use to make a epiphany strategy happened (image n.39):

a) Step 1: Unveiling Opportunities Hidden in the Technology
Technologies have many hidden potential that are not easy to understand. But when companies are able to exploit them they will be perceived as "celery written" in technology itself.
This process is not easy and often firms needs time before to see that opportunities and this is the main reason why usually technoglical epiphanies do not come at the beginning of the ferment era.

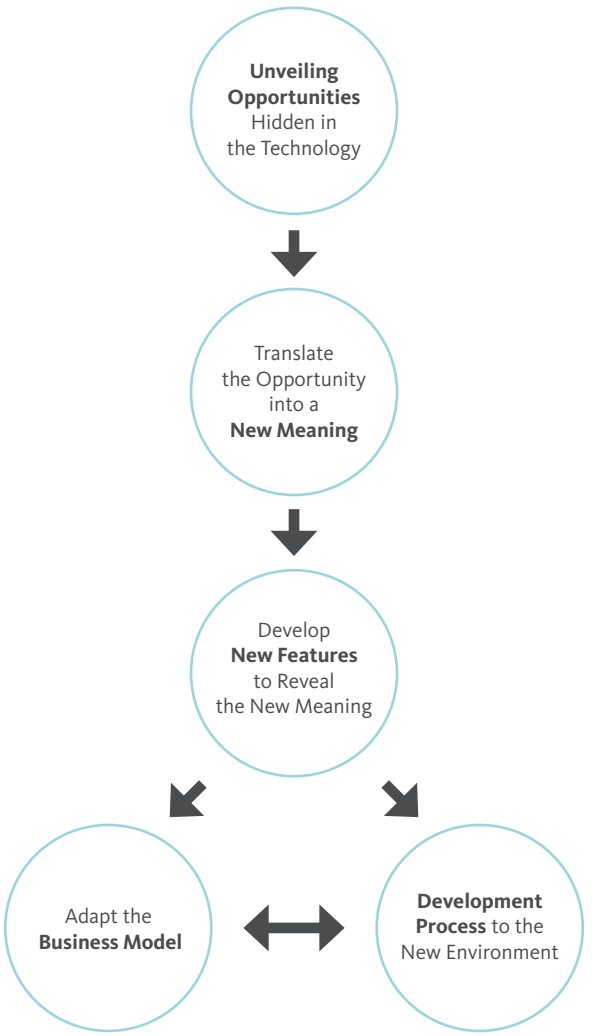
b) Step 2: Translate the Opportunity into a New Meaning
It is important give to that opportunity in a new direction, using criticism to redefine new problems and value (Verganti, 2016). The second step help to find the right meaning to recognize the right idea that can make the difference. The new proposal has to be elaborated starting from the "why" dimension instead of the "how". Having a great knowledge of the market situation and of the related meanings is important to opened a new one that it will be substantially different. The scholars states that new strategic direction sometimes can have the shape of a company mission.

c) Step 3: Develop New Features to Reveal the New Meaning
The step three is fundamental to translate the potential of the new meaning in a real advantage to generate the technoglical epiphany. The meaning have to be revealed by a set of features that have to be clearly connected with the new meaning. These feature help people to perceived and at same time "use" and "touch" the new meaning making it tangible.

d) **Step 4-5: Adapt the Business Model & Development Process to the New Environment**

These two last steps are considered necessary but not sufficient to implement the technology epiphanies. In the case of technology discontinuity, continuing to use the previous development process and the same business model hardly continue to be efficient.

Looking at Nintendo Wii example it is easy understand that game developing required a different process. Looking at Swatch example it is clear understand the Swiss watch market could not remain competitive just counting on quartz watches technology as its competitors.



graph.4 Five-Step Process to Implement Technology Epiphany Strategies

1.3 THE STRATEGIC ROLE OF PRODUCT LANGUAGE DURING TECHNOLOGICAL INNOVATIONS

Product language and meaning communication

Technology innovation manager should take in consideration not only the technology innovation, but they also need to learn how to master the right design strategies to propose the new technology meaning. The strategic decision has to be taken considering the different competitive context logics and the different level of technological shift. It is also important remember that the success of a particular trajectory given to a product depends also to the firm ability to affirm that new product meaning (I will not treat this arguments in this thesis).

Usually companies look at meanings as a part of marketing and communication, and they try to understand the meaning already given to product by users, without understand that the meaning of such product was before suggested by another competitor (Verganti, 2009). However recent studies have explained how meaning generation can really make a difference in unveiling the potential of innovation. This imply that meaning generation have to be considered a process regarding R&D as well as technologies (Verganti, 2009). Design is the process behind the discovering and the definition of new products meanings thus being able to correctly integrate it inside the firm innovation processes can really help companies in understanding how meanings of product changes and how innovate them (Verganti, 2009).
To better understand the definition of product meaning and why it is strictly related to design I will report two observations from former CEO of Apple, Steve Jobs (2000, 2003): "In most people's vocabularies, design means veneer. It's interior decorating. It's the fabric of the curtains or the sofa. But to me, nothing could be further from the meaning of design. Design is the fundamental soul of a human-made creation that ends up expressing itself in successive outer layers of the product or service," and "People think it's this veneer that the designer are handed this box and told, 'Make it look good!' That's not what we think design is. It's not just what it looks like and feels like. Design is how it work." These sentences give us a first overview of product meaning as consequence of design. He is not talking about design in term of appearance, but as a vehicle to exploit the "essence of a technology" through a working product or service and its interaction with the users. This "essence" is considered from many firms as an important market driver because people look at products and services mostly for "why" they need it rather than "what" they need. Studies prove that every product and service has a meaning in both consumer and industrial markets (Verganti, 2009): people do not buy products but meanings.
People buy and use product and services not only for utilitarian reason, but

there are also move from deeper and not manifest reasons related to emotions, psychology and sociocultural context (Verganti, 2009). This mean that people use object both for their functional utility and for a personal intangible psychological satisfaction (Cautela & Simoni, 2013). If technology determines what an object can do for user (i.e. functionalities), product design defines what the object mean for users (i.e., its meaning) (Verganti, 2008).
Design develop massages and languages that people transform in meanings as Klaus Krippendorff (1989) declare on Design Issues: "The etymology of design goes back to the Latin de signare and means making something, distinguishing it by a sign, giving it significance, designating its relation to other things, owners, users or gods. Based on this original meaning, one could say: design is making sense (of things)."
This definition, and all the studied related to it, do not want to declare that strategic role of design is to make products more emotional or symbolic, but it want to prove that every "product or service has a meaning and that firms have always innovated meaning." (Verganti, 2009).
To better understand how this process of design meaning generation can be realized without considered it as a mere aesthetic process it is important make a step back and explain what product and service design are. To do so will use the definition edited by the International Council of Societies of industrial Design (ICSID):

"Design is a creative activity whose aim is to establish the multifaceted qualifies of objects, processes, services and their systems in whole life cycles. Therefore, design is the central factor of innovative humanisation of technologies and the crucial factor of cultural and economic exchange."

These statements suggest that design create a connection between what product can do, how is produced and how it interact with people. Through the integration of technologies, functionalities, features and languages design can propose possible meanings for products. However final meaning of a product is the result between user and product interaction and it cannot deterministically designed (Verganti, 2008). Indeed, the role of design is to create suggestions for product meanings and product and services are conceived as "platforms" where people can provide their own interpretations (Verganti, 2008).
To understand how a firm can generate these "platforms" of meaning it is important understand in details witch product features are more relevant in this process. While the product can be considered as an integration of the engineering and appearance based aspects (Utterback et al., 2006) it is possible analyze separately these two different levels: the not visible aspects and the visible aspects.
The not visible aspects influence the general form of the product as size and weight and they depend from internal linkages among components and materials (Clark, 1985). These design attributes are: mechanical parts, electricals parts and software. They are more engineer relates and strictly connected with functionality and utilitarian customers needs. They are an essential part of the product, and without them it is not possible generate a product meaning, however as Rindova and Petkova (2007) states: "is the

outer form in witch technology is embodied affect the understanding and the meaning the surround the technology" and it is not through the functionality itself that design generate value. Consumption is not only based on function but also to cognitive, emotional and social aspects (Rindova & Petkova, 2007).

The visible aspects are the ones visible or perceptible by other senses from end user. They are: colors, shape, texture, sounds, materials, ornamentations, and so on (Eisenman, 2012). These are called design attributes and they are the first point of contact with users and they communicate initial information about products (Eisenman, 2012): the qualities of a good by hiding or revealing its complexity (Townsend, Montoya, & Calantone, 2011), improving its usability (Norman, 2004), and activating cognitive schemas that allow users to develop emotions toward the product. These aspects are strategically important because through them is possible influence cognitive and emotional process that involved the perception of value related to the communicated product meaning (Rindova & Petkova, 2007). It is also import remind that design have not to be considered as simple sum of these attributes but as a holistic propriety of the product.

These tangible design attributes communicate three different kind of **information: functionality, aesthetics, symbolic and style**. (Creusen & Schoormans, 2005; Krippendorff, 2006; Noble & Kumar, 2010; Norman, 2004; Rafaeli & Vilnai-Yavetz, 2004; Rindova & Petkova, 2007). Functional information is important to communicate what can be done with the product and how to use it in a proper way. Aesthetic information is related to sensory reactions, secondary cognitive reactions and emotional reactions. Symbolic information is related to the meanings and associations that users give to product beyond basic utility and emotions. Style is considered mere appearance (Verganti, 2016).

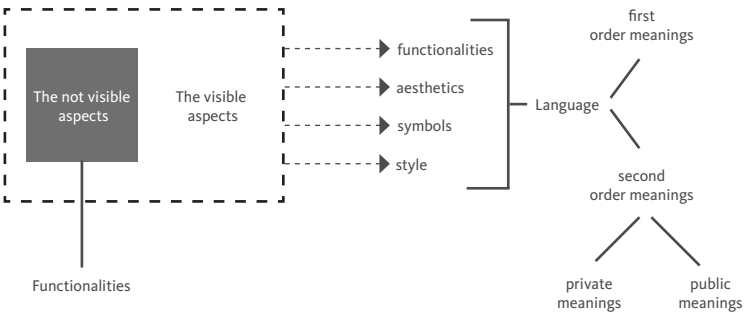
Managing the visible aspects defined as the "**design language**" (Verganti, 2008) designers can manage all this information to evoke intend and not intended meaning to shape the interaction with product (Rindova & Petkova, 2007). Thanks to a semantic process of comparison and categorization they can communicate meanings that go beyond the material embodiment itself (Gottdiener, 1985; Krippendorff, 2006; Verganti, 2009). Eisenman (2012) made a distinction between two different levels of design meanings:

1) **Fist order meanings** that communicate the immediate functions

2) **Second order meanings** related to product as a signifier for other ideas that can extend potential product use. The consequence of this extension of user experience around the product can be noticed by the increase of sales (Verganti, 2009).

The second order meanings are embedded with the sociocultural context in which the products are produced and consumed (Blumer, 1969; Bourdieu, 1984; Ulrich, 2007; Verganti, 2009). They are used by people to extend their self-concept through their possession. It is possible make a differentiation between private meaning and public meanings that people give to goods (Richins, 1994). The **private meanings** are the one that are personally given

from a person and the **public meanings** are the ones that most people share around a product (Eisenman, 2012). These public meanings can be understood as a social sign and the selection of certain design attribute instead of others it is a way to generate a social communication that can be proposed to users (Krippendorff, 2006; Verganti, 2009). Usually users give importance to product with social meaning only in a context in which goods are visibly consumed and the meaning are shared (Eisenman, 2012). To conclude it is important underline that also the user itself are producers of second order meanings (e.g., Bijker, Hughes, & Pinch, 1987; Bogers & West, 2012;



graph.5 Interpretation of design language

Product design language for getting value from innovation

Now I will enter in deeper to understand how this cognitive process works in terms of user interaction and product value creation. As we said previously functions, symbols and aesthetic properties compose the concrete object in which the technology is embodied (Rindova & Petkova, 2007) and they stimulate a variety of cognitive and emotional responses after costumer face them. These responses are the basis of the initial product value perception (Rindova & Petkova, 2007).
The explanation of the psychological judgments behind the value perception can be sum up saying that it depends on a complex assessment of fit that can to be better understand starting from the distinction between **concept** and **conception** made by Susan Langer between. If conception regards the individual version of meanings the concept regards the collative agreements around product meaning as for example the category to witch a product belongs. Collective meanings generate schemas of judgments that help people to evaluate and understand a product, and continuing with the categorization example we can said that these schemas helps to understand if certain characteristics of product make it belongs to a category instead of another (Rindova & Petkova, 2007) or even identify it as a new category.

Users try to find a fit between the configuration of the product's aesthetics attributes and the attributes that they have already in their mind as schemas to help themselves during product interpretation (Mandler, 1982). This psychological process became particulars interesting and difficult when a product embodied a new technology not fits with already in mind users' schemas. This is the reason behind the uncertain of creating a new value for a new technology novelty. In that cases became strategically important for firms became able to synchronize their technological innovation with the product form. The outer form from allows to determine the value of the perceived innovation but the cognitive and emotional response of costumer depend on the schemas that they already have. It became a delicate work to set the right attributes to communicate new values without the risk to do not be understood. As we will see later different strategies can be used for this purpose.

The design attributes can also tiger emotional sensation and in they are strategically important as Rindova and Petkova (2007) affirms. Positive emotions help to solve the already cited incongruity and directly increase the perceived value. If costumer is experiencing positive sensations and emotions they will also feel more energized to cope with novelty, resolve incongruity, and seek the potential benefits offered by new products (Rindova & Petkova, 2007). These facts are explained by two main reasons: a) positive emotions facilitate mind propensity to find new applicable schemas to better interpret the innovation b) positive emotions influence also behaviour like playfulness and willingness (Petty et al. 2001), that are the base for explore a new object and project them in new context to reach future achievements (Fredrickson 1998, 2001; Watson et al. 1999).

As we said at the begging of the chapter, it is strategically important for firms to understand how managing meanings generation of innovation because through their cognitive communication it is possible generate value around new products. Regardless of the strategy adopted to communicate the product innovation its value perception is not something that it is propose and directly understand and accepted by costumers, but it involve a process of successive cycle of learnings by costumer and producers (Dougherty, 1992, 2001). When new products entered in the market users are not able to articulate their needs because they evolve and change as more as they use the product. Rosa et. Al. (1999) affirms that it is only after the development of share knowledge structure and schemas among costumers, producer and medias that new market can be considered emerged.

In the last part of the paragraph I will explain the strategic value of design meaning management with a focus on new technology introduction. A **potential value** of innovation can be considered realized when costumers want to buy it with a price that reward company efforts. The realized value is considered high when the value intended by producers is perceived from costumers and they want to pay for it (Prime, 2006). With costumers perceived value it is intended the expectation that costumer have around a product before the actual use. When perceive value is similar to intended value there is a low gap between producer and costumer excepted value and this can be translate in a low gap between intended and realized value. Consequently, firms can have a return in their innovations because these perception are at

the basis of important users' behaviors as the purchasing. Propose the right "platforms" for meanings is crucial to close that gap and to help companies in making profit from their innovations. In fact, if this gap remains "large" companies risk to lose the potential offered by their innovation as well the costumer that will not be able to perceived the benefit.
For innovative firms that process of value communication is even more challenging and risky. This does not mean that companies have always to propose design languages between the new and the previous meanings to avoid uncertainty and be easily understood. Companies with design at the center of their business are able to invent successful product with entirely new languages. The last sentence became particularly relevant when firms want apply design on technology discontinuity. Technology discontinuities indeed have embedded many potential meanings and the role of design is to try to make them manifest, especially the ones that are not immediate (Buganza, Dell'Era, Pellizzoni, Trabucchi & Verganti, 2015). This is not an obvious and tacked for granted process for companies. Usually when a company is able to fit the new technology potential with a meaning already present in the market they opt for it making a technology substitution. These companies can be considered myopic and they may screen off technologies that do not support existing meaning on the market just because they perceived them as irrelevant. However there are some companies that are able to detect the potential of these new technologies and through the use of design they propose radical new meaning for the opening of total new markets; this is called a "technology epiphany" (Verganti, 2009). It is also possible that companies had understand that a potential radical meaning can emerge from the market and starting from it they guide their R&D on new technologies exploration (Buganza, Dell'Era, Pellizzoni, Trabucchi & Verganti, 2015).
To make this possible have to been taken in consideration that the proposal of radical meanings have to be the result of a networked research process in which languages and meanings knowledge is shared among firms and external interpreters (Cautela, Simoni & Zurlo, 2014). In this process the designers have a central role as brokers of different languages from different technology fields (Cautela, Simoni & Zurlo, 2014). Since designers have knowledge related both to technology and design languages they are essential to devolve new functionalities for products as well to cover new meaning associated with those products (Cautela, Simoni & Zurlo, 2014). Starting with the assumption that also for fast paced technology industries manage design language as a key for succeed in the market, scholars said that designers have a key role on shape the interaction between technology and the different elementary constituents of the product language and the socio-cultural trends that more profoundly affect users perception and needs. It is important said if more companies try to fosters these stimulations and meanings of technoglical produces, it will increase also the sets of objects that have an important design component that a affect their evolution (Eisman, 2012). If more technoglical firms are going to understand the value of design, more firms are going to use it shaping also costumers' expectations. Now it is clear why the strategic role of the design is becoming more and more critical during the product development process and how new technology innovation and design meaning innovation can be considered the two side of the same coin.

1.4 THE DIFFERENT TECHNOLOGICAL INNOVATION MAGNITUDES AS AN INPUT FOR DIFFERENT PRODUCT DESIGN STRATEGIES

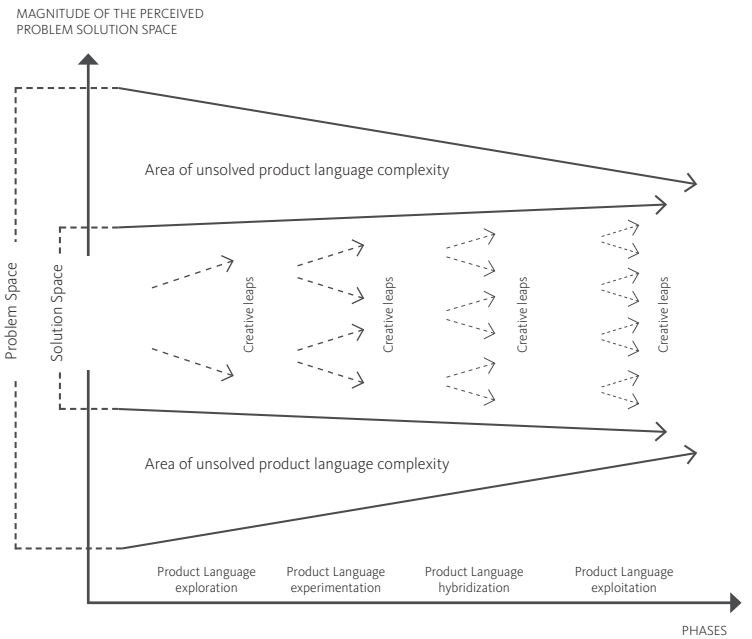
TECHNOLOGICAL CHANGES: AN INPUT FOR PRODUCT LANGUAGE INNOVATION

In a such complex context in which there is a periodical emerging of "technoglical" discontinuities" it is important try to make order on how design can strategically interact with technology evolution, taking in account that design can be used during radical innovation phases to propose new radical meaning, but also during the incremental phases of technology evolution to generate differentiation. To do so I will use the graph made by Cabirio and Simoni (2013) that overlap the evolution of "problem setting phase and problem solving phases" (at the basis of the designer new language proposals) with the evolution of the dominant design (from the first different language proposal, to the affirmation and evolution of a dominant design that will guide successive product innovation until the arrive of new technoglical discontinuity). Before explain the cited graph it is important introduce how problem setting phase and problem solving phase work and explain the dominant design evolution.

Problem setting phase and problem solving phase

The two phases are connected by a chronological order: the problem setting phase is followed by the problem-solving phase which is the one where designer produce the new language (Cautela & Simoni, 2013).
During the problem setting phase designers try to set and reframe the design problems. In this phase two factors are fundamental: experience and signal received from past and current realization of other products. The derived knowledge of these factors give to the designer the possibility of generating a framework to delimitate the space of possible creative solutions (Cautela & Simoni, 2013). The next phase is to generate solution starting from the problem framed in which constrains and opportunities helps to define an area of exploration. These two phases are continuously repeated during a product evolution and more experience are done by designer, more the space of problem solving will be reduced thanks to some garneted areas of creative solutions. The feedbacks from the past achievement move the attention and the effort of designer form problem setting phase to different more specific areas of problem solving, generating a progressive reduction of the problem space and increasing the problem-solving space (image n.27). The variety of solution decrease with an increase of the number of solution,

generating at the end a phenomenon known as "commoditization" in witch the difference between products are minimal and are based just on stylistic details. More the problems setting space is large and more it is possible propose a variety of different languages



graph.6 Interplay between problem and solution spaces

Accordingly, discontinuous technology change can "open" a bigger space of problem setting and thus it can associated to radical design innovation in term of differentiation and proposal of disruptive languages and product meanings. Three main factors are important to define the relationship between the intensity of technoglical change and the possibility to propose radical language changes (Cabirio & Simoni, 2013):

a) **Technology pliability**: it is the potential space offered by a technology to be melded and shapes in different configuration for different language frames. Indeed, each technology is embodied in a physical body and it is composed by different elementary parts that works all together to accomplish a specific function (Cautela & Simoni, 2013). Many of these parts are necessary as well their relation and both create a limit in which apply creativity and generate language. It is important well understand these intrinsic limits to fully exploit the creative space offered by the technology.

b) **Designer learning curve**: it is the level of knowledge accumulated by a designer about a specific domain. Thanks to cumulative experience if design

should face on a consolidate technoglical regime is not necessary restart to reframe the problem setting area because there are constrain and opportunities already taken for granted.

c) **Competitive rules**: the relation between technology and language is also affected by the competitive rules of the specify industry where different players shape rules about competitive advantage (Cautela & Simoni, 2013). For example, in design intensive industries new product meaning is considered as a completive factor to penetrate new market niches, to generate new consumption patterns and to reconfiguring the driving forces (Capaldo, 2007; Ravasi and Lojacono, 2005; Verganti, 2009).

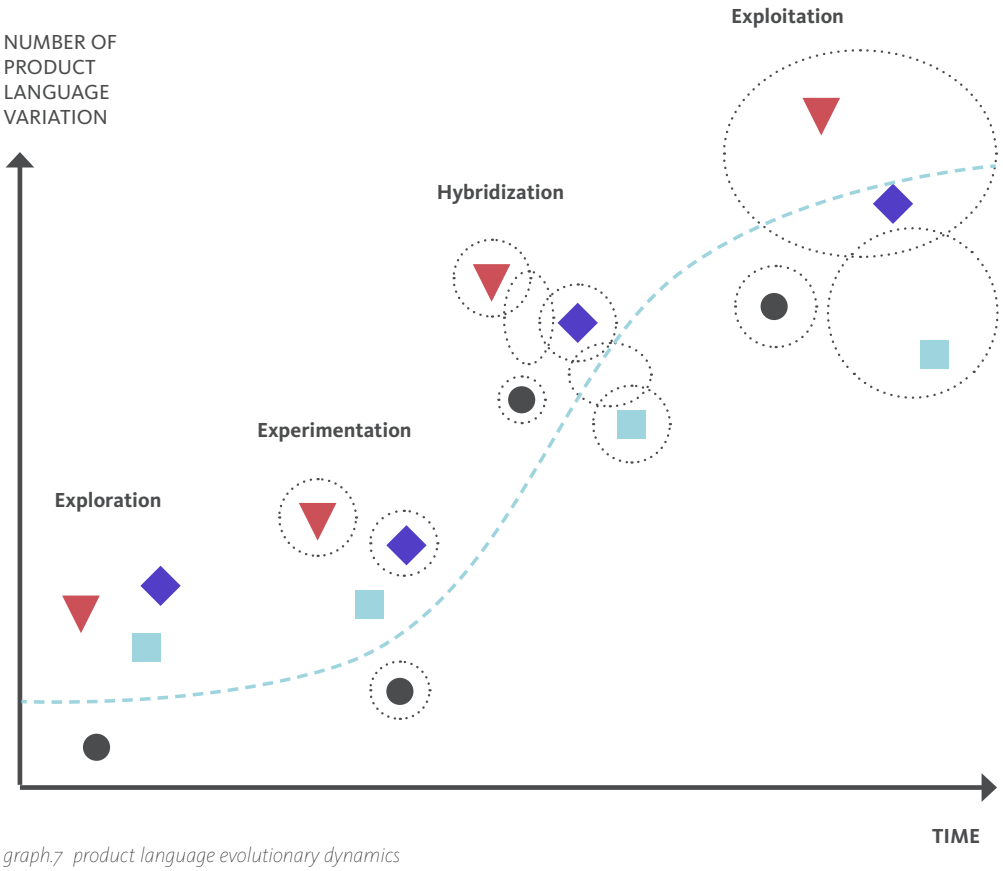
Technology pliability and different language opportunities

Cautela and Simoni (2013) explain, using a metaphor, that the combination of elements as material, finishing, shape, colour and joining parts allow designer to create product style and languages as letters and words can compose a narration. Each technology offered a different range of language configuration according to their physical limitation. Starting from this point it is easy to understand that a continue or a discontinue technology shift offered different opportunities to generate new possible languages.
User's experience the objects through two main perception "optical" and "tactile" (Hildebrand, 1893; De ' Fusco, 2005). The optical perception is also called "active sight" (Hildebrand, 1893) and it evolve costumer on the observation of the object as whole from a distant point of view, with the dominance of a bi-dimensional prospective. Instead the "tactile" perception also called "passive sight" and it is based on a closer view of the object that emphasizes the perception of details and decoration. In the case of continue theology change the firms act on elements as details, texture and decoration that do not have impact on the overall product experience, these elements are related to the "passive sight" and can called secondary elements. In case of discontinue technoglical change the product language can be completely re-invented starting from elements as shape, colour and size influencing the overall product experience. These elements are related to "active sight" are called primary elements.
Company that want to use a design-driven strategy can then stress the right elements accordingly to the intensity of technology change and the strategic goals of the company; reinforcing, changing or disrupting the linkage between users knowledge and the product (Cautela & Simoni, 2013).
The secondary elements are used by firms during incremental innovation to communicate improvements or mask the absence of strong technoglical change to stimulate consumption making the new product look improved than the predecessors (Eisenman, 2010). These languages can be used to extend the schemas already associated to the technology to generate new areas of applicability (Cautela & Simoni, 2013).
On the other hand a new technology domain can offer the possibility to

generate new language that were not considered possible with the previous one. The primary languages can be used to announce the breakthrough in a powerful way or they can be shaped trying to find a balance between the new opportunity offered and the one of the past. When new languages became accepted and its element became taken from granted, thanks to the development of a generic schema, the technology is not more considered new and its start to fit in a very specific market.

Dominant design evolution

The evolution of design dominant discourse is related to the evolution of technological innovations.
In the first period in witch a new technology emerge companies propose different forms cause to technoglical experimentation (Cautela & Simoni, 2013). The proliferation of this forms continue until a dominant design is emerged as a selection of the strongest and more promising technoglical concepts. In the follow period, other technological solution will be proposed following the direction shaped by the dominant design. It became the guide of incremental development of both product and processes (Cautela & Simoni, 2013). This incremental evolution will continue until a new technoglical breakthrough emerges (Cautela & Simoni, 2013). The cycle of technoglical innovation it is moved by a first rare period of discontinue innovation followed by a longer period of incremental innovation and is related to the emergence of the dominant design that have an impact on both firm competence and technology users' knowledge base (Cautela & Simoni, 2013). More specifically a new discontinues technoglical have an impact on technology pliability and designer learning curve consequently influencing the potential of reframing the problem space area. As we state in the first part of the chapter 1.1 the languages of a product are intrinsically link to the physically composition of a set of components as material, texture, relation among parts, signs and finish disposed in a particular way. If the technoglical pliability of a product change drastically due to a discontinuous innovation it means that also product language will be strongly affected due to new physical limits and new radical languages can be proposed. Tech discontinuity have influence also on the learning curve of designer that have the possibility and the need to reframe problem setting area without previous knowledge about constrains and opportunities. Vice versa continues technoglical changes will influence product during incremental language innovation.
Product language evolutionary dynamics
Thanks to all these consideration it is possible define the evolution of languages variation during the lifecycle of a technology. To do so I am assuming that the language evolution is related to technology innovation dynamics and also I have taken in account the evolution of the problem setting and problem solving areas.
In the product language evolutionary dynamics graph (image n.28) are considered four main phases. It is important underling that duration of each phases it is not easily to predict and it strongly influence also from the industry taken in consideration (Cautela & Simoni, 2013)



graph.7 product language evolutionary dynamics

1) Pivotal language exploration: the first phase starts after the introduction of the new discontinues technology shift. The consequence is a first language experimentation period that affect the interplay between problem and soliton space (Cautela & Simoni, 2013). It can be characterized by the proposal of different design languages through different products. These langua ges strongly differs each other f because designers are trying to exploiting different characteristics of new technology potential.These products are called pivotal experiments because they are the attempt to seat landmarks for future product language development.
The winning pivotal solution emerged during the phases will influence the subsequent product language developments and for this reason the ability to propose them is crucial to create a possible first move advantage. In that case, the advantage is not given from the technology itself but to the ability to set the right language. This one of the reason why design-driven innovation management is strategically fundamental.

2) Product language experimentation: In this phase, it will continue the

language experimentation taking in account early feedback obtained from pivotal products. As we said before this process is a continue leering experience between costumer and producers. Taking in account users responses the problem space start to shrink, because designers starts to concentrate their attention on issues considered by users. In this initial phase, the experimentations are useful to understand language pattern that can be considered successful and to exclude the one considered marginal. It is in that period that different cluster of product with different language emerge. These are both options for users and inputs for hybridization to generate new design-driven proposals.

3. **Product language hybridization**: in this phase, the main opportunity it is offer by the opportunity to mix different design languages trajectories. Instead some clusters are already define the designer attention is moved on building bridge between them. Starting from them it can be generate a new wave of design-driven innovations (Cabirio & Simoni, 2103).
This period going to be very useful in understanding if keep separate language trajectories or converge them into a unify product language pattern (Cautela & Simoni, 2013).

4. **Product language exploitation**: this last phase is based on language proposal refer to successful design languages. The language innovation in this period are improvement or variation by the one seated by existing products. Even the directions are seated the product language solution in this period are many and they follow a precise direction. It is possible to say that there is product exploitation of past exploratory efforts. At this stage of incremental innovation both in meaning and technology, design have a role of differentiate products from the one of competitors (Buganza, Dell'Era, Pellizzoni, Trabucchi & Verganti, 2015). This incremental innovation phase of design driven innovations continue until a new technoglical disunity occur (Cautela & Simoni, 2013)

There are also many other exogenous factors that can disrupt product language path generating a new space of problem setting and problem solving cycle; for example changes in socio- cultural or socio-economic dimension (Cautela & Simoni, 2013).

DIFFERENT PRODUCT DESIGN STRATEGIES

I will now list and explain, according to literature, the difference among different deign language strategies that can be applied in the case of technology innovation:

Design as “incremental and topological innovation”

This strategy allow to reach different markets segments according to the understanding of possible users’ lifestyle (Sanderson and Uzmeri 1995). This differentiation of products through product languages usually happened once the discontinuous technology is already emerged. This strategy is oriented to adapt the product meaning of new discontinuous technologies according to the preferences expressed by different market segments in an explicit or tacit way. I will explain this strategy using the successful case study of the Sony Walkman.

The Walkman success

graph.8 Sony Walkman topological innovations

The Walkman it is a great example of how, changing shape and colours of different products models, a company could reach different market segments through the offering diversification. The firs Walkman was the first product that enable portable music, and this first discontinue technology was proposed with a specific shape (image n.3); blue music cassette box, with four buttons and lightweight headphone. But this configuration was copied soon by its competitor, however Sony remain considered for over a decade the most innovative firms in the production of portable stereo keeping an undisputed market share (Sanderson and Uzumeri, 1995). If its competitor mainly produce generic models for larger market segments or less expensive version, Sony proposed specific models for each different specific market "with a myriad of product languages, shapes and ergonomic traits to address different user categories and preferences" (Sanderson and Uzumeri, 1995). Design department have a main role in this successful strategy thanks to its ability to understand different user life-style. It is interesting seen how Sony organize logistically this creative production process that was possible also thanks to a flexible manufacture (but this last factor cannot be considered sufficient to be the winner inside the market since also other companies had it). Sony had produced 3 main basic platforms from which all the other products models were developed: The WM2 (image n.4), the WMDD (image n.5) and the WM20 (image n.6) models (Sanderson and Uzumeri, 1995). These products are called generational models and they are mainly the result of engineers work. But as we said before the Sony production was huge: it proposed 20 new models each year for a total of almost 250 models. If 20-30 of these models were based of incremental change, the remain 85% were composed by topological changes that were manged by both marketing & sale organization and industrial design organization (Sanderson and Uzumeri, 1995). These organizations have their department in the main market regions (Japan, US and Europe) to better tracks respective costumers' needs. The changes proposed from the marketing department are called by Uzmeri: channel driven changes. They were little topological modification as change in colour and other minor features according to customized request of specific costumer and different distribution channels. These modifications were few and with a less impact compare to the ones proposed by designers. They were in fact able, through the modification of shape, colour and the rearrangements of functions, to address entirely different segments costumers (Sanderson and Uzumeri, 1995). The ability of the designer were based on the observation of product already on the market (both from Sony and its competitors); their attention to new technology and to the proposition of new possibilities that people haven't thought yet (Liz Powell). For example in Japan, in witch people had a more urbanize life and they mostly move using subway or train, people preferred models that were small, high perforce and rechargeable. In US market these characteristics had few meaning for costumers, because sport and outdoors activities had a central role in their life and for this reason the famous Sport Walkman (image n.7) was proposed to them (Sanderson and Uzumeri, 1995). Also many other families of products were proposed (image.8-9) to different markets as professional series (image n.10) with a highest sound quality and The My First Sony (image n.11) for

children with a nice and indestructible case (Sanderson and Uzumeri, 1995). It is clear that the strategic role of design on create new languages according to different markets was one of the key factor of their huge production. The different Walkman models was not easy to imitate and did not generate cannibalization but long-lived and successful models (Sanderson and Uzumeri, 1995).

Synchronization between product language and technological changes

Design can be used as a process of synchronization between product language and technological change to underling these changes. Thanks to the aesthetic of the product it is possible trigger cognitive and emotional response to guide costumer in the understanding and assessment of the new product value (Rindova and Petkova. 2007). Two main strategies are proposed according to degree of technological novelty:

a) **The increase of similarity of Radical Innovation to existing products** (Rindova and Petkova. 2007): to avoid the misunderstanding caused by the high degree of technological change producers can work on the product form to have a similar language to the one of an already affirmed product category. Doing that, they can transfer the knowledge of the new technology crossing the new schemas of the new technology with the one the already known category. They embodied a new language in a familiar form. According to Eisenman (2007) in the phase of a new technoglical introduction the design role is mainly to explain to users what the new technology can do and how should be used. This strategy is not without risks because if there is not a right balance between new schemas and old schemas the product novelty can be both not perceived or misunderstood. If that mistake happen it can avoid users to correctly explore the new functionalities and understanding new product value. This process can be used also crossing and linking multiple available categories schemas. In this case users will recombine them to generate a new schema, this process it is it still based on previous knowledge. The strong and the wick point of this strategic point is that in this way the consumer is less influenced by just one category. This can be a benefit but at same time a problem if the new schema generate by them is totally new and it do not fit with the firm goals.
Il will better explain this strategy using both a successful and unsuccessful example of real products emitted on the market.

Newton failure vs Palm Pilot success

In 1980 was introduced by Apple "The Newton" (image n.11). It was a miniature computer with a sensitive touch screen with an interface studied for the interaction with a specific pen. According to Thomke and Nimgade (2000) its innovative propose was to "replace the tyranny of the cumberso-

me keyboard". The direct competitor of the Newton was the computer and for this reason was designed and view as a small computer. The costumers perceived The Newton as an underperforming computer: it was to slow in comparison to the computer, and it was still too big to be perceived as more comfortable one (Patnaik and Becker, 1999). The innovative technology used had a good potential, but the wrong product category comparison choice has wasted the success opportunity.
The Palm Computing understand better the potential of this technology with the design of the Palm Pilot (image n.12). The product proposal was not to be a computer replacement, but rather the paper personal agenda replacement. After observing how user interacting with the old version of their product, the Zoomer (that was more similar to Newton), the Palm Computin decide to cut out useless features making it smaller. The new product produced could now fit in a pocket and resembling more to an agenda book. The Palm Pilot category association make it perceived as more performing and it "become the fastest selling computer product" (Thomke and Nimgade 2000, p. 8).

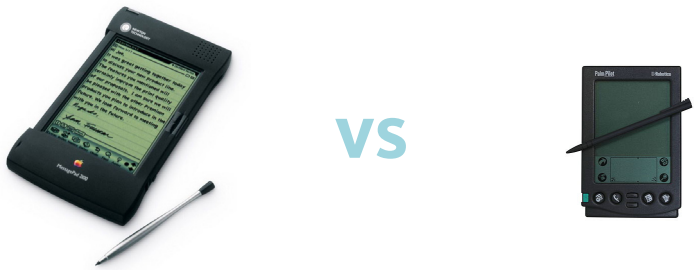


fig. 1 Comparison between Apple Newton and Palm Computing

b) **The increase of dissimilarity of Incremental innovation from existing products** (Rindova and Petkova. 2007): this strategy aims both to excite costumer in front of incremental innovations and extend the already used schemas. Incremental innovation are easy understandable but because the product main features are tacked for granted they are not perceived interesting from costumer. This problem can be solved moderately increasing product language incongruence consequently generating positive emotion that increase the perceived value of the incremental innovation. Thanks to that incongruity costumer can also extend their existing schemas generating new pattern of applicability and broadening the range of experiences that user can associate to the product. According to Eisenman (2007) that extension of the potential functionalities can be also done with the generation of second-order meanings.
Of course also this strategy is not without risks indeed the value of the novel experience proposed must justify the grade of effort to solve the language

incongruity, otherwise this effort can be perceived as unwarranted and a mere aesthetic change.
I will better explain also this strategy showing both a positive and a negative case study.

I-Mac success

In 1998 Apple propose to the market the first I-Mac (image n.13-14). The technical improvements of that computer were minor but its design language was radically different from the classic desktop computers. It was colourful, with round shapes and it had a handle on the back of the case. To propose these new computer Apple used an "home" language instead of an "office" language.
This revolution generated both positive emotion on costumer and an extension of the already existing schemas related to personal computer usability and application. The new computer suggest that I-Mac was not just a computer for work but also for play.
It had become in just six weeks after its introduction the best-sealing computer in Apple's history (Kwak and Yoffie 1999) and the 33% of its purchases came from first time buyers. This demonstrate that the new language not only increase selling's, but extending its domain of applicability and the costumer experience it generate a new pattern of demand (Rindova and Petkova, 2007).

I-Mac's **new language:**
a computer **for play**
and **not** just **for work**

fig. 2 Comparison between Apple iMac and and Machinotsh LC_I

G4-Cube failure

The next year Apple try to bring to the market a computer that look "entirely unlike a computer" (Manes 2000, p. 186), it was the G4-Cube (image n.15). To create an "innovative" shape all ports were hidden generating an unwarranted hassle for customers (Manes 2000, Taylor 2000).
This time the incongruity was too strong and the novel experience proposed by the new shape was perceived negatively because the final benefit was too little in comparison the effort to solve the incongruity. This prove that in case of technical incremental innovation is better keep a low-moderate incongruity (Rindova and Petkova, 2007), otherwise the language modification it will be perceived as a mere styling modification that reduce, without any strong reason, the usability of the product.

Incongruity was **too strong**
The new shape was
perceived negatively

fig.3 Apple G4-Cube

Deisgn-Driven Innovation

The Design-Driven Innovation theory give to design the role to unveiled the most meaningful and profitable form of a technology through the generation of new radical meaning of offering in a category (Verganti, 2011). The goal of the design is to discover the "essential nature of something" to systematically produce technology epiphanies (Verganti, 2011).
If other strategies aim to answer existing needs working more in technology substitution Design- Driven strategy try to create product or services that transcend from existing needs creating new reasons to buy them (Verganti, 2011).
This strategy does not question importance of user-centre design, but it is considered as a part of a more complex process that involve also the interaction with external interpreters (image n.16).
Instead of interpreting actual sociocultural model and what is happening to-

day, radical change in meaning is based on a broader prospective that aims to change the sociocultural models itself (Cautela, Simoni & Zurlo, 2014). Some of companies that were able to use these strategies are: Apple, Swatch and Nintendo.
I will illustrate here the case study of Nintendo Wii to explain this strategy.

Nintendo Wii success

Nintendo lost its domain in videogame industry after the introduction of Sony Playstation in 1995 and the Microsoft Xbox in 2000. These two competitors continued to produce even more powerful consoles proposing different next versions of the already cited ones. The position of Nintendo started to became critique because it was not able to compete with technoglical improvement offered by its competitors. Sony and Microsoft indeed propose every time improved and more powerful processor with high definition images, more complex games and best graphics (Buganza, Dell'Era, Pellizzoni, Trabucchi & Verganti, 2015). In this moment of crisis Nintendo introduce in the market the well-known Nintendo Wii (image 21-22) proposing a total new meaning of console game. They integrate in the gaming process a motion-sensitive controllers, exploiting their potential with the proposition of games that were: simple in graphics, with no 3D accelerated, with short playing time and multi-player dynamics in witch users have to interact physically between them. In April 2007, the US market share of Wii was twice those of the PlayStation 3 (images 17-18) and four times that of the Xbox 360 (images 19-20); the competitors' consoles that were in the market in that period.
Nintendo understand the potential of a technological innovation as the MEMES (micro-electro-mechanical systems) accelerometers, a technology already used by Nintendo competitor's in other product categories. Nintendo was not the first to keep in touch with these sensors but was the first to understand the unveiling potential of that technology applying it to videogames and proposing a total new meaning of gaming to users.

fig.4 Comparison Between Sony Playstation 3 and Nintendo WIi

1.5 "ROBUST DESIGN" AND "TECHNOLOGICAL EPIPHANY" TRADE-OFF DURING RADICAL AND DISCONTINUOUS TECHNOLOGICAL INNOVATION

"ROBUST DESIGN" AND "TECHNOLOGICAL EPIPHANY" TRADE-OFF

In the last two paragraphs I explore different ways to generate meanings using design and I define, using theoretical evidences, how technology innovation itself it can be considered one of the main driver for product meaning generation. Here we are going to cross these findings to analyse how in the first period of a discontinue technoglical change companies need to face a trade-off between the different strategies (Cautela & Simoni, 2013) to translate technoglical input in a valuable product for the market. They can opt for a radically change in product language and meaning to empathize the novelty and produce a Technoglical Epiphany that address needs that customers do not know yet (Verganti, 2011). This strategy enable to maximally exploiting the creative opportunities of the new technology acting as a subversion of the status quo (Cautela & Simoni, 2013). The second option it is more conservative and aims to find a balance between the existing product language and new traits of discontinue technology and it is called "Robust design" (Cautela & Simoni, 2013). Its purpose it is to be a link between the past, the present and the future of the design trajectory avoiding costumer and stakeholder's disorientation to exploit product acceptance (Cautela & Simoni, 2013). This strategy aim to exploit existing market acceptance and reinforce firm position and it is implemented using familiar and broad languages from the "status quo" to introduce the new technology. In this case technology is used to serve existing needs (Verganti, 2011). It is important to underline that the reason behind these strategic decisions is also related to many factors as:

a) **The breadth of the product portfolio** (Mono, 1997)

b) **The type of competition** (Mono, 1997)

c) **The phase of the product lifecycle** (Mon , 1997; Berkowitz, 1987; Person et al., 2008)

d) **The brand identity** (Karjalainen, 2003; McCormack et al., 2004; Olins, 1989)

e) **The maturity of the market** (Karjalainen, 2003)

f) **The innovation orientation of a company** (Dell'Era and Verganti, 2007)

g) **The market segments being targeted and the emergent lifestyles of consumers** (Sanderson and Uzumeri, 1995).

Robust Design

Researcher stats that innovation is a key point for value creation, but at same time they affirm that uncertainties related to its introduction it is very high (Rindova & Petkova, 2007). In the case of a discontinuous technoglical companies decrease the risk of misleading users and stakeholders opting for the use of a "Robust design" (Hargadon and Douglas 2001). As we saw before the product design have a crucial role on communicate the new technoglical value, and this approach allow to treat the technoglical discontinuities with meanings in line with the previous technology-equipped products. It is possible combining old design language and traits with new ones related to the new technology that act as semantic signals for communicate the innovation. The new messages are explored using languages composed by pre-existing knowledge, cues, schemas and script.

Companies that decide to use this strategy do not try to create a new market, but tried to find to search the best already affirmed market that better fit with the new technology. These company look for the better application for the technology generating a technoglical substitution, in witch old meaning value is reinforce by the introduction of the new technology (Verganti, 2009). These products are proposed as belonging to an already define category, that have they "already developed and institutionally codified knowledge about their common attributes" (Rindova & Petkova, 2007) than new technology value can be translate as a category improvement. These arguments and its effectiveness it is well explained by Rindova and Petkova (2007) indeed they affirm that when a new product have been designed it have not just been considered as a functional tool, but also as an artefact with symbolic and aesthetic relevance. Joining these dimensions, it is possible deliver to costumer a sensory and cultural experience that can determine how individual respond to product and its related innovation. But how is it related to "Robust Design"?

When new product embedded a new technology that generate new schemas, the innovation became incomprehensible for costumers. To avoid the perception of unusual and wired product, design can be used to solve this initial incongruity exciting both cognition and emotion (Rindova & Petkova, 2007) . With product form, it is possible to find a balance between new technology features hiding or emphasize them and also activate different schemas and related meaning from the past guiding product interpretation (Rindova & Petkova, 2007) . Starting from these old schemas help users to foster a general agreement on the product that will help to entering in the next step of a new meaning generation.

A very significant example of that strategy it is studied by Hargadon and Douglas (2001) and it concern the introduction of the electrical energy in the market. Edison introduce the new technoglical with light bulb lamps (image n.29) similar to the kerosene lamp (image n.30). This language solu-

tion helps the understanding of the new technology starting from the already existing schemas (Rindova & Petkova, 2007). The new lamp incorporated elements that where functional in the old technology but not in the new one to evoke the similarity and transfer the knowledge from the well know schema from the past.

fig.5 Comparison Light bulb lamp and Edison lamp

It can also happen that there are possibilities to find available old schemas to make associations with the past. This can generate a fragmented understanding of the product and to generate a new schema collectively accepted it can be pass a lot of time, along witch different languages and configuration are proposed. Probably this time it is influenced from the range of the innovation, the sector and the historic period that shape the ability of people to face novelty.
As any strategy "Robust Design" have both advantages and disadvantages that must be known and taken in consideration from managers and designers. Opting for that strategies companies have to take in consideration these **opportunities**:

a) **Exploit the past knowledge that designers already have** it is possible to work on a problem setting already partially developed (Cautela & Simoni, 2013)

b) **Increase and facilitate customer acceptance** because they can relate with product using already consolidate user script and schemas (Cautela & Simoni, 2013)

c) It is going to be **easier find acceptance by stakeholders** (usually they prefer to keep stable the social system postponing changes)

d) **Exploit the existing market potential** and its competitive advantage making investments in a more clear and certain direction (Cautela & Simoni, 2013)

On the other hand, this strategy has also **pain points** that must be considered as well by companies:

a) It **limits creative possibilities**, especially when this decision it takes after a technology discontinuities

b) The perception of the novelty it is reduced, the **new value can be difficult to understand**, as well the need to change the product according to technoglical shift

c) It can **be possible create a cannibalization** caused by the competition between old and new technology

d) The **possibility to establish a premium price are reduced**

Technoglical Epiphany

As Verganti (2009) state, considering just the "Robust Design" design strategy, especially during technoglical breakthroughs, it is a myopic vision of the possibilities offered by design. Starting from questioning "why" a product should be used and considering design as the best way to generate that answer a radical technoglical innovation can be coupled with new radical languages to generate a "technology epiphany" (Cautela & Simoni, 2013). Verganti (2009) define this phenomena as epiphany starting from etymology of this words taken from the Merriam-Webster Dictionary (2004) : "'a manifestation that stands in a superior position; a perception of the essential nature or meaning of something", indeed this strategy aim to understand the latent potential and the most powerful meaning from the new technologies.

This strategy it is the result of interplay between the already cited innovations strategy: design-driven innovation and technology-push (Verganti, 2009). We have already discussed about these strategies, usually used separately, can be joined to generate a new innovation.

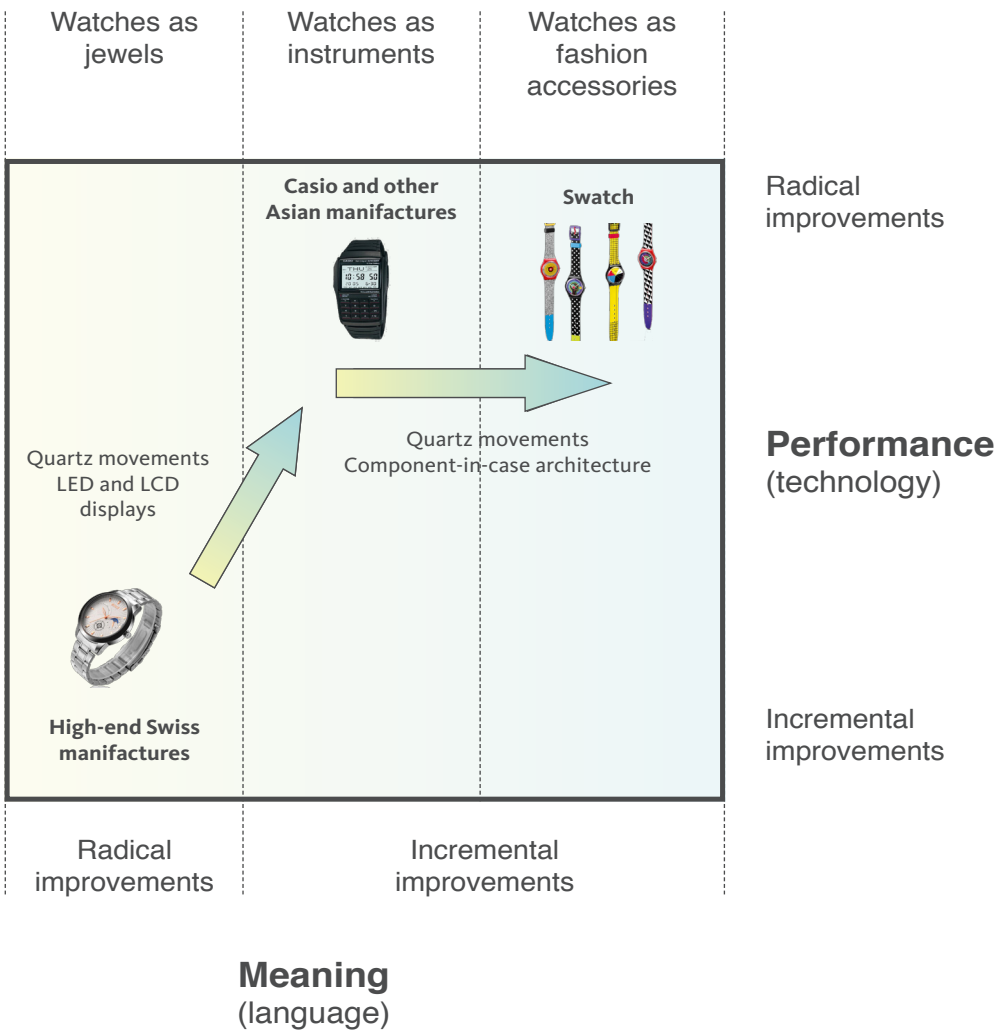
Recent research have demonstrated that discontinue technoglical change can allow design-driven innovation giving to new radical language development a key importance (Cautela, Simoni & Zurlo, 2014). Cautela & Simoni (2013) also added that in this first two phases of product language exploration and experimentation in witch there is a lack of reference to built the problem and the solution space, scholars have noticed that there is a cross-fertilization of feedbacks among industries that are living the same technoglical shift. To do so it is particularly indicated the designer profession.

If want be even more precise stating that technological epiphany to has a such strong impact need not only to reframe a new language, but also the costumer experience of product interface and architecture; the expected benefits of the product, the cognitive and emotional associations and also the main motivation of the purchasing dynamics (Cautela & Simoni, 2013).

To better understand that last point I will use as example the introduction of quartz technoglical in watch market and how the Swatch was able to find its quiescent meaning to revamp Swiss watch industry.

Until 70's the watch market Swiss companies had the control of 40% of world share watch market. This industry had its core competence in preci-

sion mechanism and assembly. In the early 1908s the situation dramatically change cause to the introduction of quartzes technology (Verganti, 2008). That technology was invented by Swiss manufacture, but they screen off it because did not fit with their main competitive competence. However Japanese and Honk Hong manufacture understand the potential of that technology and joying it with cheaper labour, they generate a new generation of meaning around watch. They transform watch in a tool with a LCD display quipped by different functionalities (image n.36-37) as timers, alarm clocks, games and even calculators (in that period digital display started to be used in different field from laboratory display, calculator and handheld videogame). From the other side,



graph.9 Comparisonof innovation strategies in the watch industry in the early 1980s

Swiss answered keeping and reinforcing the idea of watch as a jewellery (image n.35), focusing more and more on luxury segments. Consequently, the middle market segment became easy to conquer by Japanese competitors (Verganti, 2008). That discontinue technoglical shift change the market dynamics and in 1980s Swiss watch industry was near to extinction. This it is easy to perceive if we think that Seiko in 1983 (a Japan manufactory) produced alone more than all Swiss industry.

Verganti said that this shift of meaning from jewel to instrument was the most obvious interpretation of the new technology, and the quiescent meaning was not already "discovered". Indeed in 1983 Swatch launched a series of new plastic watches as fashion accessories. This strategy promoted by Hayek Engineering proposed to the market new watches made by plastic that were colourful and low price. The new watch were think as a fashion accessory as a tie, making the product emotional and easy and cheap to buy. The innovation was not just about language, but the idea to link emotion to watch was possible thanks to a radical innovation on technology. They apply quartz technology on analogue display and they also change the product architecture building components directly inside the case.

Changing the technology, the process, the language a new meaning around watches they created a not easy to copy product. They based the success on new technology and leveraging on the local manufacture ability to design miniaturized watch architectures (as the analogic display). The watch moved from a jewel to an object that can be buy following an impulsive purchasing logic (image n.38).

Radically change the meaning offered by new technology the Swatch made the Swiss watch industry rise again: in 9 years the company sold 100 million watches. The strategy started from the input of a new technology and thanks to the results of a sociocultural phenomenon analysis made from a different angle (Verganti, 2008) the meaning of Swiss swatch move from jewel to fashion accessory (image n.34)

As can be perceived by the Swatch example the ability of a firm to use new languages opportunities offered by a discontinue technoglical shift are not just an opportunity to establish the new radical paradigm (as did the Dyson vacuum cleaner). But taking as example the design-driven industries, the generation of new meaning indeed can help companies to accomplish also different strategic goals as: create new markets (Kim and Mauborgne, 2005), revamp the brand-identity (Ravasi and Lojacono, 2005), develop new product portfolio and families, explore emerging market niches (Sandersonand Uzumeri, 1995), and propose new pricing policy (Cautela & Simoni, 2103).

If using a "Robust Design" strategy companies follow the rules and the needs of the market that better fit with their innovation; a technology epiphany can have the impact to open new markets and in other case to change the competitive rules of an entire industry (Cautela & Simoni, 2013). When this happened, as we said before talking about the "dominant design", companies start to follow the direction shaped by the firm that had developed the most successful pivotal solution. This mean that be able to propose the right technology epiphany it is strategically important if that product will enter in a cycle of design improvements that can guide the user preference and that competitors are forced to follow. It is the case of Apple that with the intro-

duction of the I-Phone forced the mobile producer to follow its dominant language trajectory. This strategy can be that powerful to change the rules of the competition.
As "Robust Design" have both advantages and disadvantages that have to be known and taken in consideration we can make a list also for Design-driven innovation applied to discontinue technology innovation. I will first list the opportunities:

a) This strategy allows to **exploit all creative potential of the new technology**

b) This approach based on explore new languages give to technology the opportunity to **generate new market and attract emerging market segments**

c) That product can be perceived a total new category opened to be used in new context, spaces and occasions. The same product will can **engage user generating new sensation and emotions**

d) The new product can **revamp the brand image** of the company creation new association of value starting from the new product design.

As all the strategy, also this one have its wick points that must be taken in consideration by managers:

a) The need to reframe the problem-space solution is associated to the need to gain new knowledge and this can be translate in i**nvestment of a consistent amount of money on the learning process**

b) Introduce a new language have a **high grade of uncertainty**, and to affirm a new radical meaning it is necessary understand the initial dissonance, reduce the sceptical perception of the costumers and spend money and time for their learning.

c) As we said before the new meaning is a proposition and it is shaped with costumer interaction, it means that companies have not an entire control on it and the brand identity can be altered following a not intended path. **Without the right brand strategy** (e.g. concurrent brand repositions) the **identity can be diluted** by the presence of the new identity that do not fit with the past.

A little digression about "Dominant design"

The decision to take a "Robust Design" approach is basically made with the attempt to decrease the uncertainty related to the innovation, and in line with that we can also introduce the strategic decision to adhere to "dominant design". But, what is "dominant design"? Dominant design is the set of common languages as shapes, materials and colours used by competitors to

define a specific product. Accordingly to scholars (Capetta et al., 2006) during product lifecycle there is a period in which competitors propose language differentiations, followed by a period of convergence in witch competitors share a mainstream language also called "dominant design" (Cautela, Simoni & Zurlo, 2014). For company adhere to this languages frame it is useful to reduce investment on development of product languages, to take advantage by achievement take from others and reduce also the risk of introduce new languages. In this case, the product language cannot be strategically use as a mean of differentiation. If more companies decide to adhere to this strategy they can create a "design discourse" generating a convergence in language frame influencing the consumption trough a continue dialog with socio-cultural model and influencing the adoption of a specific language (Dell'Era and Verganti, 2007). If many company decide to adopt this strategy we can talk about Cooperation Strategy (Cautela & Simoni, 2013). If a company decide to use a different language in relation to the design discourse we are talking about Competition Strategy. Chose one of this strategy during technoglical shift could generate different advantages of disadvantages:

Competition Advantages: high possibility of differentiation fro competitors based on new product language; high possibility of leveraging design-driven innovation to improve firm's image; strict integration of product languages and other strategies

Competition Disadvantages: high costs associated with new product language' diffusion; high risks of marginalization of firms' product language

Cooperation Advantages: fast diffusion in the market; low costs of development and diffusion of new product language; low risks of marginalization of firm's product language

2 FAST-PACED TECHNOLOGICAL INNOVATION INDUSTRIES AND DESIGN-DRIVEN INNOVATION. THE ROLE OF DESIGN BEHIND THE DEVELOPMENT OF NEW PRODUCT LANGUAGES

2.1 NEW MEANING GENERATION IN FAST-PACED TECHNOLOGY INNOVATION INDUSTRY

NEW MEANINGS IN FAST-PACED TECHNOLOGY INDUSTRY

In the previous chapters I talked about the interplay between technology innovation and design-driven innovation making different examples to explain how these two strategies are related.
In this last chapter I want to make order about witch industry sectors are mainly interested on that interplay.
These strategy nowadays starting to be more and more integrated and if in the past design-driven innovation was related to design-intensive industries and the technoglical innovation was considered strategically fundamental in fast-paced industry, now that distinction became blurred.

The importance of design as a strategy to propose new radical meaning or just follow the one already present on the market is typically related to the sector recognized as design-intensive industry. I am talking about apparel, furnishing, interior design, home and fashion accessories.
In this industry technology was for long considered as exogenous variable or even an invariant on the creative process when the industry was particularly stable (Cautela & Simoni, 2013). The proposal of meaning and languages was based on the evolution and prediction of socio-cultural models (Dell'Era and Verganti. 2007; 2011). In these sectors functionality and performance was taken for granted and the costumer choice was based on their style or design (Cautela & Simoni, 2013). Differently from other industries as the fast-paced the "performance evaluation" was based on unqualifiable and not easy to measure factors.
As was saying previously this situation is changing and the number of technology change are increasing in design-intensive industries. This kind of innovation became the norms and technology itself became an important input to develop new languages. Cautela & Simoni (2013) studied how Italian lighting industry as
Flos and Artemide are improving they ability to couple new technology advancements with design and the proposition of new innovative product meaning to their customers.
The Artemide lamp Metmorfosi is a perfect example of the ability of such firms to translate technological innovation in new meanings. This lamp can change colors thanks to its connection with a computer and instead to propose this innovation in a lamp with beautiful shape that can be placed in the living room, it is proposed as a simple object that can be also hidden

because its main goal is to generate the right atmosphere according to people emotion (Verganti, 2008). They propose a new meaning for that light that is no more considered as a nice object in the living room, but it give a new role to the light itself starting to from the possibility to be customized.

On the other side, we have all that industry as automotive, services, costumer electronics, high tech products, sport equipment and medical sector in witch success was related to improved functionalities and performances. In this sector technology pull innovation was considered the main driver and design had a secondary role as mere esthetic part. These product value was considered by strategist as the insertion of new functionalities or as the improvements of the old ones,
Nowadays the situation is changed also in these sector as I proved in the last chapters with different examples regarding companies as Sony, Apple, Nintendo and Swatch. The power of design to generate new meaning around products became a strategic weapon for these companies. The role of design move from the "aesthetic value" to the ability of understand the meaning behind the technologies and it is used for different strategic goals as increase product acceptance, differentiate their products into the market or even generate completely new market in the case of a radical technology innovation (Cautela & Simoni, 2013).

fig. 6 Examples of Technological Epiphanies

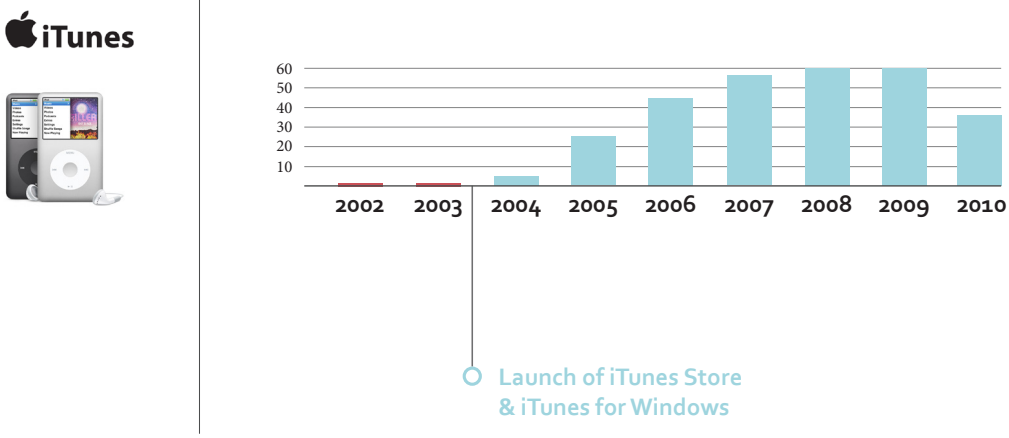
As Verganti states (2009) in his investigation of design and innovation there are two main dimension that regard product evaluation: from one side the utilitarian functions that are provided by the technology development, from the other the psychological and cultural reasons that people seek when use a product. This stamen nowadays is more and more understand by fast-paced firms that are trying to propose new meaning.
The role of design and technology is evolving in all these sectors, crossing their boundaries, contaminate languages and moving knowledges. Technology disciplines and design disciplines are evolving thanks to these contaminations. However, if each sector, each firm, and each product or service have to be observed and studied considering its peculiarity, it is the generalization of these peculiarities that allow to open new ways to observe this evolving phenomena improving and generating knowledge around it.

However until now the product language innovation phenomena in fast-paced technologies it have been studied just on a company level. If Cautela and Simoni (2015) show how technology innovation opened new product language opportunities inside the design-intensive from an industry level, there are no study that prove the same inside the fast-paced industries. This is the first litteraure lack that I found.

*There are **not studies** from an **Industry level** perspective, that prove that **technological innovation** could be considered as an **input** for new **product language generation** inside the **Fast-Paced Technology Industry***

In literature there are different example of "technoglical epiphanies" inside both design-intensive sector, fast-paced technoglical and even digital secotr. For example if we look at some cases inside this sector it is not easy to understand how the design language innovation could be the only factor related to design disciples that could exploit these new meanings. There are case as Waze and Navicom (Buganza, Dell'Era, Pellizzoni, Trabucchi and Verganti, 2015) in witch the product it is not even involved. Probably in these case we can talk about new interface language and the role of communication designer could play an interesting role. At the same time what really change in these App it is the service itself.
Furthermore I have also found an other more interesting case related to the fast-paced industry sector in witch the service innovation it seems to be fundamental in the exploit of the new technoglical innovation. I am talking about the iPod case study (Verganti, 2007). Once MP3 Technologies come up many companies see this tech opportunity as a way to improve the old meaning of "carrying music everywhere", but Apple envision the potential of the new technology proposing the iPod with an integrate Itunes store from

which people could buy music building around this object a new complete e new music experience, proposing a stronger connection with the world of music.



graph.10 iPod sold Worldwide units in Millions per fiscal year

If we look at iPod revenue reports we can observe how instead the iPod was lanuche in 2001 with a radical product language compare to other MP3 player, the revenew grow drastically from 2004 after the lunch of iltunes compatible also for Windows. With this service apple create a new meaning in the market, exploitng the techngoly opportunities.
Until now there is an interesting literature about the relation between product design and technoglical innovation, but I have nfound few information about other design approach as the PSSD could contribute on the interplay between technoglical innovation and meaning innovation.

*I have found **few information** about how **other design approach** as the **PSSD** could **contribute** on the **interplay between technoglical innovation and meaning innovation**.*

2.2 THE GENERATION OF NEW MEANING: FROM A PRODUCT CENTRIC PERSPECTIVE TO A PRODUCT-SERVICE SYSTEM DESIGN APPROACH

PRODUCT SERVICE SYSTEM DESIGN INTRODUCTION

Instead the relation between technoglical innovation and design it is manly studied with a product centric approach I wanted to better analyse the nature of other approach and how them could be use to generate innovation and propose new meanings. Particularly I wanted to focus my attention on the Product Service System Design approach.
Before to start it is important understand what Product Service System (PSS) means. The PSS can be considered an extension of the traditional functionality of the product by incorporating them in additional services. The terms it is composed by three different words that have to been define too:

1) **Product**: a tangible commodity manufactured to be sold. It is capable of 'falling on your toes' and of fulfilling a user's needs (Baines et al. , 2007)
.
2) **Service**: an activity (work) done for others with an economic value and often done on a commercial basis (Baines et al. , 2007).

3) **System**: a collection of elements including their relations (Baines et al. , 2007).

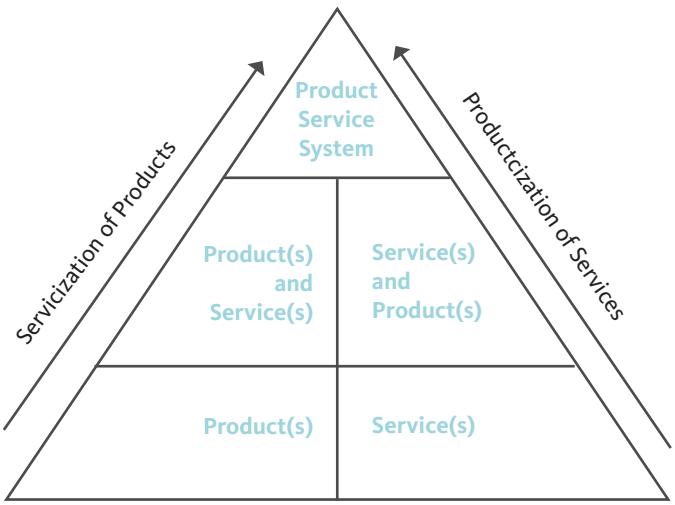
Traditionally, many people have considered products separately from services. However recently there is an attention around the phenomena known as 'servitization' of products and the 'productizing' of services. Morelli (2004) define 'servitization' as the evolution of product identity based on material content to a position where the material component is inseparable from the service system.'Productization' is the evolution of the services component to include a product or a new service component marketed as a product. The convergence of these trends is the consideration of a product and a service as a single offering.
There are different level of product service system:

1) **Product-oriented PSS**: promoting/selling the product in a traditional

manner, while including in the original act of sale additional services (Baines et al. , 2007).

2) **Use-oriented PSS**: selling the use or availability of a product that is not owned by the customer . In this case the company is motivated to create a PSS to maximize the use of the product (Baines et al. , 2007).

3) **Result-oriented PSS**: selling a result or capability instead of a product. Companies offer a customized mix of services where the producer maintains ownership of the product and the customer pays only for the provision of agreed results (Baines et al. , 2007).



graph.11 Evolution of the product service system

For traditional manufacturers, PSS is claimed to provide strategic market opportunities and an alternative to standardization and mass production. The fundamental business benefit of a PSS is an improvement in total value for the customer through increasing service elements. Competitive edge is enhanced as, for example, a service element that is not easy to copy and facilitate, communicates information about the product-service package (Baines et al. , 2007).
Designer have the ability to face process and serviced innovation. They could be considered as narration in witch there are artefact named as touch point that have to been designed (Zurlo, 2004). These artefact could not be designed without a clear vision of the entire system in witch they are embedded. Product-Service Design will design solution and not only the product. The solution it is considered in terms of products, produce-service, distributive channels and communication.

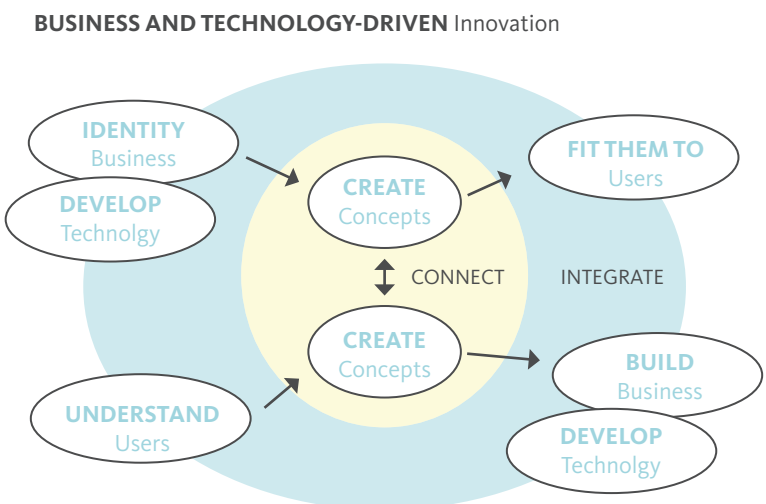
This new design role could be deduced also from the 2004 design definition from the ICSD International Council of Societies of Industrial Designers:
"Design is a creative activity whose aim establish the multifaceted qualities of objects, process services and their system in whole life-cycle. Therefore, design is the central factor of innovative humanization of technologies and the crucial factor of cultural and economic exchange"
Both Service design and Strategic design need an systemic approach, in witch the product it is design as well its context. Designer could do that thanks to their ability to zoom the problems, and observe the situation from different prospective.
Nowadays when we talk about design we can not more talk about top-down or bottom-up approach, but about Border-up approach, because the interaction with user will be help to generate the service borders (Zurlo, 2014).

I will explain PSSD principles starting from the thoery behind the book "This is Service Design Thinking" (Stickdrom & Shneider, 2010)
Product-Service System design could be considered the ability to design a sum of processes that involve multiple touchpoints and interactions. These, when combined, create service moments. These interaction could have different nature: e place human-human, human-machine and even machine-machine, but also occur indirectly via third parties (with other customers or via print or online media). It is important always considered the wider context in witch these interaction happened.
The service have to been structured considering three main steps: pre-service period (getting in touch with a service), the actual service period (when the customers actually experience a service) and the subsequent post-service period.
The method behind the service design it is systemic because it is important considered all the stockholder involved: from the user to the service provider. Furthermore it is based on the cooperation of co-operation of different disciplines towards the goal of corporate success through enhanced customer experiences, employee satisfaction, and integration of sophisticated technological processes in pursuing corporate objectives.
From all the disciplines that are involved in the process, marketing probably is the one that more complement the service design discipline. But it interesting to notice the difference between them.
Marketing is about organisations creating and building relationships with customers to co-create value; design aims to put stakeholders at the centre of designing services and preferably co-design with them.
Many tools used by designers are developed from marketing, but they are used in a different way. For example blueprints, service evidence, and a focus on the service encounter are use from designers to focus on individual users' experiences as a way into designing services. Of course designer added new tools to this list.
Other interesting difference between marketing and PSSD it is the approach in from of users insights. Marketing study customers to develop insights into their practices and values; designers can use insights as the starting point for design and add a focus to the aesthetics of service experiences. They have also a different projects approach. In marketing the has service development

is shaped by problem-solving; design professionals have an understanding of an iterative design process that involves exploring possibilities and being open to serendipity and surprise.

PRODUCT SERVICE SYSTEM DESIGN AND INNOVATION

The PSS innovation it is based on the idea of innovate the experience. As Vivay Kumar (2013) state: *"Focusing on the nature of experiences provides a perfect starting point for innovation."*
The idea of experience it is often related to software and technology industries, but it could be extend to every sector.
The key point to this kind of innovation have to found on the ability to observe the users in a wide prospective. The innovation have not to start from product centric prospective, but from the costumer activities related to the activity in witch the costumer it is involved when it is using a product or service. To do so it is important take in consideration all the component of the system. The "system" have to be considered as a set of interacting or interdependent entities that form an integrated whole which is greater than the a sum of its parts. For example if we want make an innovation related to the healthcare we need to take in consideration: patient, doctor, hospital, medical device manufacturer, medical supplier, insurance company, government, and so on.Innovators who understand how this larger system works can create and deliver offerings with high value. Let's think about the already cited iPod example. It became also more powerful if we considered all the System prosed by Apple, To arrive to develop a such wise-prospective innovation understanding and expanding the user experience it is a complex process that involve different disciplines.



graph.12 Interplay between company sectors

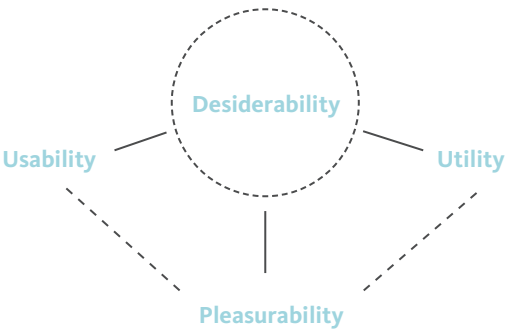
Product-Service Design approach take advantage from social science of ethnography, use observation and interaction with them to really understand people in the context in witch the product service system will be placed. This methods are also have to be also linked to more market research methods.
It is also important remember that this innovation process exist in parallel with other important process inside the industry and it important integrate it with it. PSS innovator need to synchronize the process from design, technology, business and other areas.

PRODUCT SERVICE SYSTEM DESIGN AND MEANINGS

About the relation between meaning and Product-Service System design Zurlo during its speech "Design delle opzoini" (2014) said

"All object and services need to have sense for someone. The interlocutor have to give a contribute"

We can state that the meaning of a service it is build around three main factors: utility, usability, pleasurability and desirability. The one that it is more relate with the "second order" meaning it is desiderability.
Utility it is about how the service work from a functional level, the usability it is how could be used. Usability is all about how easy it is to get to the offering (utility value) when using the service.
Pleasurability is about how the whole solution makes you feel.
Desirability it is more related to the design ability to create new meanings.
Desirability in a service fires desire in the customer and this is strongly related with the emotional dimension; often related to a pleasurable experience.
To do so it is important to build serviced from the point of view of the users.
Define and create desirability it is not. It is fundamental have a strong internal alignment, a strong brand and a good knowledge of managing design.
However, it is a very strong differentiator and gives a mind share amongst customers that can give a market lead for a considerable amount of time.



graph.13 Desiderability is made up of three basic elements

RESEARCH QUESTIONS

*Could the **technological innovation** be considered as an **input** for the **product language innovation** inside the **fast-paced technology industry**, from a **industry level** point of view?*

*How the **Product-Service System design approach** could contribute to "unveiling" the hidden potential of technology innovations to revel **"technology epiphanies"**?*

3 TECHNOLOGICAL CHANGES IN THE STAND-ALONE CAMERA INDUSTRY

3.1 The stand-alone camera industry. The reason of a choice

3.2 The technology transition of the Industry: from analogue to digital technology

3.3 The replacement of film camera with the digital camera

3.4 Action Camera: a successful but paradoxical case in single-lens camera market

3.5 GoPro market dominance: from a niche to a mass-market

3.2 THE STAND-ALONE CAMERA INDUSTRY. THE REASON OF A CHOICE

SETTINGS

The importance of design-driven strategy is growing also in technoglical fast-paced industries. As the technology is entering in every day habits the importance of design is growing in that sectors in witch the high frequency of technology innovation are becoming an inputs for new product languages proposals. As the technoglical evolution is becoming faster and interconnected also the design prospective is becoming wider and is no more related only to product itself. The consequence of these two factors is that technologies are opening new opportunities for design that go beyond the technoglical pliability (as described in the pag.n.) and influence the overall PSS.
To explore how companies are using design according to new technoglical inputs I decided to analyse a fast paced industry sector for two main reason:

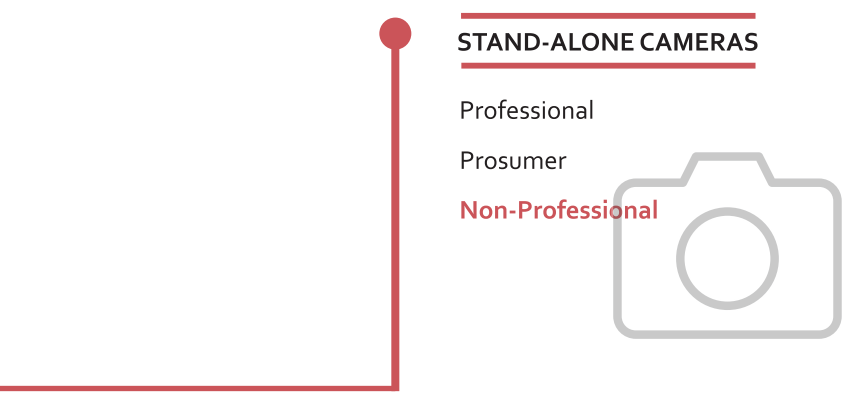
a) I wanted to better understand how design can have a strategic value in this new context that is becoming more relevant in everyday people life
b) I wanted to understand how the design discipline can take vantage from its application evolving itself and expand its boundaries.

After set that constrain I select the Camera System Industry characterize by a certain technoglical pace, an important relation with the external system. I will analysed what happened during the radical technological shift that move this market from analogue to digital.
Cameras have be employed in many context and its market its becoming more and more diversified (vedi grafico) after the digital transformation.

Products and sectors have been grouped in the seven main categories: automotive, camera and phones, Industrial, Medical, Scientific, Security and Surveillance, Tablet and PC.
Except from the stand-alone camera applications, surveillance and medical all the other application are the consequence of the digital camera introduction that. The IC industry's attention move from stand-alone photography solution to new application and embedded systems, not just for the opportunity revelled from these sectors, but also for the crisis of the stand-alone camera market. Despite annual stand-alone cameras revenue are in decline from 2007 this category result more interesting from for study the relation between technology change and the strategic importance of design for many reasons:

a) In applications as automotive, Industrial, medical, scientific, security and surveillance product design language does not play a relevant competitive lever
b) These sectors can be considered a new digital camera sensor application, but is not possible make a direct product comparison regarding the previous camera technology.
c) Camera phones, tablet and computer phone cameras can be considered competitors of this product category, and their introduction is the cause of stand-alone camera crisis. However, I decided to do not analyse in detail these product categories because their success is related also to other factors related to smartphone functionalities and performance not related to with the Image Capture Industry.

The technoglical change analysis will be made on the stand-alone camera category, with a focus on cameras for no-professional . In this sector I found particularly interesting the new meaning proposed by the Action Camera as a new typological product. Contrarily to the no-professional stand-alone market, they had a positive grow inside the market.



graph.14 Digital camera ndustry selection

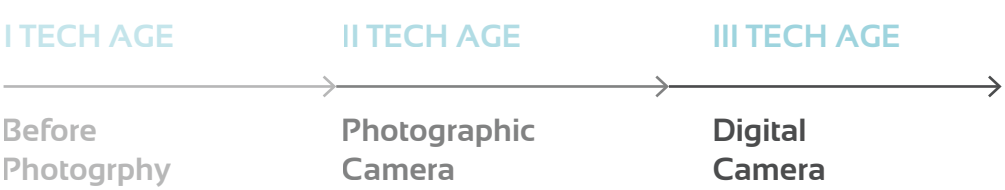
3.2 THE TECHNOLOGY TRANSITION OF THE INDUSTRY: FROM ANALOGUE TO DIGITAL TECHNOLOGY

TECHNOLOGICAL EVOLUTION OVERVIEW

A Camera is a device that is used to capture images in the form of still photographs or as sequences of moving images (movies or videos). Most cameras had a lens positioned in front of it and it works as an entrance for the light of the visible spectrum (some special cameras for specific use could use also other portions of electromagnetic spectrum). The lens aims it's to gather the image that have to be capture or the recording surface. Once the light entered from this "aperture" it reaches a recording or viewing surface in which the light it is captured and fixed.

During the camera history, there were three mains radical technoglical changes on the image support. These changes strongly influenced the camera evolution that can be split in three main camera "ages": camera obscura, photographic camera and the digital camera. Between these discontinues changes we can found different technological In relation of these main improvements different typology of cameras were introduced both for professional and no professional costumers market.

In the following sections I will analyse in a chronological order all the technoglical changes (with their consequence on camera use and market dynamics) and the related cameras design introduction.
Because of the case study that I will analyse regards the digital technoglical shift I will make a focus on that technoglical change.



I TECH AGE

BEFORE PHOTOGRAPHY

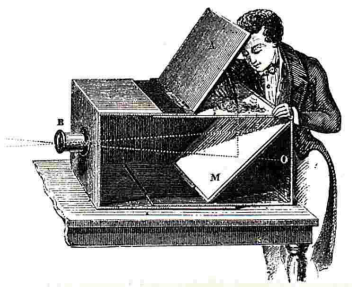
Camere Obscura (From ca. 400 BC)

The history of camera started before the introduction of the first fixed images (1816). The name "camera" in fact derive from the Latin camera obscura that mean "dark room" and it referred to a natural optical phenomenon: a define scene could be projected on a surface if between it and the scene there is a screen with a small hole that works as an opening that allow to generate on the opposite wall an inverted image of the scene (left to right and upside down). The oldest demonstration of the knowledge of this phenomenon date back to 4th-5th century BC from a record made by Mozi a Han Chinese philosopher (Rovere, n.d.).

Before the invention of photographic processes the only way to fix the project image was to trace it. With this propose were built cameras with room-size dimension (figure 3.2) witch the space for one or more people inside.

Italian polymath Leonardo da Vinci (1452–1519), wrote the oldest known clear description of the camera obscura in mirror. The cameras gradually evolved into more and more compact models and in 1685 Johann Zahn envisioned the first camera obscura compact enough to be piratical for photography. They passed at least 150 years before this application became possible (Rovere, n.d.).

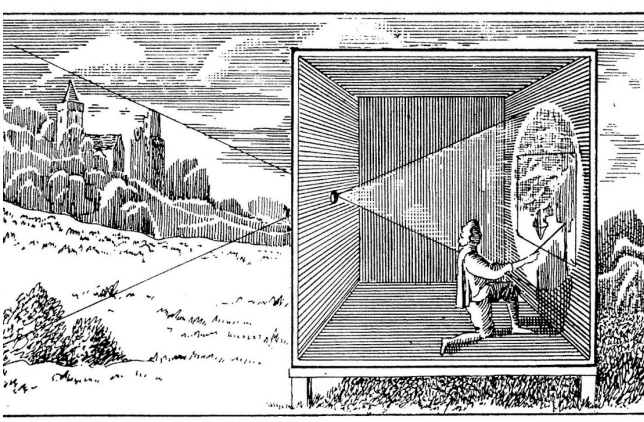
By the 18th century, following developments more easily portable models in boxes became available. These were extensively used by amateur artists while on their travels, but they were also employed by professionals.



USE

This technique was used from artists as drawing aid

fig.7 Camera obscura used for drawing



II TECH AGE

PHOTOGRAPHIC CAMERA

The incremental innovation inside this "era" regards three main areas: image support innovation, case and lens innovation and general innovations. In the following section I will analyse chronologically these innovations, pointing out their consequence in terms of: use and camera design.

First fixed images (1820)

TIn 1816 a French inventor called Nicéphore Niépce (figure 3.3) made the first partially successful photograph of a camera image (Beaumont,1982; Stroebel & Zakia, 1993).
He fixed an image on a paper coated with silver chloride that was placed inside a small camera of his own making, but once the paper was exposed to light it became dark. The photography was not yet permanent. In 1820 Niépce was able to save the first photograph (figure 3.5) using a plate coated with Bitumen of Judea place inside a wooden box camera made by Charles and Vincent Chevalier, two Parisian opticians. The bitumen became hardened in the brightest areas of the image and then removed.

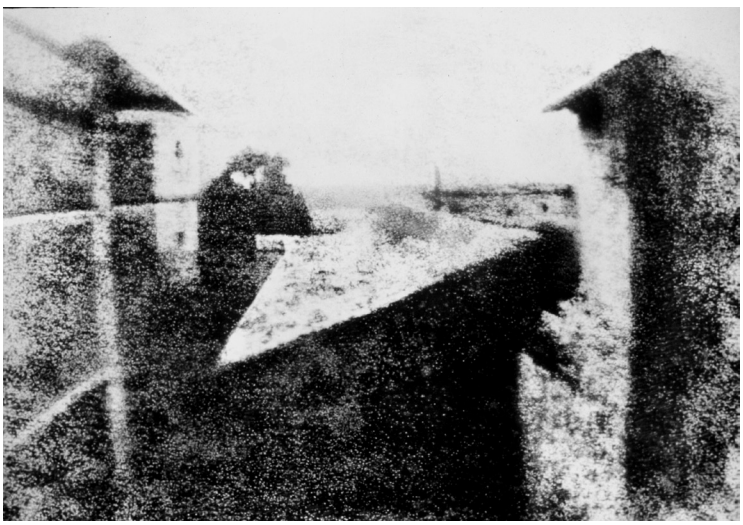


fig.8 First successful photograph

Daguerreotypes and calotypes (From 1839)

The work of Niépce was continued from his partner Luis Daguerre that was able to develop the first practical photographic process. He named this process daguerreotype, that was unveiled to the public in 1839 (Dorothy, 1999). The plate were made by silver and traded with iodine vapour that make it light-sensitive. These plate were place inside the camera in witch the exposure happened. The following process of image developing was realized with mercury vapour and fixed with a strong solution of ordinary salt.
This was not the only process available in that period, indeed in 1840 Henry Fox Talbot in parallel improved a different process called calotype. Both process use similar simple cameras composed by two nested boxes with high-quality achromatic lens as a standard.

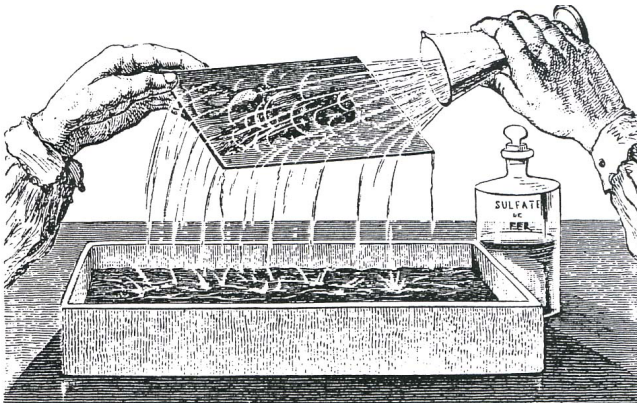


fig.9 Daguerreotype process

TYPE OF CAMERAS PLATE CAMERAS

These invention started the first significant production of cameras that used sensitive glass plates and were called plate cameras.
These simple box cameras could be found with single-lens reflex camera with interchangeable lenses. These lenses could be controlled to adjust the prospective.
With these cameras was possible to adjust the focus. A removable ground glasses screen place in the rear box could be slide in and out. After the focus setting the glasses was replaced by a light-tight holder containing the sensitized plate or paper and the lens capped. Because lens design only allowed rather small aperture lenses, the image on the ground glass screen was faint and most photographers had a dark cloth to cover their heads to allow focussing and composition to be carried out more easily.
When focus and composition were satisfactory the photographer had to remove the cover of the plate and untapped the lens and wait the right time (minutes) decide by him according to the lighting conditions. Finally he had to place again the cap and cover the holder. In 1841 Peter Voigtlander designed and manufactured an all-metal daguerreotype camera with a new fast achromatic lens enabling portrait photography.

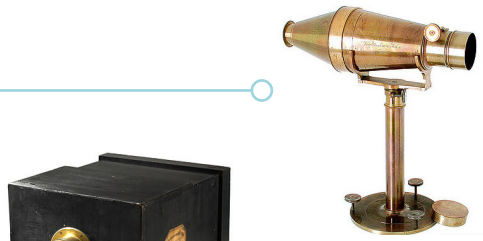


fig.10 Examples of Plate Cameras

USE

Mainly used for landscapes or portraits (fig.11)

Dry Plates (From 1871)

A fundamental step on the evolution of photography was the introduction of the Collodion dry plates allowing a faster exposure. The need of tripod for support were no more necessary making possible the development of a hand-held cameras, the diffusion of amateur photography and the consequence proliferation of different camera designs.

The first collodion dry plates were introduced by Désiré van Monckhoven since 1857, but the emulsion needed for these plates had still to be prepared inside a darkroom by the photographer in their own (John, 1979). The real diffusion of the photography started thanks to the introduction of the gelatine emulsion from Richard Leach Maddox in 1871. This invention makes possible the commercialization of already prepared plates, that photographer can easy buy and use.

The dry plates compete with dry plates in terms of speed efficiency and quality. This material improves the allowed to reach the "instantaneous" snapshot exposures practical. Thanks to the increase sensitivity small cameras could be handed by hand while taking picture with daylight, it means that supports as tripod were no more absolute necessary. Another consequence of the improvement on the exposure time implied the introduction of the shutter. This invention was a separate accessory and will be integrated to the camera at the end of the 1800.

All the consequence of these innovation were fundamental for the diffusion of the informal portrait picture drive by the growing number of new amateur photographers.

The plate cameras remain popular until the 20th century for the high-quality performance.

fig.12-11 Gelatine Dry palte box by Eastmans and cameras examples

TYPE OF CAMERAS PLATE CAMERAS

With diffusion of photography there were also a proliferation of camera design: single lens cameras, twins-lens cameras reflex, large filed cameras, folding cameras, small box cameras and even "detective cameras" that were disguised as pocket watches, hats, or other objects (John, 1979).

The more modern inexpensive plate cameras

were equipped with magazines to hold several plates at once as a answer to the compete with the roll film cameras. There were also proposed some hybrids that with a removable special backs allowed to use films packs or roll film.

With these cameras was possible to adjust the focus. A removable ground glasses screen place in the rear box could be slide in and out. After the focus setting the glasses was replaced by a light-tight holder containing the sensitized plate or paper and the lens capped. Because lens design only allowed rather small aperture lenses, the image on the ground glass screen was faint and most photographers had a dark cloth to cover their heads to allow focussing and composition to be carried out more easily.
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USE

Mainly used for landscapes or portraits (fig.13)

Film
(From 1885)

The introduction of photographic films was fundamental for the introduction of relative low-price cameras attracting the average costumer. Photographic film is a strip or sheet of transparent plastic film base coated on one side with a gelatine emulsion containing microscopically small light-sensitive silver halide crystals. The sizes and other characteristics of the crystals determine the sensitivity, contrast and resolution of the film. George Eastman started to manufacture paper film (figure 3.) and he sold in 1885 his first photographic roll film (biography.com). In 1888-89 he move this production on nitrocellulose, a highly flammable called also "celluloid" with the release of the first transparent plastic roll film. He called its first camera "Kodak" (figure 3.n) and it was sold in the market in 1888. This camera was pre-loaded with a film that could be used for 100 exposures. Once the rolled was finished it have to be sent back to the factory for processing. It was a simple box camera with a fixed focus lens and a single shutter speed. In 1900 Eastman introduce the concept of "snapshot" with the Brownie, a simple and inexpensive camera that allow to take shot in a fast and easy way. This model was so popular that its variants remained until 1960s. Commonly considered imperfect or amateurish it opened the photography to the world everyday life subjects. The film was important also for the movie camera development that became less expensive and more practical.

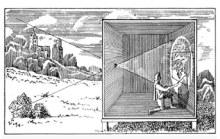
fig.14 Kodak film camera examples

TYPE OF CAMERAS BOX CAMERA & FOLDING CAMERA

The first film camera proposed to the market the "Kodak" was a box camera. These cameras was so successful that was produced until 1960s as the Brownie variants. In the market were also available special backs for cameras enabled roll film cameras to use plates.The film introduction allow to reduce the existing design of plate cameras dimension and to hinged the base-plate that could be folded up compressing the bellow (figure 3-n. 3-n). These design was used for very small models called vest pocket cameras.

USE

"Snapshot" concept born with film cameras



35mm (From 1913)

The 35mm film descend from the 35 mm film used for motion pictures. It allow the development of compact cameras capable of making high-quality enlargements. From its introduction it received a high success as an high-end compact camera. Even if after 10 years from it lunch it became accessible also for the mass market the roll film remained the format of choice for this market.
A number of manufacturers started to use 35mm film for still photography between 1905 and 1913. The first 35mm cameras available to the public, and reaching significant numbers in sales were the Tourist Multiple, in 1913, and the Simplex, in 1914. But the most successful story of these technology application stars from Oskar Barnack, a Leitz research and development employ, that tried build a compact camera using the 35mm cine film (Leica, n.d.). He built the first prototype around 1913, but cause to the World War I its development was stopped until the end of the War. The Leitz commercialized the first 35mm camera with the name of Leica I in 1925. The success was immediate and a lot of competitors adopt the same technology. It is with these technology that Japanese camera Industry started to became famous in the West, indeed soldiers stationed in Japan or coming back from the Korean War brought back cameras as the Canon 35mm and Kawnon. In 1935, Kodak introduced the first modern "integral tripack" color film and called it Kodakcrome.

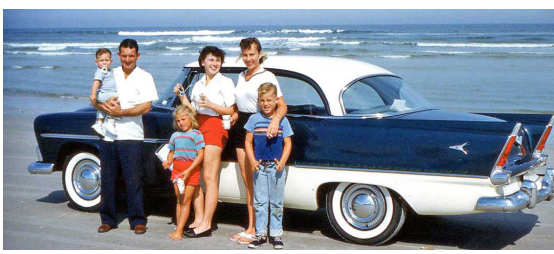
fig.14-15 35 camera examples and roll-films

TYPE OF CAMERAS COMPACT-CAMERA & RANGEFINDER CAMERA

Contaxt introduced in 1932 a 35 compact camera for the high-end market. Kodak entered into this market with a more inexpensive camera in 1934: the Retina. Kodak in 1939 introduced the Argus C3 that gain a great success. (it was produced for 27 years). The cheapest cameras continue to use the roll film. The rangefinder camera it is another type of camera in witch was applied the 35mm film, became common between 1930s and 1970s (though there were also roll film models). These cameras had a more advanced lens technology that make the focusing action more precise.

USE

Used both for "snapshot" and more professional photos



TLRS and SRLS (From 1935)

The reflex cameras could be considered costumer professional cameras, and despite they were available from decades, they had not a great diffusion for they not comfortable dimensions. They popularity started to rise around 1935 thanks to the diffusion of more compact models. The SLRs are particularly important because with them companies as Nikon started to sell these cameras as a system composed by cameras, components and accessories (Kingslake, 1989).

The first practical reflex camera was the medium format TLR, Franke & Heidacke Rolleiflex from 1928. It had a widespread popularity both in high and low end cameras. In 1933 were introduce a compact SLR camera that used a 127 roll film and few year later the Kine Exakta was the first camera using 35mm film (Kingslake, 1989).

After the World War II there was a incredible diffusion of the 35mm SLR cameras and a lot of improvement were made around this type of cameras. Important technoglical improvement were: eye-level viewfinder (first appeared in 1947 on Duflex), the instant-return mirror (always from the Duflex).

Japonese companies as Canon, Yashica and Nickon enterd in this market with a lot of success.

Particularly interesting is the case of Nikon that with the Nikon F series proposed also a high range of components and accessories becoming the first system camera (The Legendary Nikon mount, n.d.). This series with the S series if rangefinder cameras helped Nikon to built its reputation of professional-quality equipment maker.

fig.15-16 Examples of TLRS and SRLS camera

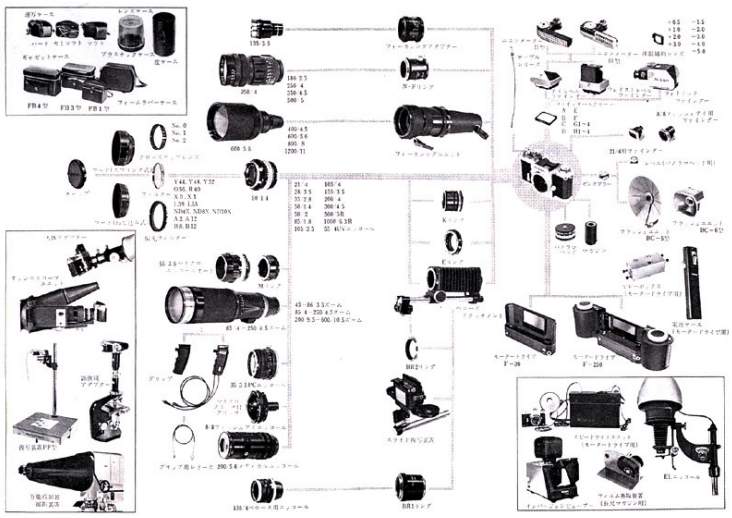


fig.17 First Nikon Camera System

NIKON F SERIES

The first system camera with an high range of components and accessories.

Instant Camera (From 1948)

An interesting case of technoglical change in the camera industry was the introduction of the instant –picture camera in 1948 with the Polaroid Model 95. These cameras used a patented chemical process that allow to print a negative paper that in less then one minute of exposition became a positive print (Archambault, 2015).
Despite a relative high price these cameras reach a huge success and in 1960s Polaroid proposed dozen of models, for example the Model 20 Swinger of 1965 was a top-selling camera of all time. The target that Polaroid tried to reach was the popular market.

fig.18 The successful Model 20 Swinger

USE

Used both for "snapshots" and artistic use (fig. 19)

Automation (From 1960)

Until now we talked about cameras that work in easy way like the snapshot cameras proposed by Kodak or more complex cameras to use as the SRL. In both case all the camera movement were mechanical, but around 1960s with the rise of low-cost electronic components cameras started to be equipped with automatic exposure systems. The first automatic exposure camera was already introduce in 1938 by Kodak with the Super Kodak Six-20 pack, but the high price of the component make it to expensive (Milestone, n.b.)
In 1960 the Mec 16 SB subminiature introduce the first light metric behind the lens that allow a more accurate metering, and it became important especially for the SLR cameras.

fig.20 First utomatic cameras

Disposable (From 1980)

The disposable camera also called single-use camera is a box camera made to be use once and it is cheap.
These cameras are different from the reusable camera because most of them did not have an actual cartridge, they the film is wended internally on an open spool; it means that all the camera is handle for processing. Most of these cameras are recycled .
These cameras are mostly used in a situation in which a reusable camera could be stolen, damage or forgotten (or if a regular camera cannot be afforded). They had a high success during 1980s and 1990s and many versions were proposed to the market as the waterproof versions.
The first attempts to commercialized a similar concept go back to 1949 with the production of a cardboard camera from the Photo-Pac company. These cameras had the propose to avoid missing the opportunity of take the right picture in the right moment because the cameras in that theme were expensive and often left safety at home. Despite they was able to place a 35mm film in a inexpensive case, it was not able to convince the market (Disposable America, n.d.).
The first disposable cameras that gained a great success were introduced by Fujifilm in 1986. Their QuickSnap line used 35mm film. Kodak follow the success of these camera, first proposing a 110-film camera to move to a 35mm version in 1988, renamed as FunSaver in 1989.

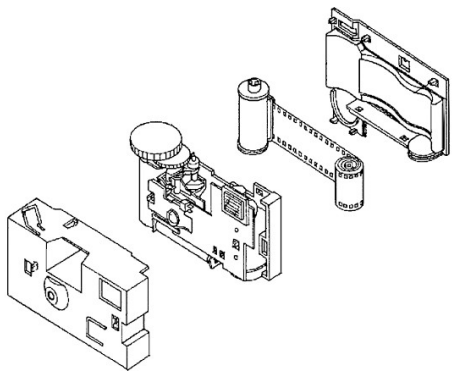


fig.23 Fujifilm expoded diagram

fig.21 Examples of disposable cameras

USE

Used for "snapshot" where there were the risk of camera breaking (fig.22)

III TECH AGE

DIGITAL CAMERA

INTRO

In this "era" section the technological progress will be analysed in a different way because they did not follow the evolution logic of the previous one. The incremental changes are many, fast and heterogeneous. The digital camera are different from plate and film cameras because they capture and save the images on a digital support as memory cards, internal storage or cloud computing. These cameras nowadays are also equipped by wireless technologies as Wi-Fi and Bluetooth that allow to communicate with other devices for image transfer, print or share. Even if the time analysed is shorter compared to the previous "era", the technoglical innovations are a lot and heterogonous. For that reason, I will organize this section in a different way. I will adopt a milestone approach in which I will show all the technological progressions with pivotal product proposals and pointing out how these evolution is strictly connected with a parallel evolution of a technoglical environment. In a second part I will list the type of cameras available in digital "era because the fast technoglical patch described before it is useful to understand the pivotal product proposal, but is not directly linked with the final camera typologies affirmed in the market. The digitals shift allow the development of different type of camera that mainly are improvement or the existing camera typologies introduced during the photographic camera "era". However the new technology allow also the introduction of new camera types.

Technolgy Evolution

Pivotal Products and External Systems

Camera Typologies

Product features analysis and relative use

Origins

The idea of capture digital images come from a Eugene F. Lally with the porpuse of take picture of plantes and stars during space travelling in order to establish astronauts' position.
In 1972 Wills Adock's a Texas Instrument employe develope the concept od the first filmless camera (US patent 4.057.830), but there are not prove of its effective realization (Trenholm
2007).
The first recorded attempt of a self-contained digital camera construction go back to 1975 by a Eastman Kodak engineer called Steven Sasson. His prototype (US patent 4.131.919) was a technical exercise not intended for production (Präkel, 2009)
. It was composed by some Motorola parts with a Kodak movie-camera lens and some newly invented Fairchild CCD image sensors chips developed by Fairchild Semiconductor in 1973. This first digital camera attempt was able to record black and with images in a compact cassette tape with a resolution of 0.01 megapixels. Its weight was 3,6 kg and ti took 23 second to capture its first image.

1975

Steven Sasson with the first digital camera prototype

fig.24

1981

Analog Electronic Cameras

The technological shift from film to digital cameras was not immediate, but before the introduction of the first digital camera there were a transitory period of Analog Electronic Cameras.
In 1981 Sony introduced the Sony Mavica (Magnetic Video Camera) that essentialy was a video movie camera able to record single frames. The image quality was comparable with the television of the period. It works recording pixels signals continuously as videotape machine without convert them to discrete level. They signals were recorded on a video floppy (Nakamura,2005). The first analogue cameras commercialized were the Casio VS-101 and the Nikon QV-1000C in 1987. They were used as press camera and sold in a small quantity.
Their cost were very high and the image quality low compared to the film cameras, in addition to print these photos a complex set of expensive instrument was needed. In 1988 was proposed the first consumer analog camera Ion (called Xapshot in America and Q –PIC in Japan). To use it were still needed different software and a specific battery that make the camera price rise.

fig.25 First analog cameras

EXTERNAL SYSTEMS

In 1981 the images were recorded on a 2×2 inch Video Floppy and to be print that images was need a frame grabber, which was beyond the reach of the average consumer. The floppy images could be visualize on different reader device but a computer interface card with software were needed. The floppy disk was palced on the back of the camera box.

fig.26 Mavica and video floppy

1988

Images started to be recorded as computerized files

The Fuji DS 1P was the first camera that record images as a computerized file (1988). The image were saved in a memory card and to keep the data in memory it need a battery. This camera was never marketed to public.
The first digital camera that actually go on sale was the Dycam Model 1 in 1990. It use a CCD image sensor, it stores picture digitally in a memory card and could be connected to a PC for download. It was a commercial failure for its high cost and the black and withe picture resolution.
The first successful market success was reached by the Kodak DCS (Kodak Digital Camera System) in 1991. It opened a long line of professional Kodak DCS SLR cameras.

fig.27 Dycam Model 1

EXTERNAL SYSTEMS

The image were saved in a SRAM internal memory card and they could be download on a PC.
In 1988 the JEPEG and MPEG images file standard were allowing image and video file to be compressed for storage.
In 1988 the first image-manipulator program called Digital Darkroom was launched for Macintosh computer and in 1990 Adobe PhotoShop 1.0 was release on the market.

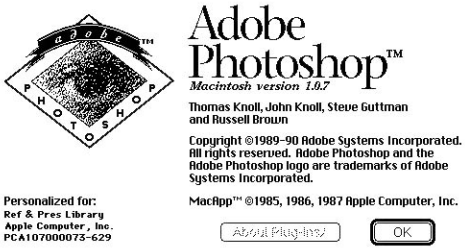


fig.28-29 First editing softwares

1992

Camera without hard drive

In 1992 was introduced the Kodak DCS 200 with a built-in hard drive. It was based on the Nikon N8008s and came in five combinations of black and white or colour, with and without hard drive (Trenholm 2007).

EXTERNAL SYSTEMS

In 1992 the Mosaic browser allow users to view photograph over the Web. It was release from the National Center for Supercomputing Applications (Trenholm 2007).

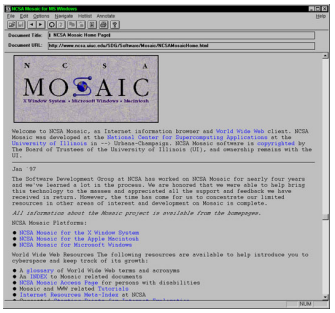


fig.30-31 Camera without hardrive and Mosaic the fisrt browser for see picture

1994

Colour digital camera release for consumer-level

Apple launch in 1994 the QuickTake 100, manufactured by Kodak. It packed 650x480-pixel CCD and take 24-bit colour picture. It could store eight image in tis internal memory. The next version was called QuickTake 200 and manufactured by Fujifilm. It was sold under $1000.

EXTERNAL SYSTEMS

QuickTake 100 and other cameras launched in these years were the first consumer-level cameras that worked with a home computer via a serial cable.

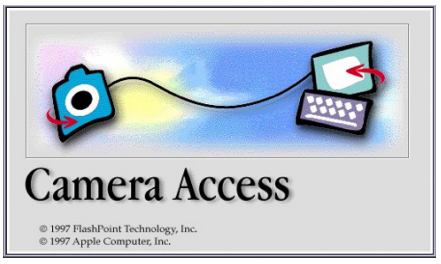


fig.32-33 First color camera for costumers and QuickTake software

1994
Connected Cameras

In 1994 the Olympus Deltis VC-1100 became the first world digital camera with a built-in transmission capabilities. With a modem connected photos could be transmitted over phone or mobile lines. The transmission of a high-quality images took around six minutes. (Trenholm 2007).

fig.34

EXTERNAL SYSTEMS

In 1994 arrived the fist quality' desktop inkjet: the Epson MJ-700V2C that manged 720z720 dots per inch.

In the same year was introduce the CompactFlash card (used for the first time in 1996 from Kodak DC-25).

fig.35

1995
LCD screen

The Casio QV-10 launched in 1995 was particularly important in term of design. Indeed this camera open the street for the compact camera as are known nowadays. It had placed on its back an LCD screen that measured 446mm from corner to corner. It was able to capture 96 colors still images and stored the picture in a semiconductor memory. (Trenholm 2007).

fig.36

1995
Camera records video and sound

In 1995 the Ricoh RDC-1 was the first camera capable to shoot both still photos and movie footage with sound appeared. It had a removable LCD screen (Baldrige 2013).
2007). The CCD packed a 768x480-pixel resolution, while the zoom clocked in at 3x and f/2.8. More than a decade later and those are still the baseline specs for compacts. It was sold at $1500..

fig.37

1999

SLR digital camera

1999 was the introduction of the Nikon D1, a 2.74 megapixel camera that was the first digital SLR developed entirely from the ground up by a major manufacturer. It a cost of under $6,000 at introduction was affordable by professional photographers and high-end consumers.

fig.38

1996

Compact Camera shape

In 1996 the Canon PowerShot 600 settled the shape of compact cameras as are known nowadays and it cost $949. It had a 1/3-inch, 832x608-pixel CCD, built-in flash, auto white balance and an optical viewfinder as well as an LCD display. It was the first consumer digital camera able to write images to a hard disk drive, and could store up to 176MB (Baldrige 2013).

fig.39

2005

Built in Wi-FI

Kodak EasyShareOne one was the first camera with integrate Wi-Fi. It was a flop because the conroll were not easy to understand and at the time Wi-Fi were not so spread (Baldrige 2013).

fig.40

2010

3D CAMERAS

Tthese cameras are able to capture stereoscopic images to recreate the 3d depth effect. it was introduce from the first time in 2010 first by fuji and than from sony with respectively the models: fujifilm finepix real 3d w and cyber-dsc tx7.

fig.41

360 CAMERAS

360-degree videos are photos with an image that have an every direction view. they are shot in different ways: using omnidirectional cameras, with a collection of cameras or with handheld dual-lens cameras.
Companies as Gopro (Omni and Odyssey model), Nokia (Ozo model), Facebook (Surround 360 model) and Axon (Azilpix studio.one model) are producing omnidirectional cameras. handheld dual-lens cameras are ricoh theta s, samsung gear 360, garmin virb 360.
360 images are made using a technique called stitching that allow to merge separate images in a spherical photo or video, usually rendered in a 4k resolution. to make the experience more real are used binaural sounds

fig.42 Examples of 360 cameras

EXTERNAL SYSTEMS

These video could be watched on different devices: personal computer, mobile devices or dedicated head-mounted devices. To observe these videos on the screen the scene can be moved using the mouse. In the case of smartphone the scene move according to the device movements thanks to the gyroscope sensors. These technique is used also from head-mounted devices as google cardboard and samsung gear vr. They have an headset enclosures in witch a smartphone can be inserted into, for viewing this content in a virtual reality format. In 1994 apple's introduce the original interactive panorama format that can be seen using apple's quicktime software. nowadays there are a lot of different players and plug-ins.

fig.43-44 Head mounted deviced to see 360 images

360 CAMERAS

VR photography (or virtual reality photography) it is similar to the 360 degree photography but it allow an interactive view of the image. As in 360 degree photography the image it is composed stitching together the photographs taken with a 360 degree rotation or it is even possible use computer-generated effect or insert computer generated objects.

EXTERNAL SYSTEMS

To an immersive experience inside a VR reality different accessories are needed.
The viewer or glasses are needed as a screen to the real user world and as projector of the virtual world. Thanks to gyroscopes sensors if the user move the head it can see different space inside the VR world, perceiving the action the moving also in the virtual world. The sounds it is reproduced by headphones.
Wired Gloves as substitute of mouse, keyboard or joystick are used to generate inputs in to intersect with the VR word. Finally a cybertuta can be wear to simulate the sense of touch and make a san of user body that could be project inside the virtual environment.

fig.45-46 VR cameras examples and Head mounted deviced to see 360 images

TYPES OF DIGITAL CAMERAS

The digitals shift allow the development of different type of camera that mainly are improvement or the existing camera typologies introduced during the photographic camera "era". However the new technology allow the introduction of new camera types.

360 Camera

fig.47

fig.48

These cameras can take picture or videos in 360 degrees using two lens back-to-back shooting at same time. They had Wi-Fi or Bluetooth that allow live streaming sharing. They images are in 4k quality. Some of these camera are resistant and can be used as Action Camera.

USE

Not well define, mostly for action (fig.49)

Action Camera

fig.50-51

These cameras are rugged, small and thanks to a wide range of accessories they can easily attached on helmet, arm, bicycle, etc. They have a wide angle lens with a fix focus and they could take picture and videos with sound. Many of the last models are equipped with sensors as GPS, compass, barometer and altimeter.

USE

Film themselves during action and share on social medias (fig.52)

Bridge camera

fig.53

These cameras are ecstatically similar to DSLRs . They share some features with these cameras but as compact cameras the use fixed lens. From 2014 they are divided in two principal classes in terms of sensor size: 1/2.3" sensor that give flexibility in lens design and allow for and handhold able zoom; and the 1" sensors that allow better image quality but generate more constrains on lens design.

USE

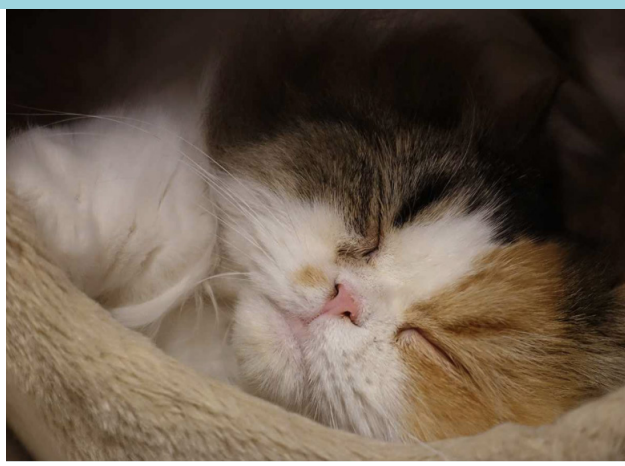
It can be used for outdoor photos. They made no professional-quality pictures. (fig.54)

Compact camera

fig.55

Compact cameras are little and portable and could be sell bot for high-end and low-end market. There are also some variant called ultra compact cameras for their even smaller dimensions. They are designed to be easy to use and generally are provide by and "auto mode" that setts automatically the camera to take the picture. Many of them have a retractable optical zoom and a LCD screen to live preview.
Most of these cameras are able to record videos.
In the market could be founded compact cameras with extra sensors as: GPS, compass, barometer and altimeter.

USE



They are particularly suitable for casual "snapshot" and no-professional photos (fig.56)

Rugged compact camera

fig.57

Major camera manufactures have at least one product in this category. Rugged compact cameras include protection against submersions (waterproof), hot and cold conditions (hotproof and coldproof), shock (shockproof) and pressure (crushproof).
Even if they lacked some features of ordinary compact cameras they can record video and sounds. They are often equipped with image stabilization, built-in flash, LCD touchscreen and GPS.

USE

These cameras are used to take picture in extreme and dangerous situations. (fig.58)

Digital rangefinders

fig.59

The rangefinder camera use a device called range finger that allow to misuse subject distance from the subject to accordingly adjust the focus. This terms is used to define al cameras with a visually-read out optical rangefinder based on parallax.

USE

They are particularly suitable for “street photography” (fig.60)

Digital single-lens reflex camera

fig.61

Digital single-lens reflex cameras (DSLR) use a reflex mirrors.
These cameras have much larger sensors than other types. These characteristic permits to receive more light for each pixel, and thanks to the relatively large lens allow these cameras to have low-light performance.
They had interchangeable lens systems

USE

They are professional cameras, particularly good performance in low-light situations (fig. 62)

Digital Single Lens Translucent camera

fig.63

Digital single-lens reflex cameras (DSLR) use a reflex mirrors.
These cameras have much larger sensors than other types. These characteristic permits to receive more light for each pixel, and thanks to the relatively large lens allow these cameras to have low-light performance.
They had interchangeable lens systems

USE

They are professional cameras, particularly good performance in low-light situations (fig.64)

Mirrorless digital camera

fig.65

The Mirrorless cameras were introduced in 2008. They have interchangeable lens. They are easy to use and more compact DSLRs because they do not use reflex systems. They use an electronic viewfinder that fast consume the battery energy.

USE

They are used both from professional and no professional photographer.
(fig. 66)

3D compact camera

fig.67

USE

They are more used to take 3D photos

These cameras had sensor and shooter incorporate into the lens module. Some of these cameras are called lens-style cameras and are used as add-on camera modules for smartphones. They miss the control because they can be used by the smartphones.

Modular camera

fig.68

USE

They are more used as a complement for smartphones.

From 2011 some compact cameras are able to take 3D still photos. The 3D panoramic photos are taken thanks to a dual camera or a single lens. It is possible play back these pictures on a 3D TV.

STAND-ALONE CAMERA TYPOLOGIES INTRODUCTION TIMELINE

I TECH AGE
Before Photogrphy

II TECH AGE
Photographic Camera

III TECH AGE
Digital Camera

1839 Wet Plate Camera
1871 Dry Plate Camera
1889 Point-and-shot Camera
1914 35mm Compact
1928 35mm Reflex
1948 Instant Camera
1980 Automatic Camera
1980 Disposable Camera
1988 Eletronic Camera
1991 Digital SLR
1996 Digital Compact
2004 Mirrorles & Digital Action Camera
2010 DSLT & Digital 3D Camera
2015 360 Camera

★ Professional
▲ Prosumers
● No-professional

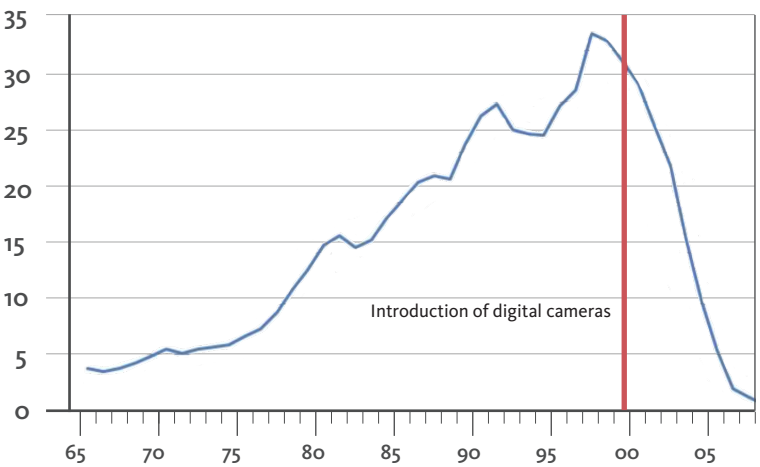
PLATES | FILMS | DIGITAL MEMORY

3.3 THE REPLACEMENT OF FILM CAMERA WITH THE DIGITAL CAMERA

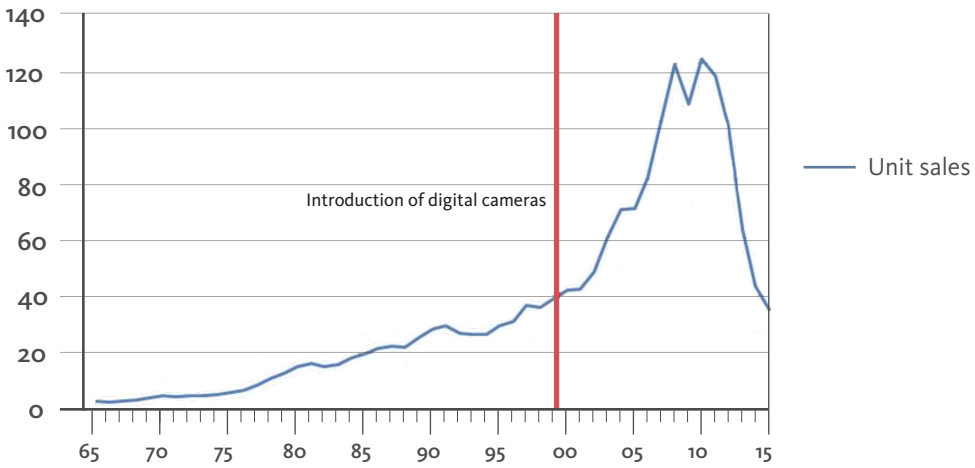
DIGITAL CAMERAS KILLED FILM MARKET IN JUST 3 YEARS

The introduction of digital cameras in the stand alone camera market had a tremendous impact in term of sales growth. Looking at CIPA data related to camera sale in a historical prospective (grph.n) can be noticed that before the introduction of digital camera in the market (in the last period of 1999) the market had a steady growth. In 2001, after three years from its introduction, the unit sales grow dramatically (Stirr, 2017).
The technological shift from analogue to digital camera have a fast and erosive effect on the film camera market. Since 2003 digital cameras have outsold the old market. In 2004 Kodak, that in 1980 -1990 control 90% of the photo film market share (Aimit K, 2013), announced in January 2004 that company would stop to sell Kodak-branded film cameras in the developed world (Cook, 2014). In 2008 the film camera market could be considered dead (Stirr, 2017) as can be observed in graph n.

Graph.15 Total camera sales 1965-2015
Unit sales (millions)

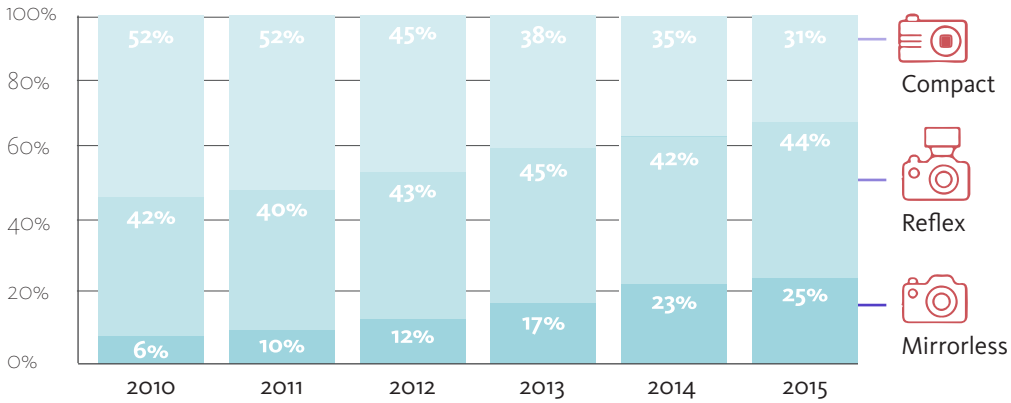


Graph.16 Film camera sales 1965-2008
Unit sales (millions)



Digital Compact-camera market fast growth and fast drop down

After 2001, for six years the digital camera growth was exponential with a production growth that from around 15 million (in 2001) arrived to more than 100 million in 2007. However, after 2007 the annual revenue for stand-alone digital cameras started to decline. Even if in 2011 the market had a new positive peck reaching a positive peak of 143 million units shipment (IC, Insight, 2012) the digital-stand alone market started a rapid decline.
Looking at the proposition of the graph made by made Heino Hilbig according to CIPA (Camera & Imaging Products Association) data it is possible better understand that digital compact cameras are the one that had a bigger impact inside this market. From the graph, it is also clear that with the change of landscape in the camera market started in 2007 they became the bigger victims (Zhang, 2014).
DSLR cameras and mirrorless camera, that represent the niece of professional costumer cameras haven't been affected as much. In 2013 the chris of reflex cameras shipment sign a -19% and even it is a very negative trend can not be compared with one of compact cameras that arrive to -40% and if we compare this data to 2010 there were a loss of -60% (Dphoto, 2013).
User's research of Idealo (Graph.n) show that Compact Cameras is dramatically drop down in favour of Reflex and Mirrorless cameras. If in 2010 the digital compact cameras generate an half of the demand, in 2015 they general a third of the general demand. It seem that the tendency is moved on professional and semi-professional model (DSLR and DSLM).

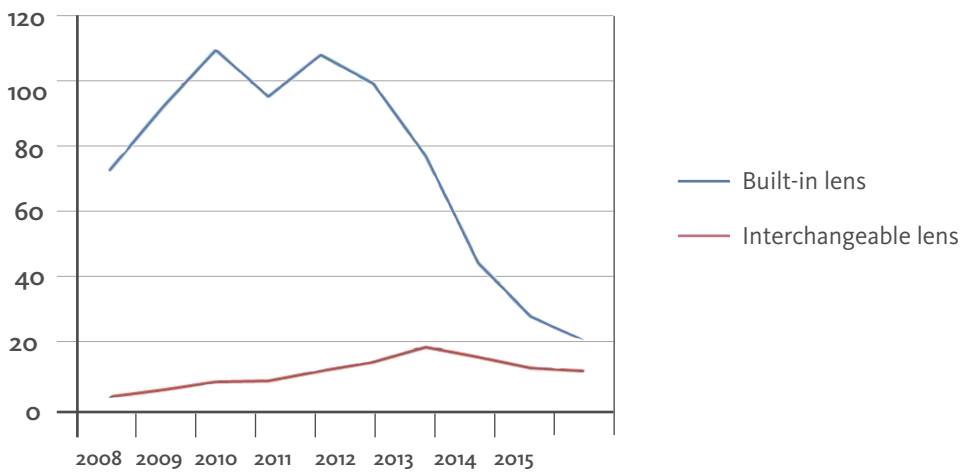


graph.17 . User's research of Idealo

However the crisis of compact cameras cannot be directly related on this shift on interest for three main reason:
a) both camera types market are in crisis (graph.n)
b) the unit shipment volume of the compact cameras (built in-lens camera) it is totally different compare to the one of DSLR and DSLT (graph.n)
c) the relative stability of the c it is related to their characteristics that make them a professional nieche market product (Primi, 2015)
The radical shift on interest from compact cameras to reflex camera indeed could be justify to the huge crisis in the compact camera sector that make this no-professional costumer product almost disappeared.

Graph.18 Built-in lens vs. interchangeable lens camera unit sales

Unit sales (millions)



Smartphone digital camera impact on no-professional digital camera market

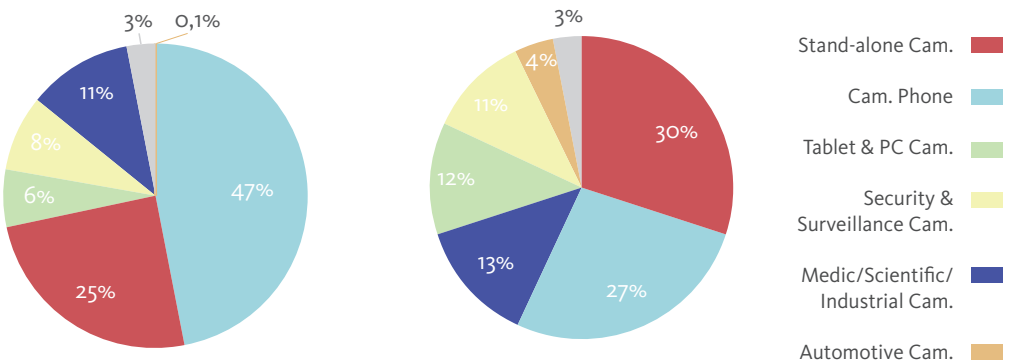
The decline of compact camera market segment it is considered from different studies related to the integration of digital cameras on smartphones (Zhang, 2014; Osawa, 2013). IC insight research on the evolution of camera system market show how the digital camera market became more and more diversified (from 2012 to 2016). The digital cameras are sold in different market segment and the importance of many of them are growing. The most impressive data regards the stand-alone market and the camera phone market that respectively lost 20% of market share (from 47% to 27% of sale) and gain 5% of market share (from 25% to 45%). These data give a first overview of how the digital camera application on smartphone are become the most important in the digital camera market.

As we seen on the previous section the compact camera have without doubt had more signify importance in the market during these years and as well it is also the category most affected by this crisis. For that reason it is important understand the relation between these kind of camera and the smartphone one, in terms of performance and use.

The compact cameras are simple point-and-shot camera that are little and easy to use. They are mostly used to take daily life picture, to catch an instantaneous memory or to share a moment (Primi, 2015).

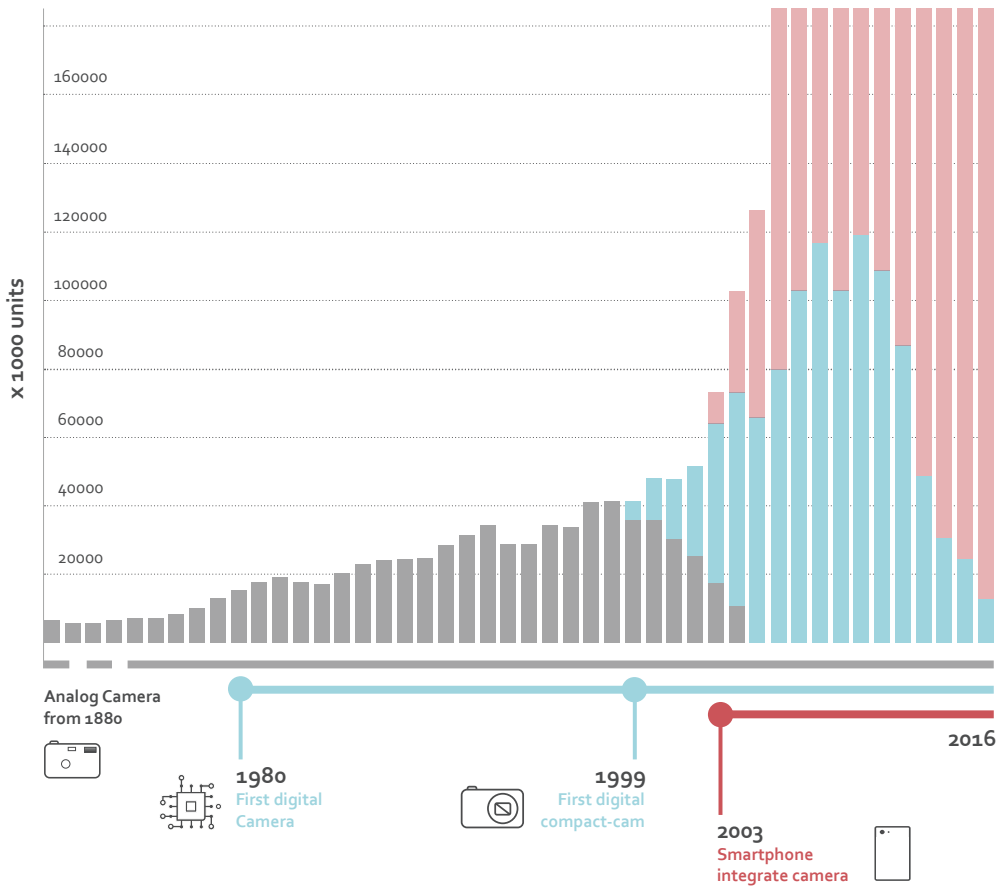
For this simple use seems that smartphone cameras are a good substitution thanks to the good quality picture that they cold take (compare to no-professional cameras). Since people bring everyware they smartphone they became the right tool to take on-the-go picture allowing to avoid people to bring everywere and extra device (Primi, 2015).

Graph.19 Camera Systems market becomes more diversified

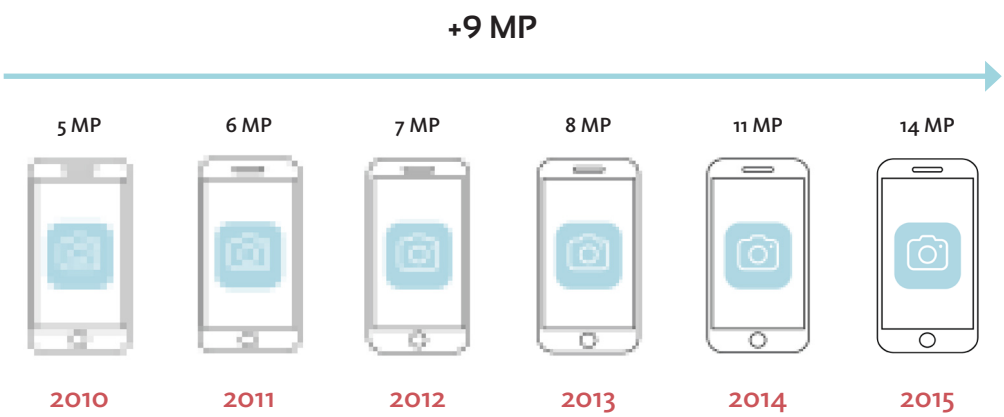


Always using the CIPA data a photographer called Sven Skatfisk display in a chart the relation between the camera market history and the smartphone sale data (taken from Gartner Inc.).
In 2000 Sharp introduced the first world cell phone with a tiny digital camera installed on its the back panel.
This phone could shoot, process an display photos on the cell screen instantly. From that moment the camera phone become a must and the quality and functions of these cameras grow year by thanks to the work of companies as Nokia and Sony.
More important in the spread of the use of camera phone as is intended today is it is the introduction of the Apple iPhone in 2007. It combined a good quality camera with a simple interface and with intuitive download and sharing tools.
In 2010 smartphone reach the first signify selling data point. From this date on the smartphone industry grow exponentially with a parallel and dramatic drop of the compact-camera market (Zhang, 2015).

graph.20 . CIPA analog, Compact Digital Cameras and Smartphones sales comparison



From 2010 the quality performance in terms of number of pixel for the incorporate digital cameras was in a constantly improvements and can be considered one of the main reason of this replacement. It grow form an avarge of 5 megapixel in 2010 to an avarge of 14 megapixels in 2014 as it is show on grapgh,.h (Idealo).
In the same period we can also observe the affirmation of the main social network that helps to develop a new shift in photography use: from save a memory to share a moment. The "selfie trend" it is an example.
Thanks to its direct connection to internet and the possibility to have it always with you, the smartphone became the right tool to take these kind of pictures. I add the introduction date of the main social network inside the Sven Skatfisk chart.
We can conclude saying that smartphone, caused to many factoris turned out as the main enemy for the no-professional costumer stand-alone camera sector.



graph.21 Average resolution of the most popular smartphones on Idealo

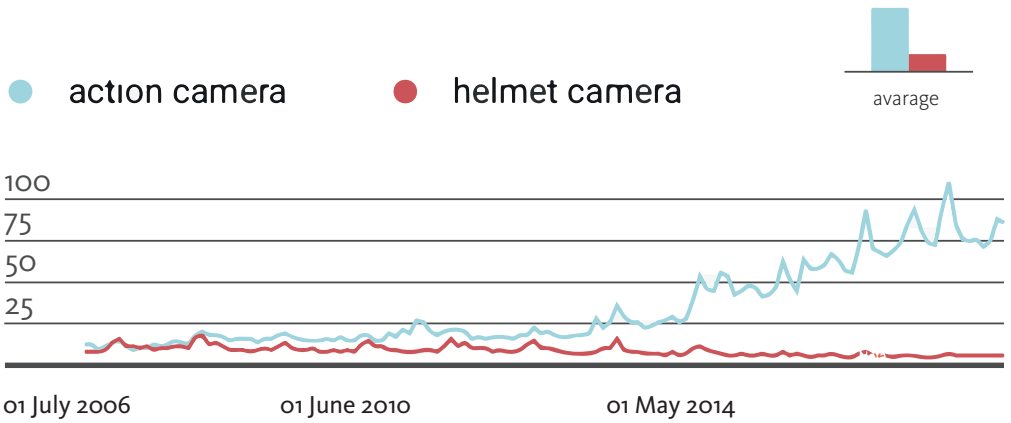
3.4 ACTION CAMERA: A SUCCESSFUL BUT PARADOXICAL CASE IN SINGLE-LENS CAMERA MARKET

GENERAL INTRODUCTION

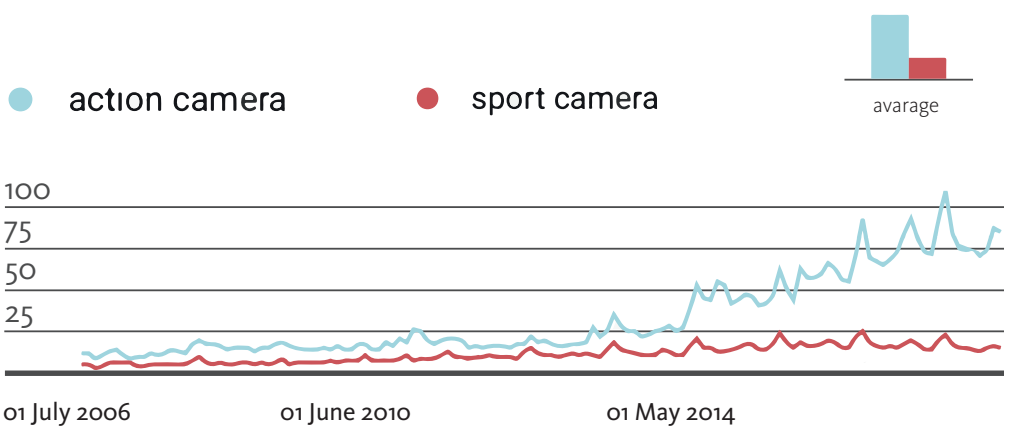
While the general stand-alone camera market sale is dramatically decreasing worldwide, there is a stand-alone camera typology that is having a parallel positive growth: the action camera.
The action it is a digital single lens camera designed to allow user to take pictures or record videos while being immersed in an action. These cameras are compact, rugged, often waterproof (or sold with a case that make it waterproof and more resisting to different hits) and with a few interaction elements to make it use as easy as possible.
A huge range of accessories it is found on the market to make this camera more versatile as possible allowing to be mounted on different supports as Helmets. Surf, Skateboard, Bike, different Human or Animal Body part, etc.
The action camera its is also related to the image sharing trend due to huge impact that GoPro, the category brand-name camera had in social network as YouTube, Instagram Facebook and Twitter.

For its small dimension. the possibility to take first person videos using specific accessories and use it while during sport it can be also found in the category of "wearable camera", "helmet camera", "POV camera" (point-of-view shot camera) or "sport camera". Googling each of this terms the product proposal were the same and many producer use different terms to identify it. I wanted to understand witch term was the most commonly used to define this kind of stand-alone cameras.
To do so I used Google Trend to compare witch of these terms were the mostly used to research the product.
The results (fig 3.n-3,n-3.n,3-n,3-m) clearly shown how from 2006 to nowadays the term action camera was always the more researched, with an exponential grow started in 2012. We can state that Action Camera it is the main term to define this product category and the other terms are more related to its specific use.

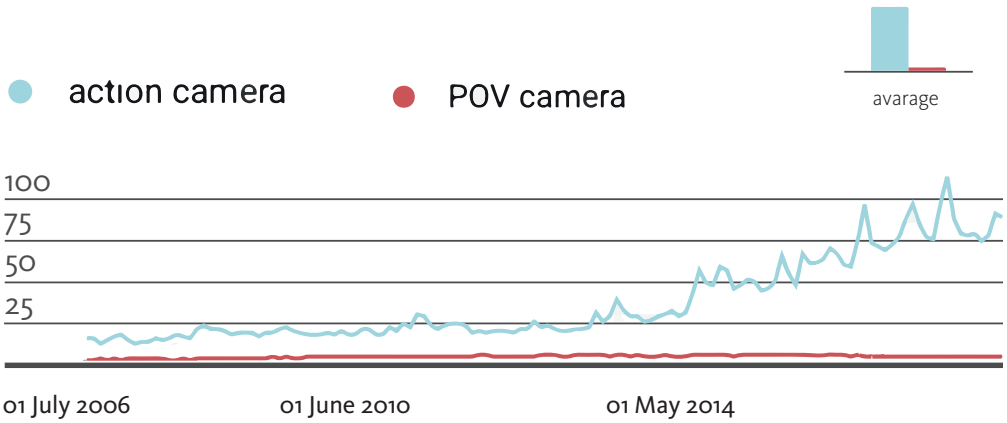
Google Trends



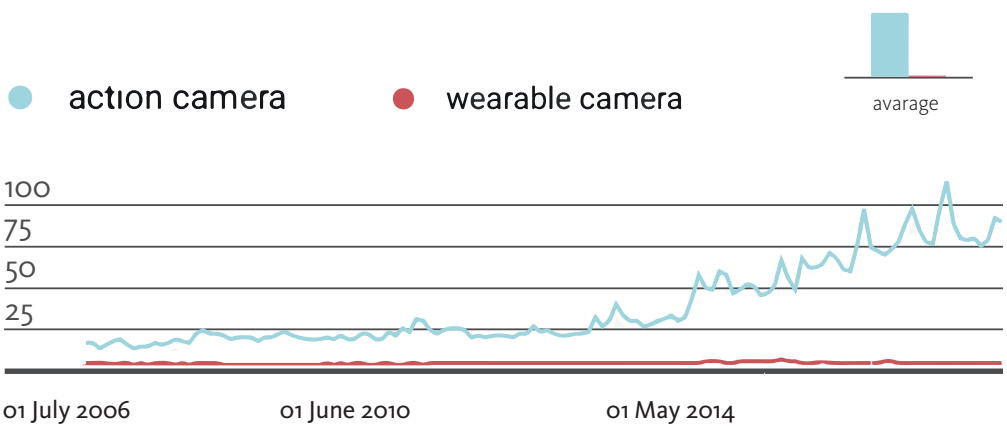
graph.22



graph.23



graph.24



graph.25

History

The first digital action camera proposed to the market were respectively the Oregon ATC 1000 in 2005 and the GoPro Digital HERO in 2006. The Oregon ATC 1000 was presented as an "extreme" helmet camera (Blass, 2005) and the GoPro Digital HERO as a Sport weatherproof "wrist camera" (fig.3-n). However the first action camera, or better, the first Sport weatherproof "wrist camera" presented to the market was the GoPro Hero 35mm in 2004 (as a "Reusable wrist camera"), that made GoPro the first action camera presented to costumer market.

The idea of a wearable camera that could shoot photos or videos during action dates back several decades, indeed there were many "creative" attempts to use a camera in this way.
Photographers and video makers always tried to find new ways to capture images to capture viewers attention and spark their imagination, finding new prospective to take photos and videos (History and evolution of action cameras, 2015). For that reason it is not easy define a precise moment in witch a the concept of "action camera" born. By the way there is a documented list of people that made some interesting attempts to use cameras to film their action while they were doing it.
A skydiver called Bob Sinclair (figure 3.n) was a member of crew adapted to record the Ripcord episodes, a 1060s show in witch were filmed extreme sky jumping (History and evolution of action cameras, 2015). It had the idea to film the jumps in a first person prospective to make people feel to be in the action and he decided to mount a video-camera on an helmet (this solution allow also to create an higher stability).
It is also curious observe the use of the Hasselblad EDC, an adapted model of the standards Hasselblad used for the moon trip from 1962. This camera was reinvented to avoid to be used with the hand because of the not comfortable gloves used by astronauts (La fotocamera spaziale ed il Necessaire di Neil Armstrong, 2017).
Others known attempts to take photos and videos during action were made by Jackie Stewart, a famous Scottish F1 driver. The first testimony of

graph.26 First action camera attempts

graph.27 First action camera attempts

its attempts it is a picture shoot in 1966 where he is pictured with a Nikon camera mounted on his helmets (figure 3.), other robust attempts to carry a video camera during not actual race are documented (figure 3.n).

In 1970 the actor Steve McQueen in the set of the movie "La Mans" was fitted with a video camera duck-trapped on his head to record a first person prospective vide while driving a motorcycle (History and evolution of action cameras, 2015).

In 1980s Canon introduced the Ci-10 (picture tiny camera (102 x 53 x 27 mm) that first capture the attention of investigators, as the NY times reported in 1958: "Due to its size it could easily fit into investigators pocket". A company called Video System found a way to use this camera in a total different context. Thanks to the remote transmission of microwaves and mounting it on the Dirk Garcia (a professional cross motorcyclist) helmet they were able to broadcast live on ABC: Canon's Ci-10 became the first camera used to broadcast first person view footage on air. Except for this particular event the information related about this camera are rare.

All these solution could be considered attempts to action camera concept development.

To find the first documented video filmed with a camera used as an "action camera" we have to wait to 1988, when the video maker Mark Schulze record a video during a Mountain bike race. He is considered the pioneer of action camera (History and evolution of action cameras, 2015). He mounted a VHS camera on top of his helmet and had a VCR with the latter in the bikers backpack connected with a RCA cable to film "The Great Mountain Biking Video" (it can be found on Vimeo on this link https://vimeo.com/10711229).

A camera that can be compared to the action camera is the Crittercam, introduced in 1986 from the biologist and filmmaker Greg Marshall to study animal behaviours without human interaction (the camera was attached on animals). This camera are continued to evolved and nowadays are able to collect also other environmental data. This camera it is largely used by National Geographic, I cited this example because the same company nowadays use GoPro to shot some of its videos (NationGeogrphic.com).

The first "helmet-video camera" were introduced

in 1990 to as a lipstick dimension video camera placed inside the professional American football Riddle helmet. It was used to live transmission. An antenna was placed on quarterbacks helmet to transmitted live signal to the production truck. Battery pack and transmitter were melded into the shoulder pads, which made camera itself impossible to take off by a player (History and evolution of action cameras, 2015).
This solution was a failure due to the high price of camera (20000$) and for its discomfort.
Nowadays NFL players use GoPro cameras during their practice practice (NFL.com).
Indeed these two las example are entered in the market bot addressed a professional market.
We have to wait until 2004 to see the first rugged and waterproof action camera marketed to an no-professional consumer: the GoPro Her 35mm 0001. It was essentially an reusable compact camera sold with a 35mm Kodak Film, a waterproof case and a wrist strap. It was sold to 20$ (it can be found a testimony of its first promotion on QVC at this Youtube link: https://www.youtube.com/watch?v=i89qZNFf6_E).
The story behind the GoPro invention it is interesting to understand for witch use this camera was designed, because it is strictly related to the main
use that make it popular and probably allow to make the name "action camera" the more used to identify this new product category.
the founder of gopro company, nick woodman in 2002 during a surfing trip in australia realized that there were no comfortable solution to capture this "action moments".
at the time there were disposable waterproof cameras, but was not easy to take a picture without stop the action and they were even not comfortable to carry (the tissue strip used to carry them make difficult to move the arm) and fragile. only pro surfer had the possibility to see their action thanks to proper waterproof professional cameras that an average costumer could not afford (action camera history and evolution, n.d.). the name gopro indeed it is referred to the desire of woodman and its friends to became (or feel like) pro surfer as he explained (2015):
"when trying to come up with an idea for the company name i asked myself, 'what do my

graph.28 First action camera attempts c

graph.29 First action camera attempts d

friends and i all want to do most?' and the answer was 'go pro...we all want to be pro surfers.' as i thought about it more i realized that gopro was a great name in that it meant [to] 'attack it full on' no matter what your passion or interest is... get after it and live life to the fullest."

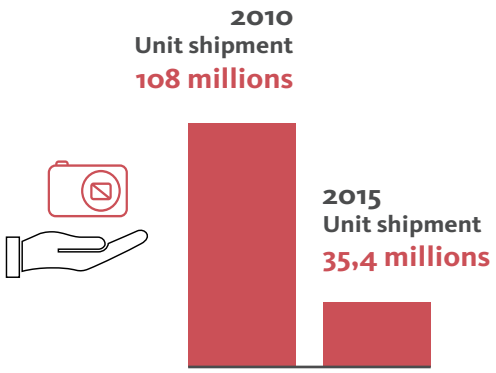
the first woodman idea was to develop a wrist strap that can fit other cameras on the top of it, the main problem was that main camera that he tried broke easily or were to heavy (first ever gopro camera – hero 35 mm – full story, 2016). than he decided to also find a the right camera to sell with it wrist strap. he found a chinese manufacture that was developing a product that fit with the characteristics needed: it was lightweight, cheap and durable. in 2004 the first gopro were sold in a san diego store chain called action sports retailer (alfio, 2013).

this marketing decision show how this product was sold as a sport accessories. looking at the box (figure.3.) if this product can be notice that it was proposed as a camera for extreme activities as surfing, biking, snowboarding and skateboarding. in 2006 the was launched the first gopro digital hero capable to record videos (for a maximum of 10 seconds and without audio) . If at the beginning it was sold as a wrist camera, an the other competitor sold "helmet" camera in 2008 gopro start to sold its device as mountable devices, making its use more general. From that mome nt the action camera success grow year by year together with the technical improvements, compatible accessories and the number of company that tried to entered in this new market. Companies from different sectors started to compete in this new market, as we will see later from the brands analysis.

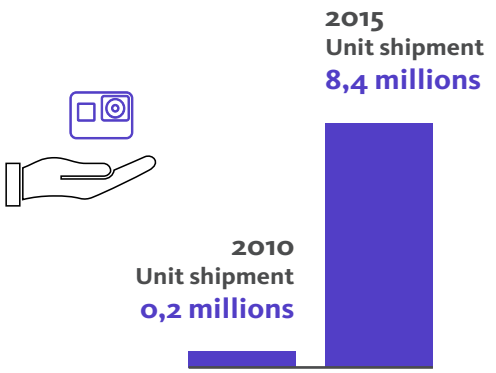
The success inside the Capture Image Device market

To better understand the market success related to this stand-alone camera typology I will analyse some interesting market data that I will compare to the parallel collapse of general stand-alone camera market.
As we said in the last paragraph in 2010 the smartphone industry started to have the first important income and from that year the compact-camera market started to be eroded. More precisely in 2010 the compact camera market count 108 million unit sold and in 2016 the number of cameras it was around 11 millions (Statista, 2017). If we look at action camera market in 2010 the unit camera sold were 0,2 millions and in 2016 the arrive to 10,6 millions (Statista, 2017 & PIV, 2016). It is clear that that the two cameras had a opposite selling trends. The implementation inside the digital camera technology of the video option made the action camera a competitor also in the camcorder market, in witch GoPro (the action camera market leader) it is dominating all the market with 42,2 % of the total market (NASDQ, 2014); the second one it is Sony with the 19% of the market.
If we consider the share of volume of Action Camera inside general Worldwide Capture Image Device market it rap present the 12%; while the traditional camcorder and compact camera have 8% of the volume each.
Nowadays we can count more than 100 different action cameras bran (Pevly. com) and they pertain to different main business as consumer electronic producers, general camera producers (there are company that produce only action cameras), sport equipment sellers and even security sectors. Fare grafico The action camera it is used both from no-professional photographer/video makers as well from professional photographer/video. For example, two Hollywood movie as "Hardcore Henry" and "Red Tails" were completely record using the GoPro and severs scene of the Ridley Scott move "The Martian" were shoot with the same device (Moskowitz, 2016). The action camera market it is extended also to different professional sector as Emergen-

Graph. 30 Single-Lens CameraCrisis



Graph. 31 Action Camera Market Growth

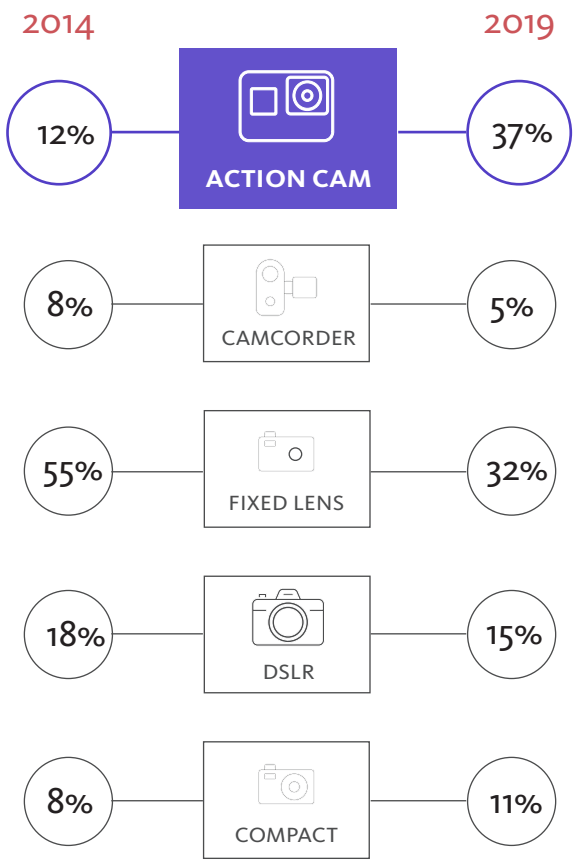


cy Service, Security and internal industrial communication with company as Axon, VieVu and Pivothead (axon.com; vievu.com; pivothead.com). However these professional sectors represent only the 14% of action camera market (FutureSource, 2014). The Action Camera allow to take picture or video while people are immersed in an action. For its versatility and resistance it is mainly promoted as a camera to film extreme activities. As the competition it is fierce companies are using different price strategy (as it is shown by the graph. taken from BrandView.com) or are trying to address slightly different target users.Some company address extreme sport users in general, other companies try to address specific target in the extreme sport sectors, others companies prose the action camera to a more creative and "less extreme" target and others try to reach all these segments. Immagini camera+tipo promozione (Polaroid, Maschere, Bici, GoPro, Drift). According to a research made by Beige Market Intelligent and Technavio (2016) the top 5 vendors action camera brand are GoPro, Garmin, Sony, Ion (recently go out to the market for strategic reasons) and Drift Innovation. Other important emerging vendors are Polaroid, JVCKenwood, TomTom, Veho, Rollei, Xiaomi, Braun Photo Technik, Chilli Technology, Olympus, and Panasonic.

WORLDWIDE IMAGE CAPTURE DEVICES

(SHARE OF VOLUME)

graph.32



3.5 GOPRO MARKET DOMINANCE: FROM A NICHE TO A MASS-MARKET

Intro

Despite this competition the undisputed market leader of the market is GoPro that take more than 45% of the action camera market share (Statista, 2015).
It produce cameras and mounts, called capture devices, that substantially generated the main revenue of the company. To better understand the action camera market evolution and diffusion it is fundamental to make a focus on the GoPro evolution indeed it is the first mover in this category that over the years had give a shape to this market in terms of: technology, standards related to accessories and target users engagement and evolution. This company had a singular marketing strategy based con consumer content creation that allow to engage users in the affirmation of the brand image giving a new meaning to photo and video sharing. We can state that the action market success it is strictly related to the GoPro success. It moves in terms of technology improvements and meaning generation shaped and guide this market, making GoPro the "synonymous" for action camera. What really made the difference around its success it is the new philosophical relationship of transitioning the cameraman to becoming the subject for audiences.

Technological Innovations

2004 it was the first "action camera" proposed to a costumer level market and focusing to the niche market of extreme sport lovers.
The HERO 35mm 0001 was an analogue camera sold with a 35mm Kodak film, a waterproof case and a wrist strap inside the box. Camera operated completely mechanical and did not require batteries. It Supported any kind of 35 mm film (24 photos),
From the came name HERO born the company claim "Be a Hero". According to the GoPro CEO Nick Woodman this is the meaning behind the choice:

"The idea was that our camera could help you capture photos (and eventually video) that made you look like a HERO. Be a HERO similarly inspires you to do your best at whatever you do."

This is he idea behind the action camera concept that rom that moment it have not stop to propose innovations in terms of accessories and technologies that allow to be different both to compact cameras and smartphones. They propose they camera as the "most versatile camera in the world".
In 2006 it was made the important shift to the digital technology allowing the camera to add the function to take videos. An important step considering that GoPro will dominate the camcorder general market. The camera was called GoPro Digital Hero and could take videos 10 second longer and without sound. In 2007 was presented the Digital HERO 3 that had a more powerful video function that allow to capture unlimited videos with sound. In 2008 with the Digital HERO 5 installed the 127° wide-angle giving users that distinct panorama shot that is now one of GoPro's signatures.
In 2008 was proposed to the market a new line of cameras the HERO HD that opened a new market to GoPro thanks to its 1080 p video resolution. From this moment on the GoPro started to increase substantially its profits. It was a camera that had not comparable quality compare to the smartphones and could be carried thanks to its dimension, resistance and accessories where neither standard compact-cameras and smartphone could be taken without risks.
Every year he GoPro proposed a new version of the HD camera with incremental innovation and keeping the same product language: in 2011the HERO2 had 11-megapixel camera, improved low-light capability and 1080P video at 30 frames per second; in 2012 with the smaller, lighter HERO 3 (black, silver and white) with 12-megapixel photo capability and 1080p video at 60 frames per second. In the same year all three versions of the HERO3 come in a new 30% smaller and 25% lighter package, with WiFi
functionality built in. In 2013 the HERO3+ Battery life is claimed to be 30% longer than for the HERO3 model; in 2014 HERO4 adds Bluetooth connectivity, Highlight tag, Protune Available for photo and a new processor claimed by GoPro to be twice as fast as that of the HERO3+ Black Edition, doubling the frame rates in most resolutions; in 2015 GoPro HERO+LCD has a touch screen to preview the shot to frame the scene perfectly and letting user easily navigate the menu. GoPro HERO+LCD is waterproof, because it is built directly into a waterproof case; in
October 2015 HERO+ it does not have an LCD built-in touch display and it is slightly lighter than HERO+LCD.
In 2016 was launched the HERO5 with new feature as image stabilization, GPS, longer battery life, voice control, auto upload to the cloud feature and waterproof capabilities (no case).
In 2015 was proposed a new HERO4 model line for a less demanding market: the HERO Session: + it does not have an LCD built-in touch display and it is slightly lighter than HERO+LCD. In 2016 it was launched the new version of the Session line: HERO5 Session

It is expected to be lunch in 2017 a line called Fusion for recording 360 videos.

One that main advantage that GoPro ad at the begging, when it launched the first HERO 3 in 2012 was to be the best proposal on the market in terms of technology, allowing to gain advantage against smartphone, compact cameras and other action camera competitors. In few years new competitors from strong techngoly companies entered in the market and GoPro started to face competition not only from low-market action cameras but also from company that had a same level of technology. For example the 2015 Sony FDR X1000V for first intrduce a camera that do not need a extra watrpoof case and had a HD image stabilizator; or the GPS function to gatehr datas were first introduced by Garmin with the Virb Elitte in 2013.

fig.70 GoPro CEO Nick Woodman

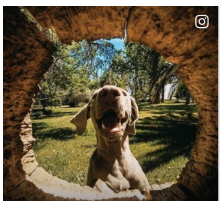
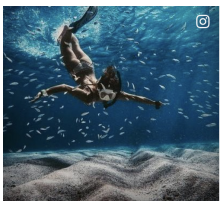
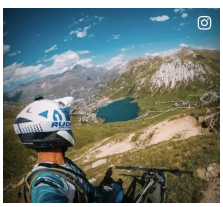
Complementary Accessories

GoPro did not propose onl innovation on the camera technology.
The complementary accessory were fundamental to make possible to use the action camera in extreme situation and allow to use it without a hands.
Together with the HERO line GoPro proposed a huge range of accessories as batteries, chargers, data cables and most important they offered a large and heterogeneous and unique range of mounts. This proposal started with the Digital HERO5 and year by year the range of accessories grow. Many other companies made their cameras compatible with GoPro accessories.
These mounts allow to capture original shots and to use the camera in different kind of activities.
The mounts could be attached on bicycles, helmets, surfs, skateboards, microphones etc.
Nowadays GoPro count more than 120 accessories studied to be used in activities as: auto driving, boat sealing, kayak, skateboarding, parachuting, snowmobile driving, surfing, biking, dipping, playing music, motorcycling, hiking, climbing, skiing, snowboarding, supping and wakeboarding (GoPro.com).
It also proposed different case an filter to be used underwater.

Thanks to all this accessories the action camera could be over to the statics photos to allow also no-professionals photographer or moviemaker to film by themselves their actions.

fig.71 Costumer pictures on Instagram




Market strategy, external systems and services accessories

GoPro is more than a manufacturing selling capture devices accessories. They understand that the potential of their product offer went beyond the technology and the heterogeneous uses allow by the accessories. The video and photos taken by its costumers were something totally new and impactful.

GoPro entered in the digital camera market in 2006 and it started to grow in a significant way from 2010. In the same period the most important social Networks were raising opening a new social dynamic environment (Facebook was launched in 2003, YouTube in 2005, Twitter in 2006 and Instagram in 2010). The company was able to leverage not only the technology opportunity related to the product, but also to understand the dynamics of this new social opportunity engaging its costumer in a global sharing experience. With a clever marketing strategy they encourage its costumers to record all their actions and adventures and share them to the world to prove achievement and to inspire other people. They do not ask costumer to mention the product, but to use it to create their personal content.

Using social media as YouTube, Instagram, Facebook, Twitter and its own website and personal channels it have established a content marketing platform to maximise the opportunity offered by costumer's content. Many other camera retailers had the same opportunity but no one has managed to realise this practice (Dillon, 2014). The brand was able not only to reach out the right consumers, but to also to actively integrate the user-generated content into its marketing strategy.

But how di it start? As many company GoPro started to engage ambassador, in this case professional stuntmen and extreme athletes, to show of the capability of the camera market as the "world's most versatile". Soon people started to post many interesting videos with the name GoPro title on social media and GoPro marketing people started to understand the opportunity behind these videos.

In 2010 GoPro launched the promotion Photo of the Day (POD) and Video of the Day (VOD) to reward users that produce amazing photo and video content. The marketing stuff needed to find these videos and photo on the web, select the best ones, proposed them on social media community giving to user the visibility and showcase the best videos and phots that consumer share.

In 2012 the POD and VOD became more structured whit a submission program where consumers could directly share their content. In addition to tagging the users in the post, for the selected material GoPro give to the customer a 50% discount to use inside GoPro website.

In 2014 the submission process was improved with the development of an easy to find landing page and a easier-to use portal format. This process became more and more used by costumer and in the same 2014 most of

marketing photo materials was taken from POD submission and the VOD submission became the main source to find and acquire the best of User Generated Content for social media distribution.
The improvement had an impact also on number of content submitted. From 137 daily photo submission for day in 2013 to 258 in 2014; from 86 per day video submitted in 2013 to 164 in 2014. Since the submission-based process was introduced in 2012, GoPro users have submitted more than 128,000 photos and 93,000 videos for POD and VOD consideration.
In 2013 the videos upload on YouTube with the world GoPro on the title were about 6000 per days, it means about 100 hours or videos upload every minutes (Landau, 2014). The amount of video views on YouTube for its own generated videos has tripled in 2014 compared to the same time in 2013. Almost 100 of its videos have reached more than 1 million views (Landau, 2014). In 2015 the submission process was introduce with the name GoPro Award and in case the videos are selected costumer receive a monetary prize. Once the content t is stented it is also possible accept a GoPro Content Licensing Program (GoPro.com) to continue to monetarize the proper content in case of GoPro would use sell them to world publicity brands (30% commission per license).
This strategy not only improve brand awareness, costumer commitment and increase camera selling. It had also an other strong impact on GoPro marketing expenses if we think that in 2013 the company erned $60.6 million on just $157k marketing budget (Hum, 2015).
Different GoPro platforms channels connected users to a complete experience in witch are reinforced the relation between the use of the product and the content generation.
Different tools, platform and services are proposed to costumes to share and edit in the best way the image that they capture in vertical integration of actions:

a) They use external systems composed by Social Media platform to promote the costumer generated contend. Every day a picture and a video are proposed on GoPro personal social media: YouTube Channel with 4.996.187 members, Facebook Profile with 10.424.664 followers, Instagram profile with 12.979.767 followers and Twitter page with 2.300.000 followers (data taken the 11th of August 2017 directly from the relatives Websites)

b) They had a the #GoPro hashtag to help user categorize their content and help social media team to find new photos and videos uploaded on different social network platforms

c) They had also property platforms as GoPro Channel for Sony Playstation and X-Box; and a internal Web-Site page where it is possible watch photos and videos.

d) In the same Web-Site it is possible upload videos and picture according to different categories to participate to GoPro Awards (also the procedure it is well explained)

e) They had a Web-page that give tips to film the best videos and also a library of free music to download to made the video more engaging.

f) They offered the possibility to free download different Desktop Software and smartphone/tablet App that allow to better control the video shot, the make (and facilitate) video editing and sharing.

For the desktop software side we had QUIK Desktop, that is the evolution of older software as GoPro Studio introduced in 2011 (GoPro.com) and GoPro App for Desktop.
From the App side we had GoPro – Featuring Quick stories before known as Capture that from an app to control remotely the camera now it also automatically edit and generate contents ready to share. There are is also Quick- Video Editors and Splice – GoPro editor

Target user evolution

GoPro camera it is initially sold as a niche product to extreme sport enthusiasts.
GoPro pears with more then 130 professional athletes as I skateboarder, snowboarder, rock star (es. Rolling Stones) and even sport association as the NHL (GoPro.com). It also signed partnership with travel destination as the Marriot hotels in Caribbean and Latin America and sponsored different extreme sport events as the GoPro Mountain Games in Vail Colorado that attract more than 3000 athlets an 53000 enthusiast every year. It also made an important partnership with an other brand related to extreme sport as Red Bull (for example in Red Bull TV channel there is a section related to GoPro contents) that made its video using the GoPro first person prospective.
The great success of the bran allow the company to grow the distribution as much that not only their "core"costumer are involved as the same Woodman said (2015): "Action implies something kind of risky and dangerous that you're doing, but in truth the majority of our customers use a GoPro to film themselves having fantastic weekends with their families and perusing sort of more everyday activities, and unlike a smartphone or a traditional camera where you need a third person to hold the camera to photograph or film you doing whatever it is that you love to doing life, with a GoPro you can film yourself."
Looking at GoPro Award section could be seen witch can of content can be delivered to the contest and its clear that the camera it is addressed also to les extreme use.
The same proposition of the Session line it is a result of this evidence, as an answer to the market and to competitors that tried to address this other piece of the market (Polaroid propose the CUBE camera for less extreme and more creative before GoPro).
If GoPro it is a mirror of the action camera market is clear that the action camera became, starting from a niece, a mass market product that in a certain way substitute of the traditional compact camera market that address no-professional photographer and movie maker, without be killed to the smartphone technology.
I decided to use to better analyse the action camera market to try to understand how the new technology evolution was used as an inputs in term of product design language proposals, how much this was relevant and if there were new system related way in which design could be integrate in the unveiling potential offered form new technology.

4 SINGLE-LENS CAMERA PRODUCT LANGUAGE ANALYSIS: INDUSTRY LEVEL

INTRODUCTION

In this section, it will divided in three main areas in which respectively I will analyse the product language evolution inside the single lens digital camera market market splitting the analysis on the general compact-camera segment and the action camera segment.

To analyse the different languages I will compare the different camera proposed year by year from the selected brands. The comparison will be based on the analysis of both elements related to the "optical" and "tactile" perception (Hildebrand, 1893; De ' Fusco, 2005). These elements influence user's product experience. The "optical" perception also called "active sight" regard the perception of the object as a whole and it is influenced by shape, colour and size. The "tactile" also called "passive sight" it is related to a closer view of the object and are related to detail, texture, finish and decoration. For these particular case studies I will considered the colours as a decoration indeed, especially in compact-camera market product with the identical "optical" and "tactile" features differs only for the colour applied on the box. I organize the categorization in a matrix. On the vertical axes i placed the "Body Shape" that group cameras taking in account different shapes and dimensions. To define this category for the compact camera segment I started from the categorization proposed by Dpreview, but making some modification beacuse it was often not acurate and contradictory. For the action camera there is not an official categorization and I had to create it. On the orizonatal axe I placed categories related to the style, finsh and extra elements that I define after an initial research.

COMPACT-CAMERAS
ANALYSIS & RESULTS

ACTION-CAMERAS
ANALYSIS & RESULTS

DATA COMPARISON
FINAL CONSIDERATIONS

fig.72 Industry level Analyis overview

4.1 THE ANALYSIS OF THE COMPACT-CAMERA COMPETITIVE CONTEXT

Settings

The analysis of the compact camera market it will be done starting analysing the product proposal from the three main world brand: Canon, Nikon and Sony. I will took the cameras form the Dpreview database (dpreview.com).
I will consider the time between 1996 (when the first digital compact camera were sold with stable standard characteristics) and 2017. Different cameras modelas from the same year proposed with the same shape (but different name and performance) will be proposed using just one variant.

Range of time

1996-2017

Brands

SONY

Canon

Nikon

tab. 1-2-3 Compact-Camera language analysis matrix 1996-1997-1998

YEAR 1996	Variant Handle Silver
Body Type Classic	 CANON PoweShot 600

YEAR 1997	Variant Handle silver	Variant Pocket Plastic Vintage	
Active Box	 CANON PoweShot 350		
Body Type Vertical		 NIKON Coolpix-100	 NIKON Coolpix-300

YEAR 1998	Variant Handle silver	Variant Pocket Tech. Silver
Body Type Classic	 NIKON Coolpix-300	 CANON PoweShot 350
Active Box	 CANON PoweShot 350	
Body Type Articulated	 CANON PoweShot 350	
Body Type SLR-like	 NIKON Coolpix-100  CANON PoweShot 350	

YEAR 1999	Variant Handle Plastic Vintage	Variant Handle Silver	
Body Type Classic	 NIKON Coolpix 700  NIKON Coolpix 800		
Body Type Articulated	 NIKON Coolpix 950		
Active Box		 SONY Mavica FD-83  SONY Mavica FD-73	
Body Type SLR-like		 CANON Cyber-shot DSC-D505  CANON Cyber-shot DSC-D770	

tab. 5 Compact-Camera language analysis matrix - 1999

Variant
Pocket
Tech. Silver

NIKON
Coolpix 700

NIKON
Coolpix 800

YEAR 2000	Variant Handle Plastic Vintage	Variant Handle Silver	
Body Type Classic		 SONY Cyber-shot S50  SONY Cyber-shot S70  NIKON Coolpix 880  CANON PowerShot G1	
Body Type Articulated	 NIKON Coolpix 900		
Active Box		 SONY Mavica FD-90	
Body Type SLR-like		 SONY Mavica CD1000	

tab. 6 Compact-Camera language analysis matrix 2000

	Variant Pocket Tech. Silver		Variant Pocket Silver Semi-rounded
	 CANON PowerShot S20	 CANON PowerShot S100	 SONY Cyber-shot DSC-P1

YEAR 2001	Variant Handle Plastic Vintage	Variant Handle Silver			
Body Type Classic	 SONY Cyber-shot S85	 CANON PowerShot G2	 SONY Cyber-shot S75	 NIKON Coolpix 885	
	 NIKON Coolpix 5000	 CANON PowerShot G1	 CANON PowerShot A10	 NIKON Coolpix 775	
Body Type Articulated	 NIKON Coolpix 995				
Active Box		 SONY Mavica FD-75			
Body Type SLR-like		 SONY Mavica FD-97	 SONY Cyber-shot DSC-F707	 CANON PowerShot Pro90 IS	

tab. 7 Compact-Camera language analysis matrix 2001

	Variant **Handle Semi-rounded**	Variant **Pocket Tech. Silver**	Variant **Pocket Silver Semi-rounded**
	 SONY Mavica CD200	 CANON PowerShot S20  CANON PowerShot S100  CANON PowerShot S2300	 SONY Cyber-shot DSC-P3  SONY Cyber-shot DSC-P20  SONY Cyber-shot DSC-P30

YEAR 2002	Variant Handle Plastic Vint.	Variant Handle Silver		Variant Handle Semi-rounded	
Body Type Classic		 CANON PowerShot G3	 NIKON Coolpix 4300	 NIKON Mavica CD250	
		 NIKON Coolpix 2000	 CANON PowerShot A302		
Body Type Articulated	 NIKON Coolpix 4500				
Active Box				 SONY Mavica FD-100	
Body Type SLR-like	 NIKON Coolpix 5700	 SONY Cyber-shot DSC-F717			

tab. 8 Compact-Camera language analysis matrix 2002

	Variant **Pocket** **Tech. Silver**	Variant **Pocket Silver** **Semi-rounded**	Variant **Pocket Flat** **Tech. Silver**
	 CANON PowerShot S230  CANON PowerShot S330  CANON PowerShot S45	 SONY Cyber-shot DSC-P51  SONY Cyber-shot DSC-P9  SONY Cyber-shot DSC-P2	 SONY Cyber-shot DSC-U20  SONY Cyber-shot DSC-P31  CANON PowerShot S230

YEAR 2003	Variant Handle Plastic Vint.	Variant Handle Silver		Variant Handle Semi-rounded
Body Type Classic	 NIKON PowerShot G5	 SONY Cyber-shot V1	 CANON PowerShot A80	 SONY Mavica CD350
	 NIKON Coolpix 5500	 NIKON Coolpix 2100		 SONY Mavica CD500
Body Type Articulated				
Body Type SLR-like	 SONY Cyber-shot DSC-F828			

tab. 9 Compact-Camera language analysis matrix 2003

	Variant **Pocket Tech. Silver**		Variant **Pocket Silver Tech. Semi-rounded**	Variant **Pocket Flat Tech. Silver**
	 CANON PowerShot S400	 CANON PowerShot SD100	 SONY Cyber-shot DSC-P52	 SONY Cyber-shot DSC-T1
	 NIKON Coolpix 3700	 CANON powershot_sd10	 SONY Cyber-shot DSC-P92	 SONY Cyber-shot DSC-U40
	 CANON Cyber-Shot u40			
	 NIKON Coolpix-SQ			
	 SONY Cyber-shot DSC-U50			

YEAR 2004	Variant Handle Plastic Vint.	Variant Handle Silver	
Body Type Classic	 NIKON Coolpix 8400	 CANON PowerShot A85	 CANON PowerShot G6
		 NIKON Coolpix 4100	 CANON PowerShot A95
	 NIKON Cyber-shot V3	 NIKON Coolpix 3200	 NIKON Coolpix 3800
		 CANON Coolpix 4200	 SONY Cyber-shot DSC-W1
Body Type Articulated			
Body Type SLR-like	 CANON Coolpix 8800		
	 NIKON Power-shot Pro1		

*Colored squares indicate different color options

	Variant **Pocket Tech. Silver**	Variant **Pocket Silver Tech. Semi-rounded**	Variant **Pocket Flat Tech. Silver**
	 CANON PowerShot S60  CANON PowerShot SD200  CANON PowerShot 400  CANON powershot_sd10  CANON PowerShot SD200  CANON PowerShot 4310	 SONY Cyber-shot P92  SONY Cyber-shot P150  SONY Cyber-shot P41  SONY Cyber-shot P150	 SONY Cyber-shot DSC-T3
			 SONY Cyber-shot M1

tab. 10 Compact-Camera language analysis matrix 2004

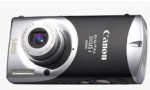
YEAR 2005	Variant Handle Plastic Vint.	Variant Handle Silver		Variant Pocket S. Semi-R.
Body Type Classic		 CANON PowerShot A520	 CANON PowerShot A610	 SONY Cyber-shot P200
		 SONY Cyber-shot S60	 NIKON Coolpi L1 ■	
		 NIKON CoolpixP1	 NIKON Coolpix 5600 ■	
		 CANON PowerShot S2 IS		
Body Type Articulated				
Body Type SLR-like	 SONY Sony Cyber-shot DSC-R1	 NIKON Sony Cyber-shot DSC-H1		

*Colored squares indicate different color options

tab. 11 Compact-Camera language analysis matrix 2005

Variant
Pocket
Tech. Silver

CANON
PowerShot SD450



SONY
Cyber-shot P41

CANON
PowerShot SD430

SONY
Cyber-shot N1

CANON
PowerShot SD500

SONY
Cyber-shot S40

NIKON
Coolpix S4

Variant
Pocket Flat
Tech. Silver

NIKON
Coolpix S2

NIKON
Coolpix S1

SONY
Cyber-shot T9

SONY
Cyber-shot T33

SONY
Cyber-shot T7

SONY
Cyber-shot M2

YEAR 2006	Variant Handle Plastic Vintage	Variant Handle Silver	
Body Type Classic	 NIKON PowerShot G7	 CANON PowerShot A520  CANON PowerShot A630  NIKON Coolpix L5  CANON PowerShot S2 IS	 CANON PowerShot A710 IS  NIKON Coolpix L2  CANON PowerShot A700  CANON PowerShot A420	
Body Type Articulated				
Body Type SLR-like	 SONY Cyber-shot DSC-H5  CANON PowerShot S3 IS	 NIKON Cyber-shot DSC-H2		

*Colored squares indicate different color options

	Variant **Pocket** **Tech. Silver**		Variant **Pocket Flat** **Tech. Silver**
 SONY Cyber-shot W70	 CANON PowerShot SD700	 CANON PowerShot SD800IS	 CANON Cyber-shot T10
 SONY Cyber-shot S600	 SONY Cyber-shot P41		 NIKON Coolpix 57C
 SONY Cyber-shot N2	 NIKON Coolpix P3		 CANON PowerShot SD500
	 NIKON Coolpix S10		

tab. 12 Compact-Camera language analysis matrix 2006

YEAR 2007	Variant Handle Plastic Vintage	Variant Handle Silver	
Body Type Classic	 NIKON Coolpix P5000	 CANON PowerShot A560	 NIKON Coolpix P50
	 CANON PowerShot SX100	 NIKON Coolpix L10	 CANON PowerShot A650 IS
	 NIKON Coolpix P5100	 SONY Cyber-shot W70	
	 SONY Cyber-shot DSC-H3		
Body Type Camcorder like			
Body Type SLR-like	 CANON EOS-1Ds Mark III	 CANON EOS-40D	
	 NIKON D40X	 SONY Cyber-shot DSC-H9	 NIKON D3

*Colored squares indicate different color options

Variant
Pocket
Tech. Silver

CANON
PowerShot SD1000

SONY
Cyber-shot S650

SONY
Cyber-shot P41

SONY
Cyber-shot W35

NIKON
Coolpix S510 600

CANON
PowerShot
SD870 IS

CANON
PowerShot SD750

SONY
Cyber-shot W80

SONY
Cyber-shot S730

CANON
PowerShot TX1

Variant
Pocket Flat
Tech. Silver

NIKON
Coolpix S50

SONY
Cyber-shot
DSC-T20

NIKON
Coolpix L2

SONY
Cyber-shot
DSC-G1

SONY
Cyber-shot
DSC-T2

tab. 13 Compact-Camera language analysis matrix 2007

YEAR 2008	Variant Handle Plastic Vintage	Variant Handle Silver	
Body Type Classic	 CANON PowerShot G10  SONY Cyber-shot -H10  NIKON Coolpix P60  NIKON Coolpix P6000  CANON PowerShot SX110	 CANON PowerShot A58  NIKON Coolpix P50  CANON PowerShot A650 IS  NIKON Coolpix L10	
Body Type SLR-like	 SONY Cyber-shot DSC-H50  CANON PowerShot SX10 IS  NIKON Coolpix P80		

*Colored squares indicate different color options

Variant
Pocket
Tech. Silver

CANON
PowerShot SD770 IS

CANON
PowerShot
SD880 IS

CANON
PowerShot SD1100

NIKON
Coolpix S210

NIKON
Coolpix S510 600

SONY
Cyber-shot P41

SONY
Cyber-shot DSC-S730

CANON
PowerShot SD990

Variant
Pocket Flat
Tech. Silver

SONY
Cyber-shot T300

NIKON
Coolpix S52

NIKON
Coolpix S60

SONY
Cyber-shot DSC-T20

SONY
Cyber-shot DSC-T20

tab. 14 Compact-Camera language analysis matrix 2008

YEAR 2009	Variant Handle Plastic Vintage	Variant Handle Silver	Variant Sport
Body Type Classic	 CANON PowerShot G11	 CANON PowerShot A1000	 CANON Power-shot D10
	 CANON PowerShot A2100 IS	 NIKON Coolpix L19	
		 CANON PowerShot SX120 IS*	
Body Type SLR-like	 NIKON Coolpix L100	 SONY Coolpix P90	
	 CANON PowerShot SX20	 SONY Cyber-shot DSC-HX1	

*Colored squares indicate different color options

Variant
Pocket
Tech. Silver

NIKON
Coolpix S640

CANON
PowerShot
SD970

CANON
PowerShot SD1200

SONY
Cyber-shot S980
S210

SONY
Cyber-shot
DSC-W230

CANON
PowerShot SD980 IS

CANON
PowerShot A480

CANON
PowerShot S90

CANON
PowerShot SD990

NIKON
Coolpix S230

CANON
Coolpix S510 600

CANON
PowerShot
SD960 IS

Variant
Pocket Flat
Tech. Silver

SONY
Coolpix S1000

NIKON
Coolpix S70

SONY
Cyber-shot DSC-TX1

SONY
Cyber-shot DSC-G3

SONY
Cyber-shot DSC-T20

tab. 15 Compact-Camera language analysis matrix 2009

YEAR 2010	Variant Handle Plastic Vintage	Variant Pocket Tech. Vintage	Variant Handle Silver
Body Type Classic	 CANON PowerShot G12	 NIKON Nikon Coolpix S8000	 SONY Cyber-shot DSC-S2000
	 NIKON Nikon Coolpix P7000		 SONY Cyber-shot DSC-HX5
	 SONY Cyber-shot DSC-H55	 NIKON Coolpix S8100	 CANON PowerShot SX130 IS
Body Type SLR-like	 CANON PowerShot SX30 IS		
	 NIKON Coolpix P100		

*Colored squares indicate different color options

Variant
Pocket
Tech. Silver

SONY
Cyber-shot
DSC-W310

CANON
PowerShot
SD4500 IS

NIKON
Coolpix S3000

SONY
Cyber-shot S980
S210

CANON
PowerShot
A3100 IS

CANON
PowerShot SD1400

SONY
Cyber-shot
DSC-W380

CANON
PowerShot S95

SONY
Cyber-shot
DSC-W350

CANON
PowerShot A3000 IS

Variant
Pocket Flat
Tech. Silver

NIKON
Coolpix S80

SONY
Cyber-shot DSC-TX5

SONY
Cyber-shot DSC-G3

tab. 16 Compact-Camera language analysis matrix 2010

YEAR 2011	Variant Handle Plastic Vintage	Variant Pocket Tech-Vintage	Variant Handle Silver
Body Type Classic	 NIKON Coolpix P7100  SONY Cyber-shot DSC-HX7V  SONY Cyber-shot DSC-HX9V  SONY Cyber-shot DSC-H70	 CANON PowerShot S100  NIKON Coolpix S8200  NIKON Coolpix P300	 CANON PowerShot A800  CANON PowerShot SX130 IS
Body Type SLR-like	 CANON PowerShot SX40  NIKON Coolpix P500		

*Colored squares indicate different color options

Variant Pocket Tech. Silver	Variant Pocket Flat Tech. Silver	Variant Sport
 CANON ELPH 310 HS		
 CANON PowerShot ELPH 100 HS		
 NIKON Coolpix S3000		
		 NIKON Coolpix AW100
 CANON PowerShot SX230 HS		
 SONY Cyber-shot DSC-W550		
 SONY Cyber-shot DSC-W570		
	 NIKON Coolpix S100	
 SONY Cyber-shot DSC-W560		
 CANON IXUS 220 HS		
 SONY Cyber-shot DSC-W350		
		 SONY Cyber-shot DSC-TX10
 SONY Cyber-shot DSC-WX9		
 NIKON Coolpix L24		
	 SONY Cyber-shot DSC-TX55	

tab. 17 Compact-Camera language analysis matrix 2011

YEAR 2012	Variant Handle Plastic Vintage	Variant Pocket Tech-Vintage	Variant Handle Silver
Body Type Classic	 CANON PowerShot G1 X  CANON PowerShot G15  NIKON Coolpix P7700	 NIKON Coolpix P310  SONY Cyber-shot DSC-RX100  SONY Cyber-shot HX30V  SONY Cyber-shot DSC-RX1	 CANON PowerShot A810  CANON PowerShot SX130 IS  CANON PowerShot SX160 IS  SONY Cyber-shot DSC-H90
Body Type SLR-like	 CANON PowerShot SX50 HS  NIKON Coolpix P510-red	 CANON PowerShot SX500 IS	 SONY Cyber-shot DSC-HX200V

*Colored squares indicate different color options

Variant
Pocket
Tech. Silver

CANON
PowerSho
A2300

SONY
Cyber-shot
DSC-W610

NIKON
Coolpix S3300

NIKON
Coolpix S01

NIKON
Coolpix S6400

NIKON
Coolpix S6300

CANON
PowerShot
ELPH 530 HS

CANON
PowerShot S110

SONY
Cyber-shot
DSC-WX150

SONY
Cyber-shot
DSC-WX50

Variant
Sport

CANON
PowerShot D20

NIKON
Coolpix S30

SONY
Cyber-shot DSC-
TX20

tab. 18 Compact-Camera language analysis matrix 2012

YEAR 2013	Variant Handle Plastic Vintage	Variant Pocket Tech-Vintage	Variant Handle Silver
Body Type Classic	 CANON PowerShot SX510 HS  SONY Cyber-shot DSC-HX50V  NIKON Coolpix P7800	 NIKON Coolpix A  SONY Sony Cyber-shot DSC-RX100 II  SONY Cyber-shot DSC-WX300  SONY Cyber-shot DSC-RX1R	 NIKON Coolpix L28
Body Type Social Cam			
Body Type SLR-like	 NIKON Coolpix L320  SONY Cyber-shot DSC-H200	 SONY Cyber-shot DSC-HX300  NIKON Coolpix L820	 SONY Cyber-shot DSC-RX10  NIKON Coolpix P520

*Colored squares indicate different color options

Variant
Pocket
Tech. Silver

CANON
ELPH 115 IS

CANON
PowerShot A2500

CANON
Coolpix S3300

NIKON
Coolpix S02

NIKON
Coolpix S5200

SONY
Cyber-shot
DSC-W730

CANON
PowerShot
S120

SONY
Cyber-shot DSC-
WX80

SONY
Cyber-shot
DSC-WX150

NIKON
Coolpix S6500

CANON
ELPH 130

CANON
PowerShot N

CANON
PowerShot N Facebook

Variant
Sport

SONY
Cyber-shot DSC-TF1

NIKON
Coolpix AW110

SONY
Cyber-shot DSC-
TX30

NIKON
Coolpix S31

tab. 19 Compact-Camera language analysis matrix 2013

YEAR 2014	Variant Handle Plastic Vintage	Variant Pocket Tech-Vintage	Variant Handle Silver
Body Type Classic	 CANON PowerShot SX700 HS  CANON PowerShot G1 X Mark II	 NIKON Coolpix P340  SONY Sony Cyber-shot DSC-RX100 III  CANON PowerShot G7 X	 SONY Cyber-shot DSC-W800
Body Type SLR-like	 CANON PowerShot SX400 IS  SONY Cyber-shot DSC-H400	 NIKON Coolpix L830  CANON PowerShot SX60 HS	 NIKON Coolpix P530  CANON PowerShot SX520 HS

*Colored squares indicate different color options

Variant
Pocket
Tech. Silver

CANON
PowerShot ELPH
150 IS

SONY
Cyber-shot
DSC-WX220

NIKON
Coolpix S810c

CANON
PowerShot S200

SONY
Cyber-shot DSC-
WX350

NIKON
Coolpix S6800

SONY
Cyber-shot
DSC-W830

Variant
Sport

CANON
PowerShot D30

NIKON
Coolpix AW120

NIKOM
Coolpix S32

tab. 20 Compact-Camera language analysis matrix 2014

YEAR 2015	Variant Handle Plastic Vintage		Variant Pocket Tech-Vintage
Body Type Classic	 CANON PowerShot G5 X	 NIKON Coolpix S9900	 CANON PowerShot G9 X
	 CANON PowerShot SX710 HS		 CANON owerShot SX610 HS
			 SONY Cyber-shot DSC-RX100 IV
			 SONY Cyber-shot DSC-RX100 IV
Body Type SLR-like	 NIKON Coolpix P610	 NIKON Coolpix P900	
	 NIKON Coolpix L840	 CANON PowerShot SX410 IS	
	 SONY Cyber-shot DSC-RX10	 CANON PowerShot SX530 HS	

*Colored squares indicate different color options

	Variant **Pocket** **Tech. Silver**			Variant **Sport**
	 CANON PowerShot ELPH 170 IS	 CANON PowerShot ELPH 160	 NIKON Coolpix S2900	 NIKON Coolpix S33
	 NIKON Coolpix S6900	 NIKON Coolpix S3700	 NIKON Coolpix S6800	 NIKON Coolpix AW120
	 CANON PowerShot ELPH 350			

tab. 21 Compact-Camera language analysis matrix 2015

YEAR 2016	Variant Handle Plastic Vintage	Variant Pocket Tech-Vintage
Body Type Classic	 CANON PowerShot G7 X Mark II  CANON owerShot S X720 HS  CANON PowerShot S X620 HS  NIKON Coolpix A900	 SONY Cyber-shot DSC-RX100 IV  SONY Cyber-shot DSC-WX500  SONY Cyber-shot DSC-HX90V
Body Type SLR-like	 CANON PowerShot SX420 IS  NIKON Coolpix B500  CANON PowerShot SX540 HS	 SONY Cyber-shot DSC-RX10 II  NIKON Coolpix B700

*Colored squares indicate different color options

	Variant **Pocket** **Tech. Silver**	Variant **Sport**
	 CANON PowerShot ELPH 190 IS  CANON PowerShot ELPH 360 HS  NIKON Coolpix A10  NIKON Coolpix A100  NIKON Coolpix A300	 NIKON Coolpix W100

tab.22 Compact-Camera language analysis matrix 2016

YEAR 2017	Variant Handle Plastic Vintage	Variant Pocket Tech-Vintage	Variant Sport
Body Type Classic		 SONY Cyber-shot DSC-HX80  SONY Cyber-shot DSC-RX100 V  CANON Canon PowerShot G9 X Mark II  CANON Canon PowerShot SX730 HS	 NIKON Coolpix W300
Body Type SLR-like	 SONY Cyber-shot DSC-RX10 III  SONY Cyber-shot DSC-HX350		

*Colored squares indicate different color options

tab. 23Compact-Camera language analysis matrix 2017

4.2 COMPACT-CAMERA PRODUCT LANGUAGE EVOLUTIONARY DYNAMICS

Methodology

This matrix classification allow me to identify how many languages variants were developed during 22 years of digital compact camera evolution and how much was the technoglical pliability exploited.
To understand the importance of the product language in this sector I need to understand the number of language proposal, their survival during the time, their evolutionary dynamics and the witch were the more relevant languages. I will analyse also if the competition was based on a common design discourse. Finally I made a comparison with the past product proposal to understand if the new technology was proposed as a robust design or a technology epiphany. As I explained in the settings I analysed the cameras using a matrix composed by two axes: Body Type and Variant. In terms of an architectural point of view the Body Type exploration seems to have a bigger impact in terms of pliability exploration indeed they involve features as dimension and general shape. The Variant are language elements are applied on the camera body shape and define different styles. In the first part of the analysis I will list all the different categories emerged both from Body Type and Variants. Than I will place on two different Cartesian graph (one for Body Type and one for the Variants) the different language categories to understand their evolution. Than I will cross the result to have a more clear product evolution dynamic overview. Once define the more relevant language emerged I will define if the there were a coherence inside the design discourse. Finally will compare them with some analogue samples to understand if the new technolgy it was treated with a robust design approach or a technology epiphany approach. To make a final consideration about the product design relevance I will wait the last paragraph of this section to

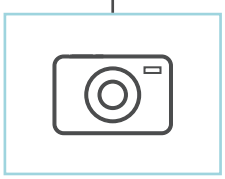
GENERAL OVERVIEW

BODY TYPE CATEGORIES — 7

VARIANT CATEGORIES — 9

414	**The number of the digital compact cameras analyzed during 22 years of market evolution**

Graph.32a Compact Camera Body Type List



CLASSIC

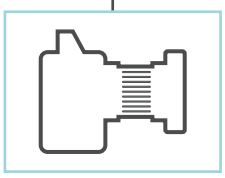
DIMENSION

min 95x60x20 mm
max 115x70x55 mm

DESCRIPTION
The box of this cameras had a parallelepiped shape. It is the classic shape of compact cameras.

325 CAMERAS NUMBER

21 YEARS



SRL-LIKE

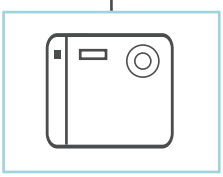
DIMENSION

min 130x90x100 mm
max 130x110x150 mm

DESCRIPTION
These cameras instead are compact cameras from a technoglical point of view have a SRL camera appearance

67 CAMERAS NUMBER

19 YEARS



BOX

DIMENSION

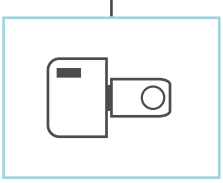
min 95x50x65 mm
max 142x100x95 mm

DESCRIPTION

The box of this cameras has a more regular proportion compare to the one of classic shape. They are also bigger.

8 CAMERAS NUMBER

6 YEARS



ARTICULATED

DIMENSION

min 51x77x35 mm
max 140x123x40 mm

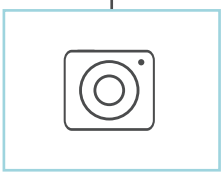
DESCRIPTION

The box of this cameras could have different shapes, but the more relevant factors is that they are jointed and the lens can be rotated.

11 CAMERAS NUMBER

6 YEARS

Graph.32b Compact Camera Body Type List



SOCIAL CAM

DIMENSION

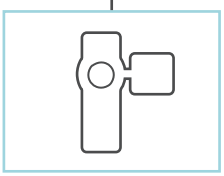
80x60x30 mm

DESCRIPTION

Their box has a regular proportion between its dimensions, and it is small. They are designed for a fast social network sharing

2 CAMERAS NUMBER

1 YEARS



CAMCORDER LIKE

DIMENSION

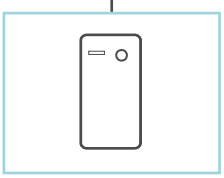
90x60x30 mm

DESCRIPTION

These cameras are proposed with a camcorder shape, with the height dimension more pronounced and with a jointed LCD screen

1 CAMERAS NUMBER

1 YEARS



VERTICAL

DIMENSION

min 60x150x35 mm
max 80x150x35 mm

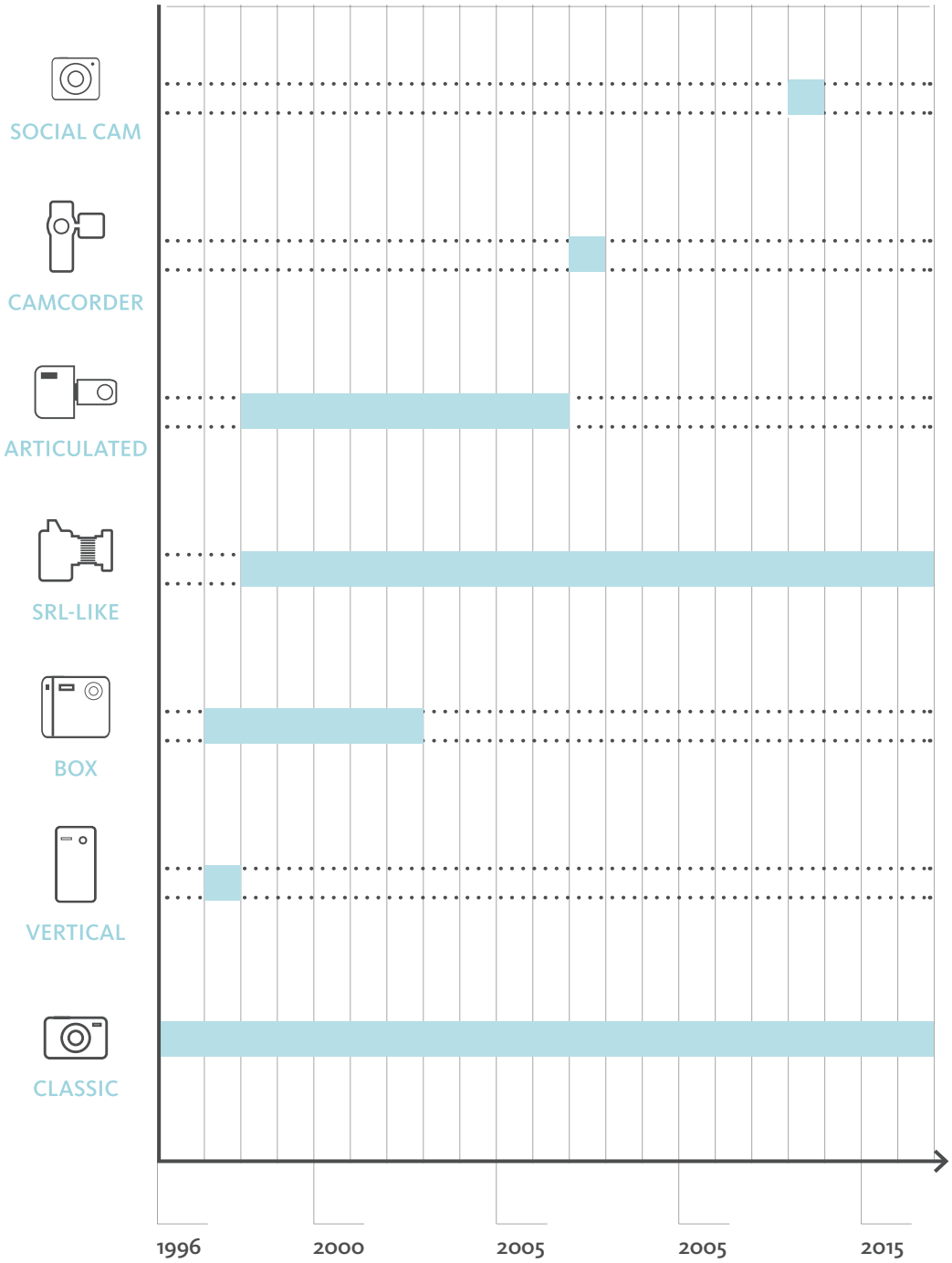
DESCRIPTION

These cameras are proposed with reversed proportion compare to the classic cameras.

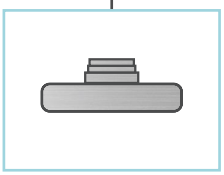
2 CAMERAS NUMBER

1 YEARS

Graph.33 Body Types presence inside the market from 1996 to 2017



Graph.34a Compact Camera Variant List



POCKET TECH. SILVER

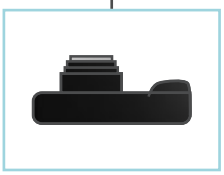
DETAILS
No handle on the side;
Retractile lens

FINISH
Look-like silver box (also colored)

STYLE
Technological object

132 CAMERAS NUMBER

18 YEARS



HANDLE PLASTIC VINTAGE

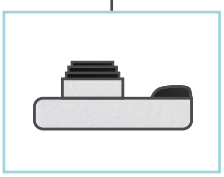
DETAILS
Handle on the side.

FINISH
Dark opaque plastic box.
Look-like silver on little details

STYLE
Vintage compact camera

99 CAMERAS NUMBER

18 YEARS



HANDLE SILVER

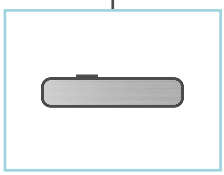
DETAILS
Handle on the side.

FINISH
Look-like silver box (also colored).
Opaque plastic on little details

STYLE
Between technological and vintage

84 CAMERAS NUMBER

18 YEARS



POCKET FLAT TECH. SILVER

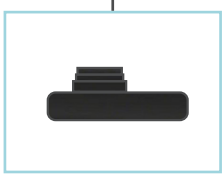
DETAILS
No handle on the side;
No retractile lens

FINISH
Look-like silver box (also colored)

STYLE
Technological object

35 CAMERAS NUMBER

9 YEARS



POCKET TECH. VINTAGE

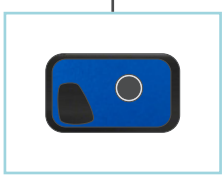
DETAILS
Little details that refer to vintage cameras

FINISH
Dark metallic plastic box.

STYLE
Technological-elegant object

27 CAMERAS NUMBER

7 YEARS



SPORT

DETAILS
Rounded and beveled corners

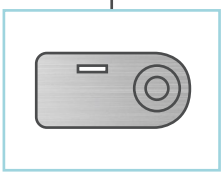
FINISH
Mix of metallic and plastic
Always colored

STYLE
Robust and energetic

17 CAMERAS NUMBER

7 YEARS

Graph.34b Compact Camera Variant List



POCKET SILVER SEMI-ROUNDED

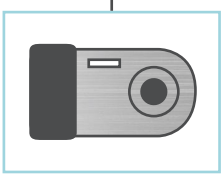
DETAILS
One rounded side
Retractile lens

FINISH
Look-like silver box (also colored)

STYLE
Technological object

14 CAMERAS NUMBER

5 YEARS



HANDLE SEMI-ROUNDED

DETAILS
One rounded side
Retractile lens

FINISH
Silver look-like and/or plastic

STYLE
Between technological and vintage

4 CAMERAS NUMBER

3 YEARS

POCKET PLASTIC VINTAGE

DETAILS
No handle on the side;
No retractile lens

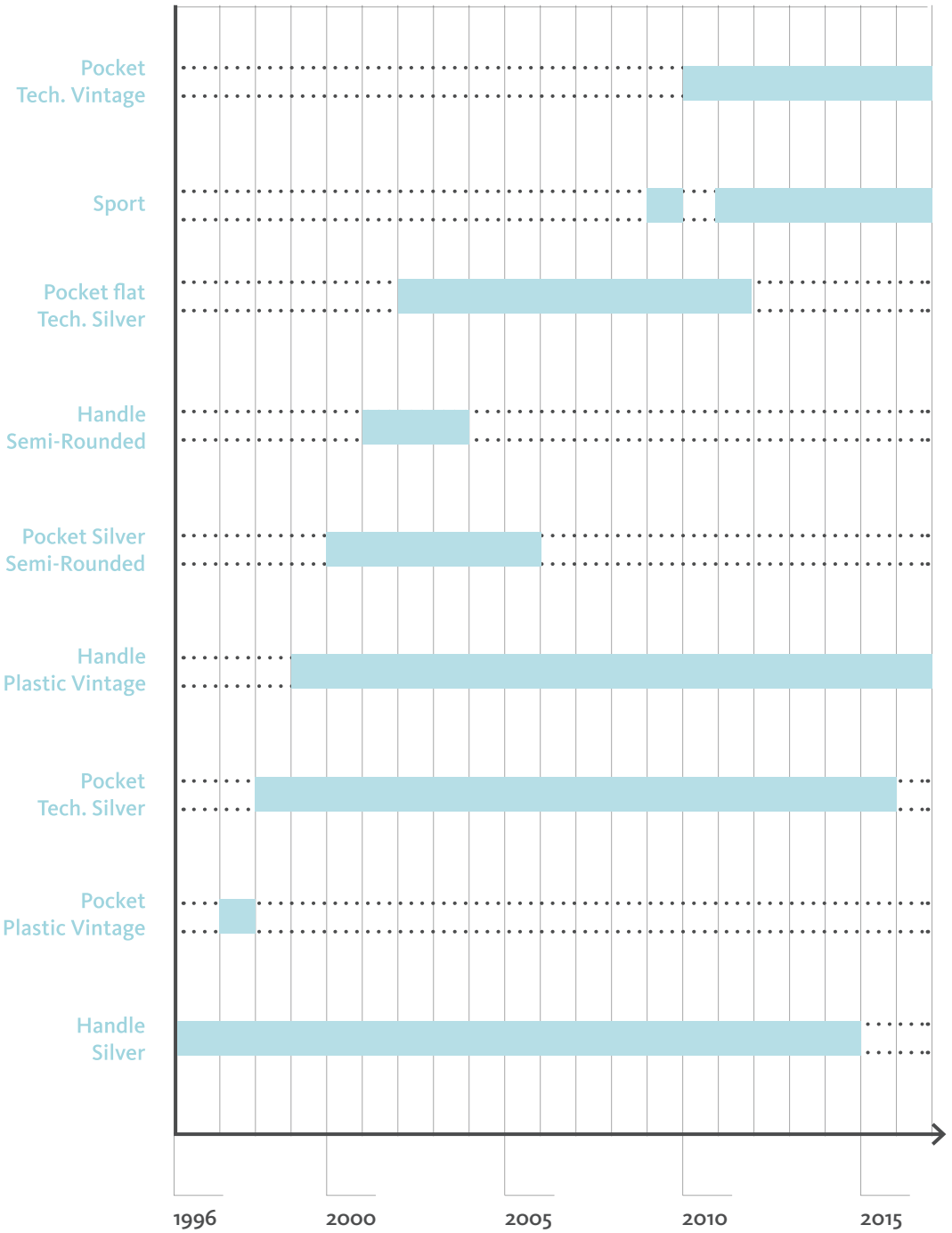
FINISH
Dark opaque plastic box.

STYLE
Between technological and vintage

2 CAMERAS NUMBER

1 YEARS

Graph.35 Variants presence inside the market from 1996 to 2017



Evolutionary dynamics: product language exploration, tech. style exploitation and decline

Considering the graph "Body Types presence inside the market from 1996 to 2017" on page 75 it is possible observe that in the initial phase of product proposals there were many different body type cameras. In the middle of the timeline the body cameras become just three and from 2007 the relevant body cameras affirmed on the market remained are just two. The fast failure body camera proposed at the end of the timeline are related to an attempt to reach a niece market (e.g. Social Camera). The Body Camera categories are related to features as shape and dimension that are usually used to propose new radical language. In the first periods of exploration and experimentation usually new pivotal product experiments are made and they involve that features that more influence a "active sight" perception. In the last phases, the successful pivotal product became dominant giving more space to other kind of product design differentiations, more related to details and styles. If we take a look to body cameras numbers we can observe that the number of cameras related to "Classic Cameras" and "SRL-like" are massive compare to the others. Both categories had an incremental grow during the years (if we exclude the last two years where the camera numbers fall down probably for the market crisis analysed in the previous chapter). Between these last two groups the Classic Cameras are the more relevant.

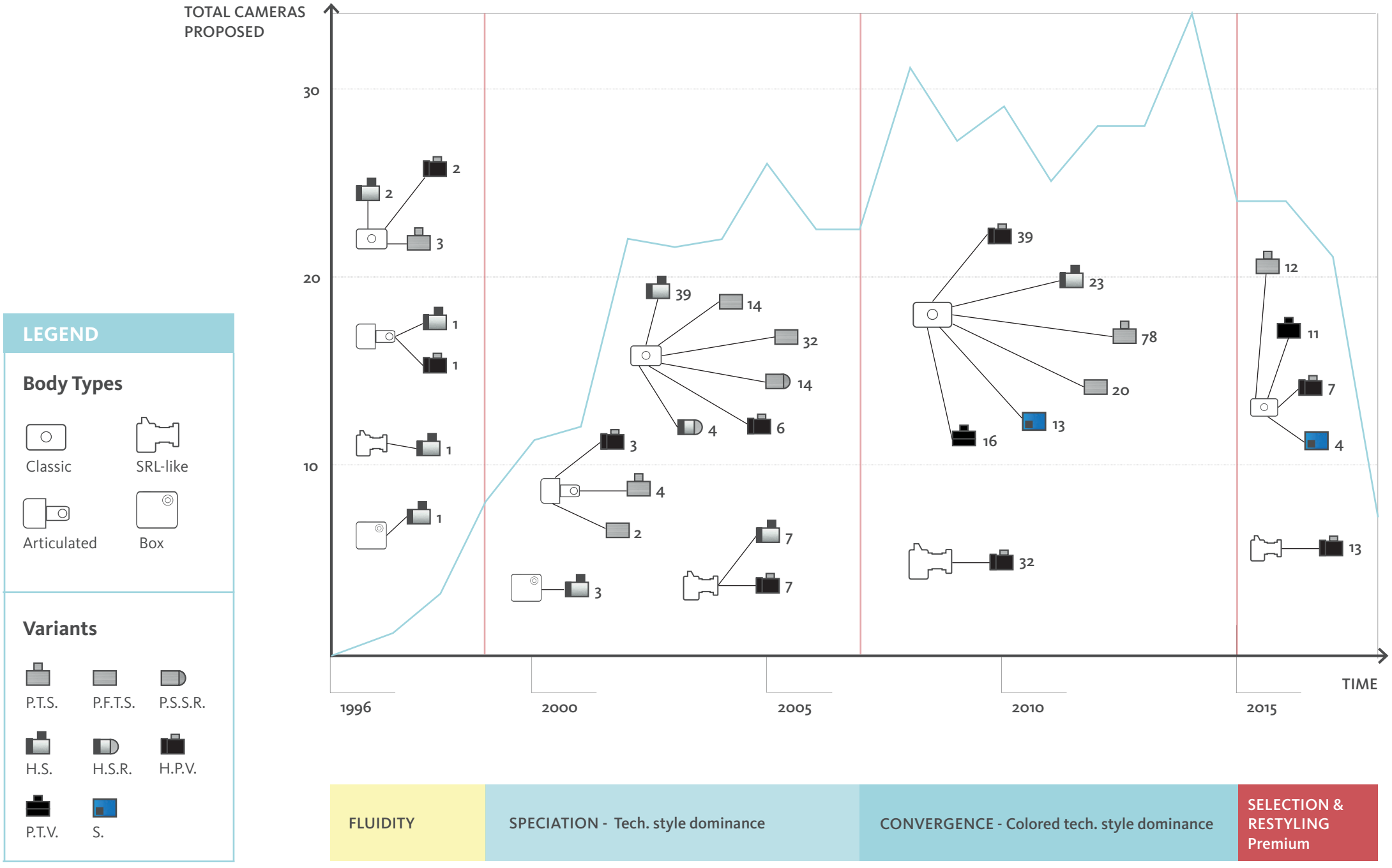
If we move our attention on the graph "Variances presence inside the market from 1996 to 2017" on page 79 we can observe a total different behaviour of the language evolution compared to the previous on. From the begging almost every one-two year a new language was proposed. Except for two cases (Pocket Plastic Vintage and Handle Semi-Rounded) the life of the languages is more than 5 years. During these periods many cameras are proposed for each categories. These product design attribute are used to differentiate the cameras and they are "applied" on the different body shape.

To better understand how Body Types and Variants are used during the years I developed a Product Language Evolutionary Dynamics graph in witch it is possible observe how the product language proposals evolve during the years. On the vertical axe I place the Total number of camera proposal and on the horizontal axes the time.

Looking the graph it is possible observe how the number of camera proposed it is related to a different moment of product language proposal.

We have a first short period in witch many pivotal Body Type camera are proposed with few number of Variance. We can define this period as the exploration. In the next period we found the same Body Type cameras but with different Variants for each of it. In this period different details and finish are applied to the Body Cameras. We can called this moment Experimentation. We can observe that during the experimentation period there is a dominance of a "Technological product" style. The next phase it is characterized by the affirmation of the more successful Body Shape and Variants. Inside these crossed categories more camera are proposed compare to the past. This mean that we can observe an Exploitation moment in witch companies tried to work on secondary elements to differentiate the product. Indeed we can observe that the tech style remained the dominant and for each camera proposed there are many version that different just for little elements. In this period the camera model are proposed with many coloured variants. Also two new Variants are proposed in this period: Sport and Pocket Tech. Vintage. The first one clearly tried to address a niece. As we could see from the last phase that I called decline the number of cameras decrees drastically. Also the style dominance completely change indeed it seems that vintage cameras and sport cameras slowly took the place of "tech. style" cameras. Probably because the tech. style cameras was the one used for point and shot cameras, while the Vintage cameras and the sport cameras are more related to nieces. For example most of the Pocket Tech. Vintage cameras had also have advanced option to take picture. Its premium design it is used to show that with this cameras it is possible take better picture than standard compact cameras and smartphones as well.

GRAPH.36 COMPACT-CAMERA MARKET EVOLUTIONARY DYNAMICS



4.3 COMPACT-CAMERA PRODUCT LANGUAGE STRATEGIES

Robust Design Strategy

The digital technology shift in the camera market it is a discontinuous technoglical change. I wanted to understand if also product design language was used using a radical innovation approach. To do so I needed to compare the new product languages with the one proposed in the past for the analogue cameras. To do so I decided to make a first selection of the most relevant digital compact languages. To do so I use the criteria of number of camera proposed and duration during the year. Then I pick one representative sample from all the categories and I made a comparison with a selected successful analogue model. In the case of the SRL-like camera I took as example an SRL 35mm compact camera. The product language selected are the following:

a) **Body Type: "Classic" + Variant: "Pocket Tech. Silver"**
For this comparison I selected for the digital compact camera side the "Canon PowerShot SD100" ; and the "Nikon One Touch Zoom90s" for the analogue cameras.

b) **Body Type: "Classic" + Variant: "Handle Plastic Vintage**"
For this comparison I selected for the digital compact camera side the "Canon PowerShot G7X" ; and the "" for the analogue cameras.

c) **Body Type: "Classic" + Variant: "Handle Silver"**
For this comparison I selected for the digital compact camera side the "Canon PowerShot A10" ; and both "Canon PowerShot G7X" and the "Nikon One Touch Zoom90s" from the analogue cameras.

d) **Body Type "SRL-like" + Variant: "Handle Plastic Vintage"**
For this comparison I selected for the digital compact camera side the "Nikon Coolpix B500" ; and the "Nikon F75 35mm" for the analogue cameras.

To make to comparison I analysed the difference between the elements that influence Optical and Tactile perception. If the difference are related to Optical perception elements the product language evolution it's considered radical; if the difference concern only Tactile elements could be considered Incremental (Robust Design).
All the cameras analysed could be considered the result of a Robust Design strategy because they have in common both Optical perception elements and even many Tactile perception elements.

Tab.24a Compact Cameras language analysis: analogue vs digital

BODY TYPE CLASSIC

VARIANT POCKET TECH. SILVER

ANALOG	DIGITAL
	
DIMENSIONS 60x 115x25 mm	DIMENSIONS 55 x 85 x 20 mm
SHAPE	SHAPE
COLORS	COLORS
Finish	Finish
Decoration	NO — Decoration
Texture — NO	NO — Texture
Details — Golden and Black types	Golden and Silver types — Details

ROBUST DESIGN

Tab.24a Compact Cameras language analysis: analogue vs digital

BODY TYPE CLASSIC

VARIANT HANDLE PLASTIC VINTAGE

ANALOG	DIGITAL
	
DIMENSIONS 125 x 70 x 50 mm	DIMENSIONS 110 x 60 x 45 mm
SHAPE	SHAPE
COLORS	COLORS
Finish	Finish
Decoration	Decoration
Texture	Texture
Details — White types	White types — Details

ROBUST DESIGN

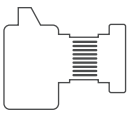
BODY TYPE SRL-LIKE

VARIANT HANDLE PLASTIC VINTAGE

ANALOG

DIMENSIONS
60x 115x25

SHAPE



COLORS

Finish

Decoration — NO

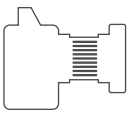
Texture

Details — White and Orange types

DIGITAL

DIMENSIONS
55 x 85 x 20

SHAPE



COLORS

Finish


Decoration

Texture

White types — Details

ROBUST DESIGN

Tab.24c Compact Cameras language analysis: analogue vs digital

BODY TYPE CLASSIC

VARIANT HANDLE SILVER

ANALOG

DIGITAL

ROBUST DESIGN

Robust Language Hybridization

The Classic + Silver Handle it can be considered a hybridization between the Handle Plastic Vintage and Pocket Tech. Vintage Variant on a Classic Body Shape.

Cooperation inside the design discourse

After the first three year of exploration in witch all brands tried to proposed different product languages the three camera Brand analysed start adhere to the same design discourse. All the competitors proposed cameras in all the Body Type categories and on all Variant proposed. All the competitors proposed a massive number of "Classic" body shape cameras, with a focus on all the Variant with a "technoglical product" style (during Experimentation phase and Exploration phase). From 2006 companies tried to use colours to differentiate they offer for both "Tech." style cameras and the more neutral Handle cameras. It can be also observed a common evolution during the year of the reduction of little details: the "tech." cameras became more minimal. As we observe in the previous paragraph also the SRL-like cameras were produce since the begging till the end. These Body Type camera were proposed only with the "Handle Plastic Vintage" from the 2007. All companies produced both SRL-like and Classic cameras under this Variant from the begging to the end. And it can be also notice that from 2010 all Producers start to reduce the number of "Tech. Style" cameras and increase the production of Vintage Cameras (also a new "Vintage" variants was added to the list). From 2011 all the companies started to produce the Sport camera variant. We can conclude saying that Canon, Nikon and Sony shaped with a cooperative approach the compact-camera design discourse

Low degree of languages variations inside the digital Compact Camera market

Looking at the most relevant languages emerged from the analysis it is possible trace a line on witch could be placed the product language differences. From an extreme of a more profession and vintage appearance to a more easy use that is linked to a more technological product style. All the other less relevant categories could be place in this line. The only type of camera that can not be place inside this line it is the Classic + Sport Variant. The result of that analysis show that the degree of language differentiation inside the compact camera market is not high.

graph.37 Variants insisde the market

Recap

With the digital shift inside the digital camera market the companies do not use design as a main competitive driver.
Indeed the radical technoglical shift it was not support by a radical design change. As I proved the companies used a Robust Design strategy. Also inside the market companies adhere to the design discourse. Even the language variation inside the same market are reduced to two main categories in witch are proposed variance with a different degree of diversity.

4.4 THE ANALYSIS OF ACTION-CAMERA COMPETITIVE CONTEXT

Settings

With this analysis I tried to understand the action cameras language evolution from the launch of the first action camera (2004) to the current year (2017). The first year the only camera analysed it is the GoPro Hero that was still analogue. I decided to put it to give a more complete idea of the language evolution in this sector.
As the competition in this market it was fast and dynamic, with many cameras proposition, with new competitors every years and a not clear database to define witch were (except for GoPro) the market share during the year I decide to select an wide range of significant brands. A first complete list of action camera producers was taken from Pevly.com (Action Camera Brands, n.d.). Than I selected the most significant brands looking the most cited ones on specialized websites. To made a clear and precise Timeline I had search end for each brand, year by year, the camera proposals launched on the market. dTo do so I made a cross research analysing the company website, specialize tech. websites (as TheVerge.com, Engagedt.com, Techradar.com) and the social network YouTube (often used to present the camera models both from companies or amateur). After this first analysis I build a matrix to compare the different language using the same criteria presented in the Introduction (in this case the axes are reversed for a layout issue).
To better understand the language proposal, especially for the "Variant" categories I take in account also how the cameras were presented inside the website (it is possible look this more complete analysis on the appendix).
In the next page I list the 38 brand analysed, making a distinction according to different industry field. This will help to understand how this new market involve not only camera producer, but generate a complex and heterogeneous completion. The action cameras producer involved belong to the following industries: consumer electronics, optics and imaging, sport equipments, GPS and wearable technology, specialized action cam producers and enforcement

Range of time

2004-2017

Tab.25 Action Camera Brands

tab. 26-27-28Compact-Camera language analysis matrix 2004-2005-2006

YEAR 2004	Body Type Classic
Variant Plastic tech.	 GOPRO HERO 35mm

YEAR 2005	Body Type Helmet	Body Type Gun
Variant Accessory	 OREGON SCI. ATC-1000	
Variant Enforcement		 AXON Taser X26P

YEAR 2006	Body Type Classic	Body Type Helmet
Variant Plastic tech.	 GOPRO Digital HERO	
Variant Accessory		 OREGON SCI. ATC2k

YEAR 2007	Body Type Classic	Body Type Helmet
Variant Plastic tech.	 GOPRO Digital HERO3	
Variant Accessory		 OREGON SCI. Eicma 2008
Variant Premium		 CONTOUR VHOLDR

YEAR 2008	Body Type Classic	Body Type Helmet	Body Type Life Logging	Body Type Goggle
Variant Plastic tech.	 GOPRO Digital HERO5			
Variant Premium		 CONTOUR VHOLDR		
Variant Sport				 LIQUIDIMAGE Explorer
Variant Enforcement			 AXON Axon Pro	

tab. 30 Action -Camera language analysis matrix 2008

YEAR 2009	Body Type Helmet	Body Type Life Logging	Body Type Goggle
Variant Accessory	 OREGON SCI. ATC3K		
Variant Premium	 CONTOUR Contour HD	 MUVI Veho VCC-003	
Variant Sport			 LIQUIDIMAGE ProHD350
Variant Enforcement		 VIEVU LE3	

tab. 31 Action -Camera language analysis matrix 2009

YEAR 2010	Body Type Classic	Body Type Helmet	Body Type Camcorder	
Variant Plastic tech.	 GOPRO HD HERO	 CHILLI TECH. Action Cam 1  CHILLI TECH. Action Cam Max		
Variant Sport		 OREGON SCI. ATC9K	 DRIFT X170	
Variant Premium				

tab. 32 Action -Camera language analysis matrix 2010

	Body Type **Life Logging**	**Body Type** **Goggle**
	 KODAK Playsport zx3	 LIQUIDIM. Explorer  LIQUIDIM. Freestyle  LIQUIDIM. Summit D1
	 MUVI VCC-005-MUVI- HD10 Mini	

YEAR 2011	Body Type Classic	Body Type Helmet	Body Type Camcorder	
Variant Plastic tech.	 GOPRO HD HERO2	 CHILLI TECH. Action Cam 1  CHILLI TECH. Action Cam Max	 MIDLAND XTC	
Variant Sport	 SWISS+GO Swann PRO		 DRIFT Drift HD  MIDLAND XTC-350	
Variant Premium	 SWISS+GO Swann Freestyle HD	 CONTOUR Contour HD		
Variant Accessory		 REPLAY REPLAY XD  OREGON SCI. ACT MINI		

	Body Type **Life Logging**	**Body Type** **Goggle**
		 LIQUIDIM. Impact
	 MUVI VCC-004-ATOM	

YEAR 2012	Body Type Classic	Body Type Helmet	Body Type Camcorder	
Variant Plastic tech.	 GOPRO HD HERO3			
Variant Sport	 POLAROID XS7	 ION Air Pro  POLAROID XS20  POLAROID XS100	 DRIFT HD Ghost  JVC GC-XA1BEU	
Variant Premium			 SONY HDR-AS15	
Variant Accessory		 OREGON SCI. ATC Chameleon  OREGON SCI. ACT Beats		

	Body Type **Life Logging**	**Body Type** **Wearable**	**Body Type** **Goggle**
	 KODAK PIXPRO SPZ1  LIQUIDIMAGE Ego	 ACTIVEON Action Shot	 LIQUIDIM. SUMMIT  PIVOTHEAD Durango  LIQUIDIM. APEX
	 MUVI VCC-005-ATOM		

YEAR 2013	Body Type Classic	Body Type Helmet	Body Type Camcorder	
Variant Plastic tech.	 GOPRO HD HERO3+  CHILLI TECH. Mini Cam Pro HD		 SJCAM n.d.	
Variant Sport		 ION Air Pro 2  REPLAY XD 1080	 DRIFT HD Ghost 1080  KODAK 1080p action cam  MIDLAND XTC-450	
Variant Premium		 CONTOUR Contour +2	 SONY HDR AZ1 Action Mini	
Variant Accessory		 CHILLI TECH. HD 120  PANASONIC HX-A500		

	Body Type Life Logging	**Body Type** Deck	**Body Type** Goggle
	 SJCAM HD SJ1000	 ION The Game  GARMIN Virb  GARMIN Virb Elite	 LIQUIDIM. Skiing  LIQUIDIM. Sky
		 MOEBIUS Action Cam	

YEAR 2014a	Body Type Classic	Body Type Helmet	
Variant Plastic tech.	 GOPRO HD HERO4  ACTIVEON DX  SJCAM SJ4000		
Variant Sport		 ION Air Pro 3  ION Xtra Texture	
Variant Funl/lifestyle	 XIAOMI Yi 4K		
Variant Premium	 MUVI k1	 CONTOUR ROAM 2	
Variant Accessory		 PANASONIC HX-A100D	

	Body Type **Camcorder**	**Body Type** **Life Logging**
	 MIDLAND XTC-400	
	 DRIFT HD GHOST  JVC GC-XA1	
		 OREGON SCI. Gecko HD
	 SONY AS100V  SONY HDR – AS30V	

YEAR 2014b	Body Type Deck	Body Type Cube	
Variant Plastic tech.			
Variant Sport	 RICOH WG M1		
Variant Funl/lifestyle		 POLAROID Cube	
Variant Premium			
Variant Accessory			

	Body Type Tube	**Body Type** Wearable	**Body Type** 360
		 CASIO Exilim ex-fr10	 KODAK PIXRO SP360
	 HTC RE		
			 FLY 360 Fly

YEAR 2015	Body Type Classic	Body Type Camcorder	Body Type Life Logging	Body Type Helmet	
Variant Plastic tech.	 LIQUIDIMAG EGO-LS				
Variant Sport	 GARMIN Virb-XE			 TOMTOM Bandit  REPLA Bandit	
Variant Enforcement			 AXON Body 2  VIEVU LE 4 minu		
Variant Funl/lifestyle		 GRAAVA Graava			
Variant Premium	 GOPRO Hero+	 SONY HDR AS100V			
Variant Accessory				 PANASONIC HX A1	

	Body Type Cube	Body Type Deck	Body Type Goggle	Body Type Wearable
	 CHILLY TECH. Pro II HD			 ION SnapCam
			 PIVOTHEAD KUDU	
	 GOPRO Session  SJCAM SJM10			 DRIFT Compass
		 MOEBIUS Action Cam  SHIMANO HD CM-1000		

YEAR 2016a	Body Type Classic	Body Type Helmet	
Variant Plastic tech.	 ACTIVEON DX  GITUP Git2 2K  SWISS+GO Prix		
Variant Sport	 MIDLAND H7  GARMIN Ultra 30		
Variant Funl/lifestyle			
Variant Premium	 GOPRO HERO5  NIKON KeyMission 170  XIAOMI Yi 4K  MUVI K2	 LG LTE	
Variant Accessory			

	Body Type **Camcorder**	**Body Type** **Wearable**	**Body Type** **Life Logging**
	 DRIFT GHOST 4K		
	 SONY FDR-X3000R	 CASIO Exilim EX-FR100 FR100	 NIKON KeyMission 80
	 OLYMPUS TG-Tracker - TOUGH		

YEAR 2016b	Body Type Deck	Body Type Cube	
Variant Plastic tech.			
Variant Sport	 RICOH WG-M2		
Variant Funl/lifestyle		 POLAROID Cube+	
Variant Premium		 GOPRO Session5	
Variant Accessory			
Variant Enforcement		 VIEVU LE5 LITE	

	Body Type Goggle	Body Type 360
	 PIVOTHEAD Durnago	 KODAK SP360 4K  MIDLAND H360
	 LIQUIDIMAGE ZEAL HD2  LIQUIDIMAGE Scuba HD720P_  LIQUIDIMAGE Torque Motocross  PIVOTHEAD Recon Black Jet	
		 360FLY 360Fly 4K  NIKON KeyMission 360

YEAR 2017*	Body Type Classic	Body Type Helmet	Body Type Deck	Body Type 360
Variant Plastic tech.	 SJCAM SJ7 Star			
Variant Premium	 XIAOMI Yi 4K Plus	 ION Air Pro 4K		 GARMIN Virb 360
Variant Accessory			 SHIMANO CM-2000  SHIMANO CM-1100	

*Cameras have been update untill 31 August 2017

tab. 39 Action-Camera language analysis matrix 2017

4.5 ACTION-CAMERA PRODUCT LANGUAGE EVOLUTIONARY DYNAMICS

Methodology

This matrix classification allow me to identify how many languages variants were developed during 13 years of digital action camera evolution and how much was the technoglical pliability exploited.To understand the importance of the product language in this sector I need to understand the number of language proposal, their survival during the time, their evolutionary dynamics and the witch were the more relevant languages. I will analyse also if the competition was based on a common design discourse. Finally I made a comparison with the past product proposal to understand if the new technology was proposed as a robust design or a technology epiphany.As I explained in the settings I analysed the cameras using a matrix composed by two axes: Body Type and Variant. In terms of an architectural point of view the Body Type exploration seems to have a bigger impact in terms of pliability exploration indeed they involve features as dimension and general shape. The Variant are language elements are applied on the camera body shape and define different styles.In the first part of the analysis I will list all the different categories emerged both from Body Type and Variants. Than I will place on two different Cartesian graph (one for Body Type and one for the Variants) the different language categories to understand their evolution. Than I will cross the result to have a more clear product evolution dynamic overview.Once define the more relevant language emerged I will define if the there were a coherence inside the design discourse. Finally will compare them with some analogue samples to understand if the new technology it was treated with a robust design approach or a technology epiphany approach. I also try to understand looking to brands website pictures if the product language differentiation was related to a different target proposal.

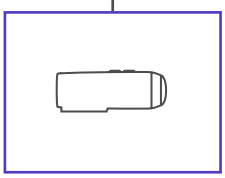
GENERAL OVERVIEW

BODY TYPE CATEGORIES — 11

VARIANT CATEGORIES — 6

148	The number of the digital action cameras analyzed during 13 years of market evolution

Graph.38a Action-Cam Body Type List



HELMET

DIMENSION

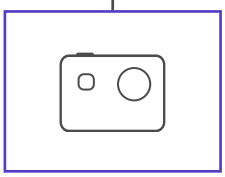
~ 50x30x100 mm

DESCRIPTION

These cameras had a tube-horizontal shape and are particularly indicated to be fixed on helmets

34 **CAMERAS NUMBER**

13 **YEARS**



CLASSIC

DIMENSION

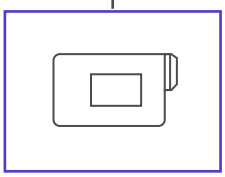
~ 40x60x25 mm

DESCRIPTION

The proportion between the box sides it is similar to the compact cameras. The lens position as well

30 **CAMERAS NUMBER**

11 **YEARS**



CAMCORDER

DIMENSION

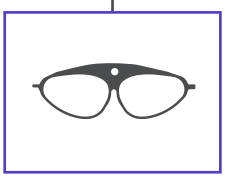
~ 50x30x85 mm

DESCRIPTION

These cameras are proposed with reversed proportion compare to the classic cameras.

22 **CAMERAS NUMBER**

7 **YEARS**



GOGGLE

DIMENSION

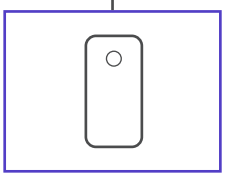
Not define

DESCRIPTION

The cameras it is directly placed on goggle structures.

17 **CAMERAS NUMBER**

8 **YEARS**



LIFE LOGGING

DIMENSION

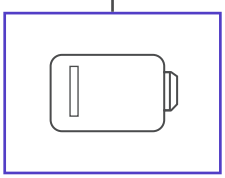
~ 85x65x20 mm

DESCRIPTION

In terms of high and length proportions they are opposite to the Classic one. More similar to a phone shape.

14 **CAMERAS NUMBER**

8 **YEARS**



DECK

DIMENSION

~ 35x45x80 mm

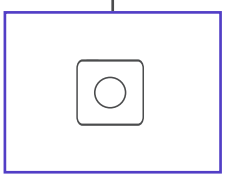
DESCRIPTION

In terms of high and length proportions they are opposite to the Camcorder Body Type.

10 **CAMERAS NUMBER**

5 **YEARS**

Graph.38a Action-Cam Body Type List



CUBE

DIMENSION

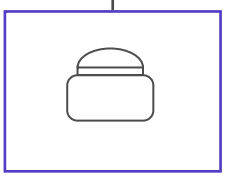
~ 35x35x35 mm

DESCRIPTION

They are tinny models with the same dimension for each side. They look as a cube

7 CAMERAS NUMBER

3 YEARS



360

DIMENSION

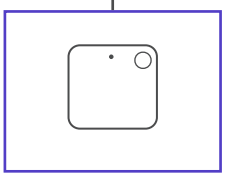
~ 65x60x60 mm

DESCRIPTION

I made this category that had inside different shape variants because it is considered as a separate group of action cams

7 CAMERAS NUMBER

3 YEARS



WEARABLE

DIMENSION

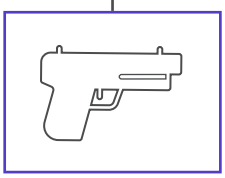
~ 45x45x15 mm

DESCRIPTION

These tinny models have very similar high and length but they have a very small width. They fill a very small amount of space

5 CAMERAS NUMBER

4 YEARS



GUN

DIMENSION

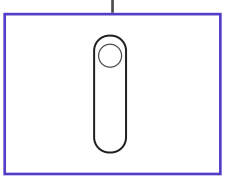
Not define

DESCRIPTION

The camera it is place on camera handle.

1 CAMERAS NUMBER

1 YEARS



TUBE

DIMENSION

~ 95x25x25 mm

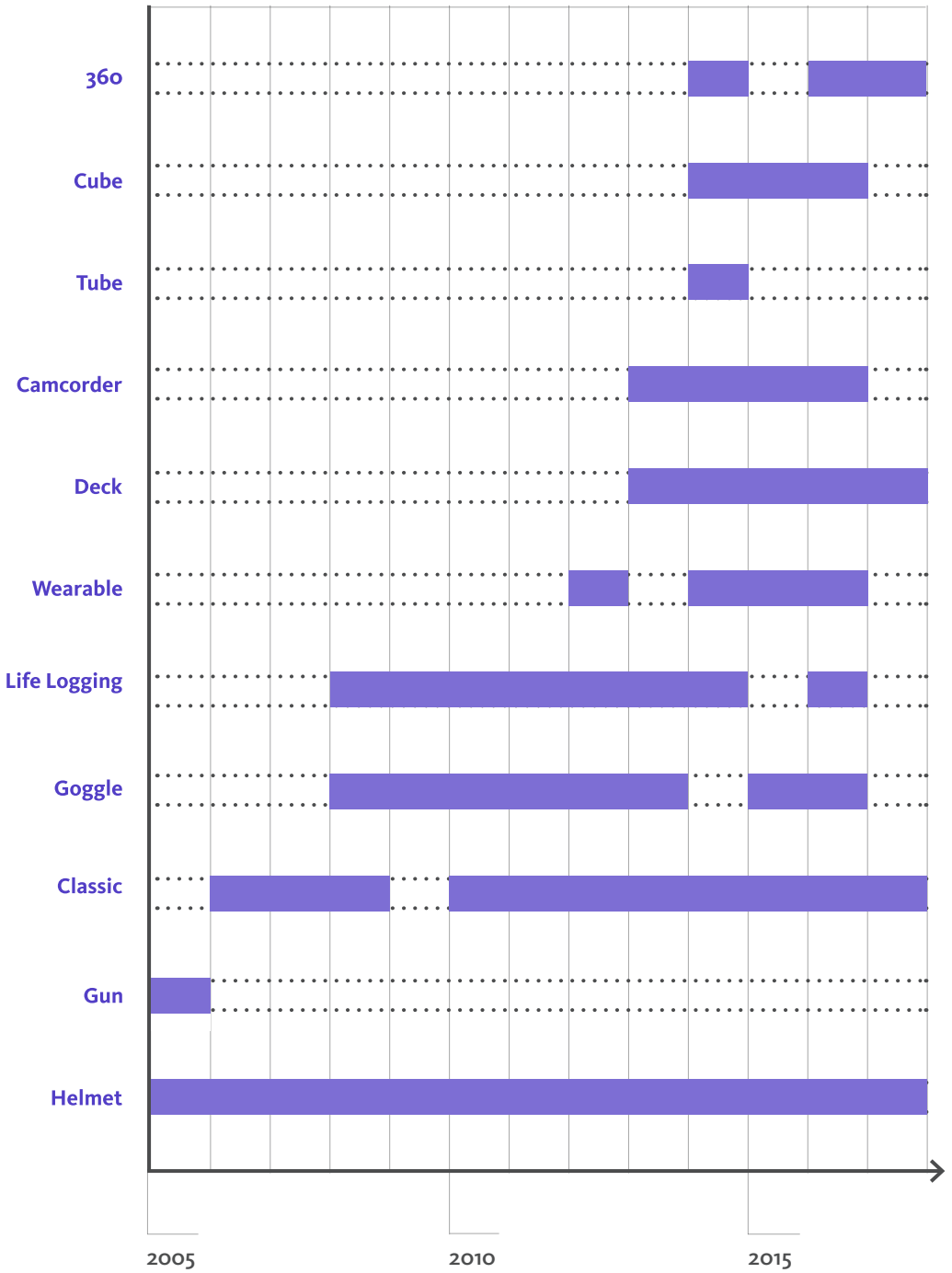
DESCRIPTION

The camera have a tube-vertical shape, with the lens place on the length side.

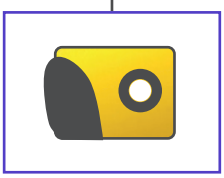
1 CAMERAS NUMBER

1 YEARS

Graph.39 Body Types presence inside the market from 2005 to 2017



Graph.40a Action-Cam Variant List



SPORT

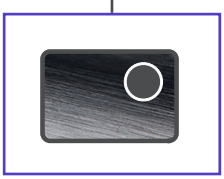
DETAILS
Rounded and beveled corners

FINISH
Mix of metallic and plastic
Often colored

STYLE
Robust and energetic

53 **CAMERAS NUMBER**

9 **YEARS**



PREMIUM

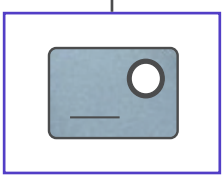
DETAILS
Cared for the little details

FINISH
Dark lucid plastic box.
Look-like silver on little details

STYLE
Elegant and resistant

36 **CAMERAS NUMBER**

11 **YEARS**



PLASTIC TECH.

DETAILS
Not many details

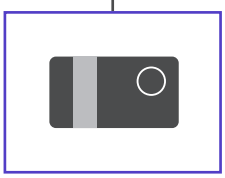
FINISH
Opaque plastic (Different colors)

STYLE
Technolgical but affordable

28 **CAMERAS NUMBER**

11 **YEARS**

Graph.40b Action-Cam Variant List



ACCESSORY

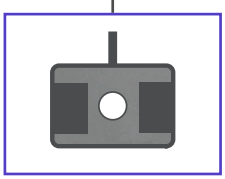
DETAILS
Some metallic decorations

FINISH
Dark opaco plastic box.
Look-like silver on little details

STYLE
More supplement than a camera

19 **CAMERAS NUMBER**

11 **YEARS**



ENFORCEMENT

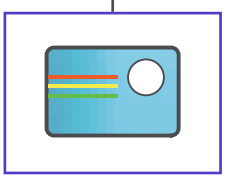
DETAILS
Rubber inserts for a secure grip

FINISH
Dark opaque plastic box;

STYLE
Police accessory

6 **CAMERAS NUMBER**

5 **YEARS**



ART/FUN

DETAILS
Soft and elegant curves

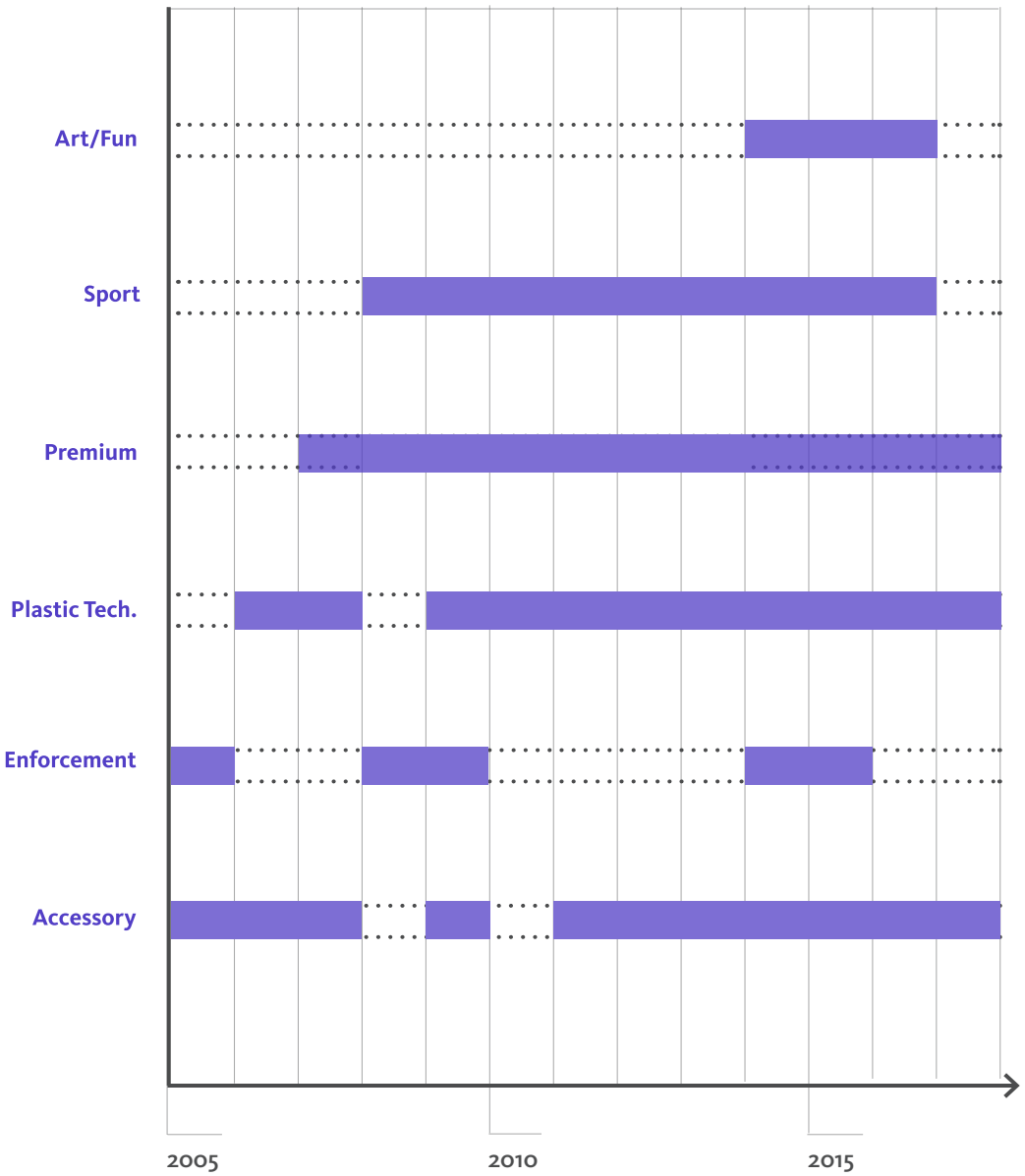
FINISH
Colored plastic

STYLE
Lifestyle and fashion object

6 **CAMERAS NUMBER**

3 **YEARS**

Graph.41 Body Types presence inside the market from 2005 to 2017

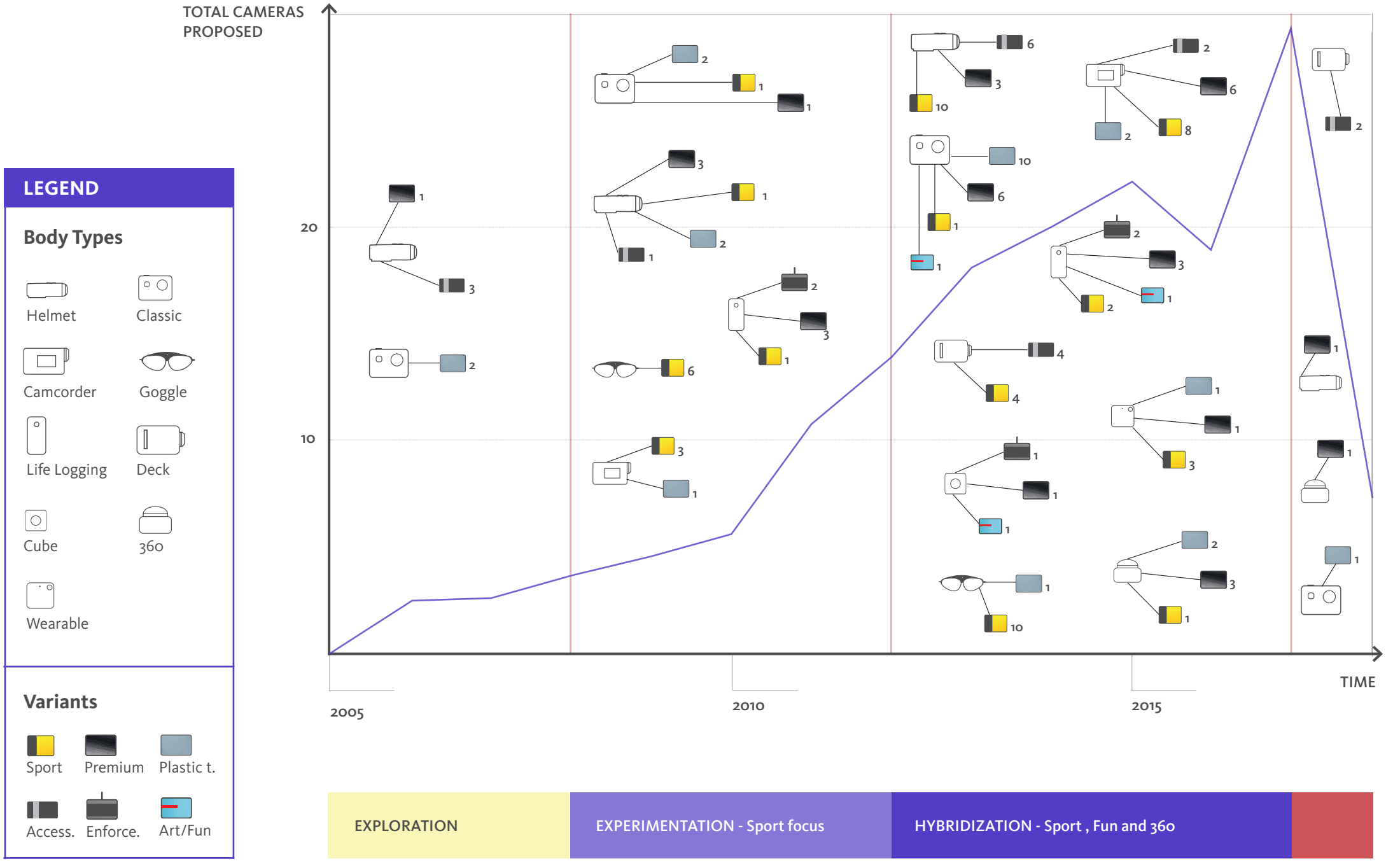


Evolutionary dynamics: product language exploration, exploitation and hibridization

Considering the graph "Body Types presence inside the market from 2005 to 2017" on page 88 (related to Action Camera market) it is possible notice a completely different behaviour compare to the one of compact cameras. The number of Body Type proposal is higher with 11 proposals instead the 7 of compact cameras. Another important factor is that if compact cameras had an high proposal of body types cameras at the begging, becoming more stable during exploration phase and even shrinking its proposal to just two types in the last two phases. For the action camera market the new Body Types proposals are continue for all the years analysed. And it is also interesting to notice that almost all the Body Types cameras are proposed until the end. The presence of empty spaced inside the same Body Type proposal indicate that not every company were proposed the same language. Also looking at the number cameras proposed to market in the same category it is possible notice an equilibrium. There are three camera Body Types that have inside their category between 20-30 (Helmet, Classic and Camcorder) cameras; three other categories that have between 10-20 proposal (Goggle, Life Logging and Deck). Categories as Cube and 360 have 7 proposals each, but they are inside the market from a shorter period of time. Moving our attention to the graph "Body Types presence inside the market from 2005 to 2017" on page 91 we can observe that the number of variant it is lower compare to the number of Body Type proposal (6 vs 11) and even smaller than compact cameras Variant proposal (6 vs 9). As for the compact camera Variant the proposals once insert in the market tend to remain until the end. The new proposal of these language traits it is concentrate in the first years of market existence.

To better understand how these categories are crossed during the year I realize an Evolutionary Dynamic graph. It can be spitted in four main areas looking to the camera numbers growth during the year. More the number of camera proposal growth, more language proposal we had. The first period can be considered an exploration phase in which some pivotal body shape and few related Variants are proposed. In the second phase we had three new body type proposal and two new Variant proposal. The Sport variance it is dominant in this period highlighting the main target of action camera typology. For each body type we have different Variants. In the third period we had one new Variant and 4 new Body Types. it means that companies are still proposing a strong language differentiation. I called this period hybridization for two main reason: a new target was proposed and a new technology was introduced. The 360 degree digital cameras technology it is introduced in action camera market. The Wearable and the Cube Body Types and the Art/Fun Variant indicate the interest from the market to capture the attention also of less extreme users. The last phase analysed had a clear collapse of the camera proposal, but I cannot considered it as a crisis for two main reason: the data regard the 2017 that it is not yet conclude and it seems that companies are moving to 360 degree digital camera tangoes, and this translation could take time.

GRAPH.42 COMPACT-CAMERA MARKET EVOLUTIONARY DYNAMICS



4.5 COMPACT-CAMERA PRODUCT LANGUAGE STRATEGIES

Radical design language on Incremental innovation

The action camera market born in 2005, ten years later the launch of first compact camera. Compare to this technological incremental innovation the design language innovation of on this product can be considered radical. Indeed, if we take the action cameras main languages and we compare them with the one of digital compact cameras we can observe a differences in terms of that elements that influence the "First Sight" perception: shape, colours and dimensions. To make this comparison I took the already used representative sample of digital compact cameras:

a) **Body Type: "Helmet" + Variant: "Sport" .**
For this comparison I selected from the action camera side the "TomTom Bandit"

b) **Body Type: "Helmet" + Variant: "Accessory"**
For this comparison I selected from the action camera side the "Oregon Scientific ATC-1000"

c) **Body Type "Classic" + Variant: "Premium".**
For this comparison I selected from the action camera side the "Oregon Scientific ATC-1000"

d) **Body Type "Camcorder" + Variant: "Sport"**.
For this comparison I selected from the action camera side the "Kodak 1080p"

e) **Body Type "Camcorder" + Variant: "Premium"**.
For this comparison I selected from the action camera side the "Sony HDR-AS-15"

f) **Body Type "Goggle" + Variant: "Sport".**
For this comparison I selected from the action camera side the "Liquidimage Impact"

The analysis results said that 5 on 7 cameras languages could be considered radically innovative in comparison to the compact digital cameras languages previously analysed. These camera different from the other for two o more "First Sight" perception attribute. We can state that the Action Camera in the action camera market the more relevant strategy in terms of proposal numbers it is a Radical product language proposition.

Tab.40 Action Cameras language analysis: action-cam vs compact camera

BODY TYPE HELMET

VARIANT ACCESSORY

BODY TYPE HELMET

VARIANT SPORT

NEW PRODUCT LANGUAGES

ACTION CAMERAS	COMPACT CAMERAS

DIMENSIONS
50X30X100

SHAPE

COLORS

DIMENSIONS
50X30X100

SHAPE

COLORS

Tab.40b Action Cameras language analysis: action-cam vs compact camera

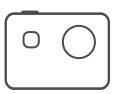
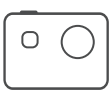
BODY TYPE CLASSIC

VARIANT PREMIUM

BODY TYPE CLASSIC

VARIANT PLASTIC TECH.

ROBUST DESIGN

ACTION CAMERAS		COMPACT CAMERAS
		
DIMENSIONS 40X60X25	**DIMENSIONS** 40X60X25	
SHAPE 	**SHAPE** 	
COLORS 	**COLORS** 	

BODY TYPE CAMCORDER

VARIANT PREMIUM

BODY TYPE CAMCORDER

VARIANT SPORT

NEW PRODUCT LANGUAGES

ACTION CAMERAS

DIMENSIONS
50X30X100

SHAPE

COLORS

DIMENSIONS
50X30X100

SHAPE

COLORS

COMPACT CAMERAS

Tab.40 Action Cameras language analysis: action-cam vs compact camera

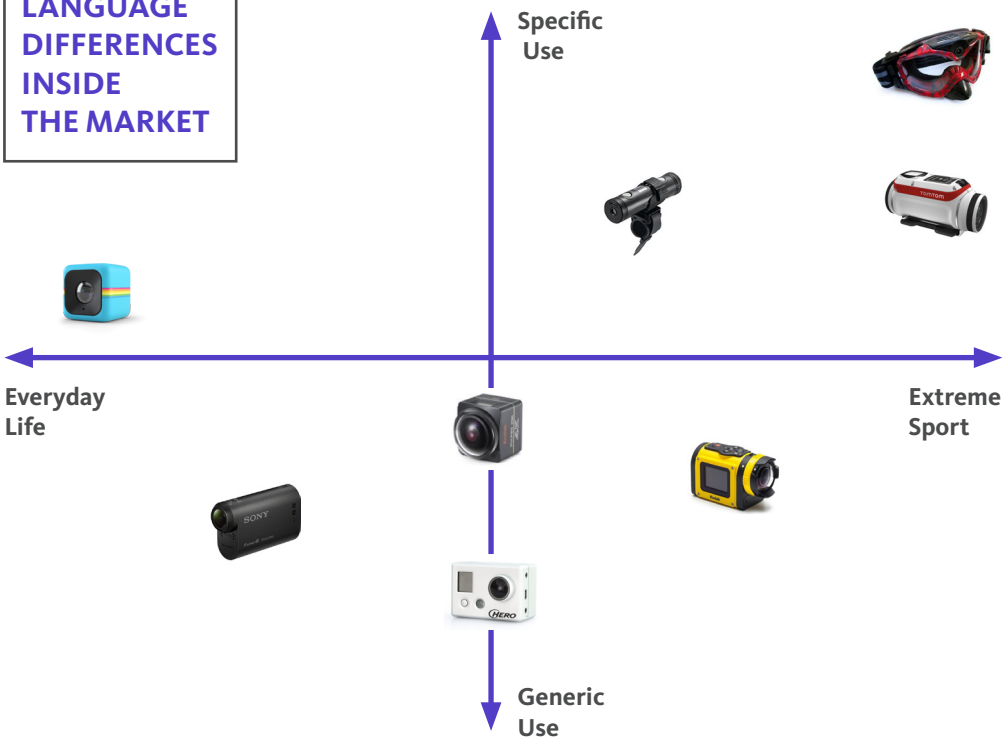
BODY TYPE CLASSIC

VARIANT PREMIUM

NEW PRODUCT LANGUAGES

ACTION CAMERAS	COMPACT CAMERAS
	
DIMENSIONS Not found	
SHAPE 	
COLORS 	

LANGUAGE DIFFERENCES INSIDE THE MARKET



High degree of languages variations inside the digital Action Camera market

Looking at the most relevant languages emerged from the analysis it is possible trace a graph with four extreme and place inside the different cameras. I called the vertical extreme Specific Use and Generic Use. This dimensions are more relate to how much it is specific the use of the camera according to the shape (e.g. the Goggle were developed for a very specific extreme sport). On the Horizontal dimension I use as extreme in witch field the camera are design to be used: extreme sport activities or everyday life. I place on the graph some representative samples and the result show that inside the Action Camera market there is a high differentiation in terms of product design languages.

Competition inside the design discourse

Since from the beginning to the end companies tried to propose different product languages. As can be observe from data there were an equilibrium among different Body Types and Variant and most of the companies propose its own variant. Of are few companies that tried to propose different Body Type

cameras, but using the same language Variant. Also in this heterogeneous we can observe that in the exploration phase is the Sport variant was the most used on the different Body Shapes. It is interesting the case of Goggle Body Shape with Sport variant that directly link a sport accessory to this camera. This trend can be linked with the main use of the camera manly used to shot extreme sports. Another interesting relation can be found from the proposal of Classical and Camcorder Body Shapes. Indeed, this digital camera it is used to shot videos. The presence of Enforcement Variation indicate that this technology had be used also in professional fields. In the hybridization phase, it is interesting see that companies as Drift and GoPro start to add respectively to their proposal Cube and Wearable Body Shapes. These Body Type camera are presented after the introduction, in 2014, of the Polaroid Cube that have as a target a less extreme user. We can read on this variation that the action cameras started to try to address a larger market segment, even if Sport Language still remain still more important. With a little dominance of the sport variant, we can not find a coherence design language discourse in the action camera market.

Recap

It seems that action camera category had a relevant use of design.
Indeed the incremental technoglical shift (compare to action cameras) was supported by a radical product language innovation. As I proved the companies used a Innovative Language Design strategy. Inside the market companies do not adhere to a design discourse indeed most of the companies tried to place its own language. The degree of language variation is high also between the different language proposed.

4.6 ACTION-CAMERA PRODUCT LANGUAGE STRATEGIES

To better understand the relationship between the use of product design language between general compact cameras and action cameras I needed to compare the data result of the previous analysis. More specifically I compare the results related to the Product Language Evolutionary Dynamics of both general Compact Camera Market and the Action Camera segment (relatively on page. 97 and 85). The comparative graph, on the next page, put in relation the number of Compact-Cameras and Action-Cameras language combinations during the time. More precisely I divided each category on the 4 main time spaces that I define previously for each category. For the compact camera category we had the following periods: Exploration (from 1995 to 1999), Experimentation (from 2000 to 2006), Exploitation (from 2007 to 2014) and decline (from 2015 to 2017). For the action camera category we had the following periods: Exploration (from 2005 to 2007), Experimentation (from 2008 to 2011), Hybridization (from 2012 to 2016) and last period that it is to short to be analysed (and it regard the current year not yet finished). The digital action camera introduction and Exploration period it is place between the end of the general compact camera Experimentation period and the begging of the Exploitation Period. The next phase of language Experimentation and Hybridization related to the action camera segment happened during the rest of the digital Compact Cameras Exploitation and crisis period. This relation clearly show that in a moment in witch the general compact camera market had a stable (and not very diversified) product language proposal, the action camera typology bring to the general digital camera market a wide and various range of product language differences. New Body Shapes and Variants are proposed and while the rest of digital camera market shrinks its proposal numbers, the action camera market grow. The first impression according to these results it is that the product language variety had an important role on the success of action cameras.

Action camera influence on compact camera market

It is interesting to see how the success of this digital segment had influence the general digital compact camera market. Indeed from 2011 on the compact cameras market it is constant the presence of the Sport Variant. This Variant it is shared in both market analysis and it rise before on the Action Camera segment in the 2008. Furthermore this language variant it is the most relevant on the action camera market. It seems that the Action Camera success influence all the digital camera market. It is also interesting look how from 2014 with the introduction of both Wearable and Cube Body shape and the Art/Fun Variant the market seems to address a less extreme segment of costumers. This trend can be related with the decline of general compact camera category.

ACTION CAMERAS

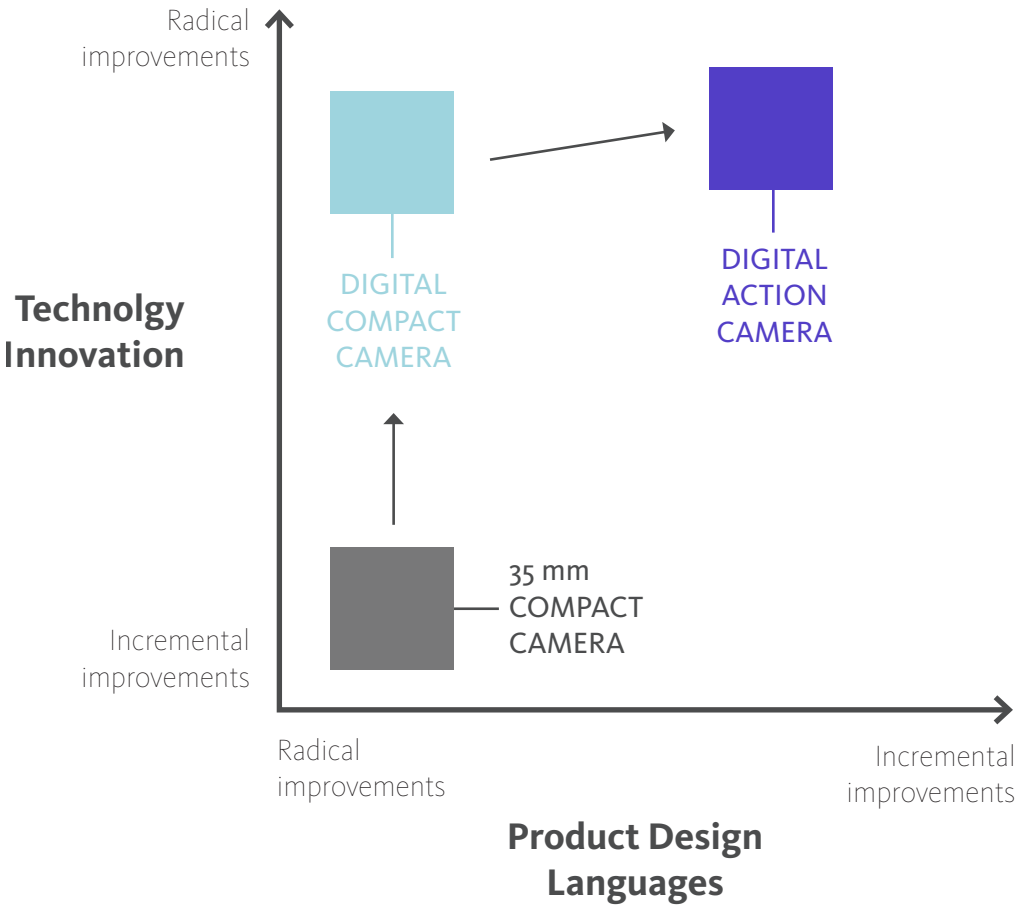
2008 Sport Variant

COMPACT CAMERAS

2011 Sport Variant

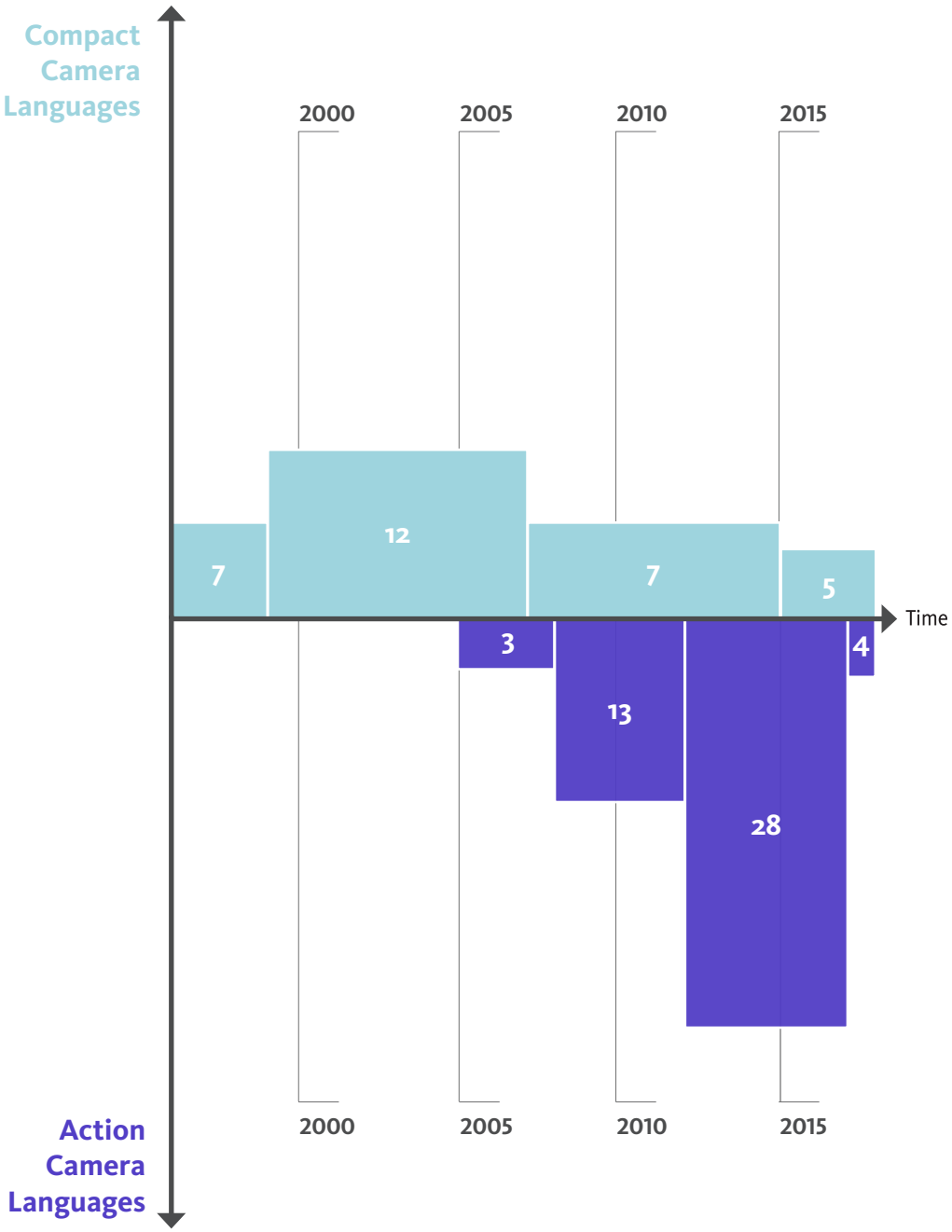
Interplay between technological tnnovation and product language innovation

While the digital compact camera market start to suffer a dramatic crisis (from 2010) digital compact camera was ina period in wich the product language innovation had a secondary relevance, inversely the action camera market grow it is related with an explosion of many new product languages.



Graph. 44 Interplay between Product Language and Technoolgy Innovation (Compact vs Action camera)

Graph. 45 Body Types and Variants combinations: comparison



4.7 RESEARCH FINDINGS

*From an **industry level** the **technological innovation** can be considered as an **input** for the **product language innovation** inside the **fast-paced technology industry***

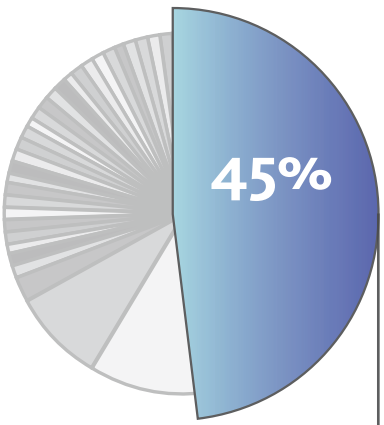
5 ACTION CAMERA PRODUCT-SERVICE SYSTEM ANALYSIS: COMPANY LEVEL

5.1 GOPRO: THE ANALYSIS OF ACTION CAMERA MARKET L EADER PRODUCT LANGUAGES

GOPRO PODUCT LANGUAGE ANALYSIS

The results of the language analysis seems to show a strong relevance of the Product Language innovation and variety inside the action camera Market.
However looking to the data related to action camera market share it is clear that this camera typology sector it is dominate by the GoPro brand and its HERO cameras. It is market share it represent the 45% of the total action camera market, and the other competitors have not a significant relevance (Statista, 2015).
The GoPro HERO cameras are mainly proposed as Classic Body Type cameras and Plastic Tech. variants. This Language Combination was, together with the Classic + Premium, the only that result as a Robust Design in comparison to the Digital Compact Cameras (and consequently to the 35mm Compact Cameras). This first anomaly make me suppose that the product language innovation could not be considered a factor of success inside the action camera market.
As GoPro it is considered the company that have introduce the action camera I supposed that its success had to be related to its first mover strategy and the ability to be the one to propose the more advanced technologies. Many articles indeed link the success of GoPro with its technological innovations (Mac, 2013).
To prove the success of the HERO cameras was to be related to the technology innovation an not on the product language innovation I decide to explore more in deep both fields.. The chapter it is divided in three main parts: Focus on Product Design Relevance, Focus on Technology Innovation relevance and Conclusions.

Graph.46
ACTION CAMERA MARKET SHARE (Statista, 2015)

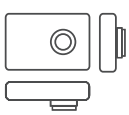


The comparison it was made taking in consideration the first digital GoPro action camera release on the market in 2006: the Digital HERO and two digital compact camera release the previews year: the Canon PowerShot SD450 and the Nikon – Coolpix S1.
From the previous product design analysis related to compact cameras I can state that the compact cameras langue selected are representative of a common and affirmed languages inside the digital compact camera market. More precisely they were categorized as: Pocket Tech. Silver and Pocket Flat Tech. Silver. The results of the comparison enlighten how the GoPro had in common the shape and the

CANON - POWERSHOT SD450

DIMENSIONS
54 x 86 x 22 mm

SHAPE



COLORS

Finish 

Decoration 

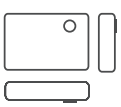
Texture ——— NO

Details ——— Golden and Black types

NIKON - COOLPIX S1

DIMENSIONS
58x 90x 20 mm

SHAPE



COLORS

Finish 

Decoration ——— NO

Texture ——— NO

Details ——— Silver types

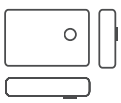
5.2 ANALYSIS RESULTS: GOPRO APPLIED A “ROBUST DESIGN” STRATEGY

Colour withthis cameras. The dimension are sensibly lower, but the proportion of the object are the same. Also. The main different are found on secondary elements as Details and Decoration. This analysis explain that GoPro cameras are presented to the market with a Robust Design strategy. Where the only interesting difference could be found on its dimension and as a consequence of an architectural innovation. The image quality of these model even show a that GoPro had a lower image definition (dpreview.com; cnet.com). On page n. can be observe how GoPro strictly follow the compact camera Design discourse.

GOPRO - DIGITAL HERO

DIMENSIONS
64x 76 x 18 mm

SHAPE



ROBUST DESIGN

COLORS

Finish 

Decoration ——— NO

Texture ——— NO

Details ——— Black types 

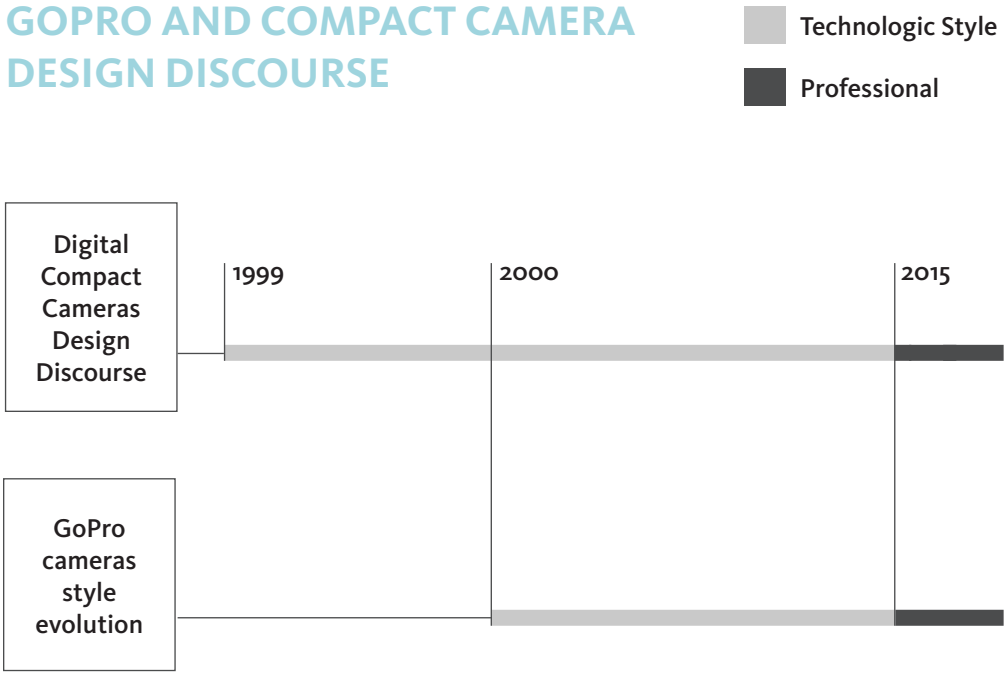
Tab. 41 Tab.41 GoPro language strategy analysis

Tab.42 GoPro Language Evolution

To complete the product language analysis I analyse the language evolution of GoPro cameras during the years. The GoPro language evolution look stable, except for a change started in 2015. It propose a new camera model: the Session, with a Cube Shape. Both HERO cameras and Session camera from that monet untill 2016 are proposed with a dark colour that give to the camera a Premium aesthetic. This change could be related with the high price of the cameras. Even these colour and shape changings are not innovative, indeed were before introduced from others competitors. The Cube shape was first introduce in 2014 from Polaroid with the CUBE model (altadefinizione.com) and the Premium Classic Body Shape was introduced by Muvi with the K1 model (engadget.com).

 2004 HERO 35mm	 2006 Digital HERO	 2007 Digital HERO3	 2008 Digital HERO5
 2010 HERO HD	 2011 HERO2	 2012 HERO	 2013 HERO3+
 2014 HERO4	 2015 Digital HERO  201 Digital HERO	 2016 Digital HERO  2015 Digital HERO	GOPRO HERO CAMERAS YEAR BY YEAR LANGUAGE EVOLUTION

GOPRO AND COMPACT CAMERA DESIGN DISCOURSE



GOPRO CHANGE OF LANGUAGE IN 2015 WAS NOT INNOVATIVE

2014	2015
 MUVI K1	 GOPRO HERO+
 POLAROID CUBE	 GOPRO SESSION

Tab.43 Technolgical Evolution comparison

To move my analysis on a different level I had before to prove that GoPro dominance on the market it is not related other possible advantages related to technology innovation. For that reason I tried to understand if it could be considered the first mover of it was the first to introduce more high quality on the sector. From the result of my research it appear that the first Digital Action Camera introduce in the Market was placed in 2005, one year before GoPro, from Contour (Contour.com).
The other technoglical innovation that I choose for the comparison are the one that regards improvements list as fundamental in this sector (Forbes.com, Engaget.com): HD (1080p) quality introduction, wide-lens introduction, GPS and motion sensor integrations, 4k image resolution and optical stabilization integration. GoPro have for first introduce wide-lens and 4k image resolution. But in no one of other improvements was the first (Contour.com, Altadefinizione.com; Haine, 2016; Forbes.com).

TECHNOLOGICAL EVOLUTION MILESTONES

Technology Innovation	First-Mover Company	Action Camera	Release Year
First Digital Action Cam	Oregon Scientific		2006
Video HD resoultion	Contour		2009
Wide-lens Camera	GoPro		2008
GPS and motion	Contour		2012
4k image resolution	GoPro		2012
Optical Stabilization	Garmin		2016

5.3 COMPLEMENTARY PRODUCT ANALYSIS BETWEEN THE ACTION CAMERA MARKET LEADER AND COMPACT CAMERA MARKET LEADERS

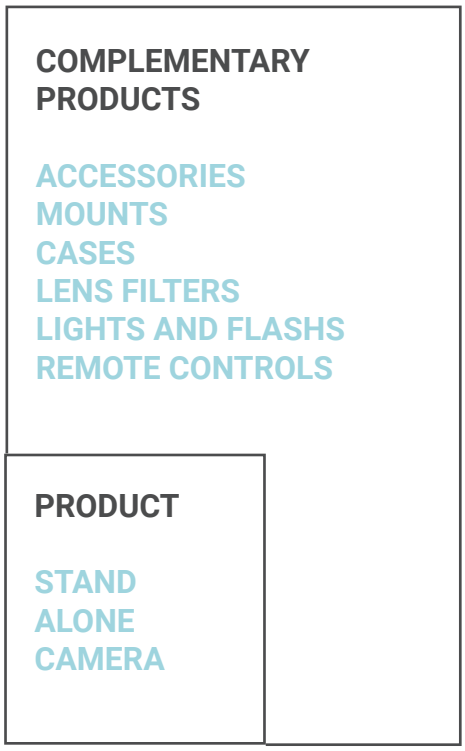
If the GoPro from a technoglical point of you could be considered an architectural innovation compare to the digital compact cameras, beacuse the size are reduced, but all the other components are the same and the quality of the images capture it is comprable. For example in 2009 both in general compact cameras merket and in action camera market there were cameras allow to film HD videos.
To better understand what really make the difference in terms of use of this cameras compare to the compact one I decided to analyze their competition in terms to complementary producs offering. To do so I analyze the offering of complementary accessories proposed by the three main digital compact cameras producers: Canon, Nikon and Sony compare to the one of GoPro. To do so I check on the relative wesites the offering in terms of accessories, mounts, box cases, housing and lens filter. For the analysis I had exclude standard complemetary products as batteries and cables. The different analysis could be observed on the following pages.

The current offering of Canon Compact cameras in terms of accessoires (Canon.com) it is limited to the object that coul be found inside the camera package and on the website there is not the option to select extra "accessories". Than the only accessoty that I could list was the wrist strap (page. n.)

The Nikon offering in terms of complementary products (Nikon.com) it is different. For the standard compact cameras all the accessories proposed are related to the field that I exclude: battery and cables. However the offers realated to the sport compact cameras it is composed for a total of 8 accessories listed as Optiona Accessories (page n.).

The Sony offered it is the most wider from the digital compact cameras competitors (Sony.com). It offers a total of 16 accessories listed in four different categories (page n.): easels and remote controls (9); mini-monitors (2); lights and flashs (1) and others (4).

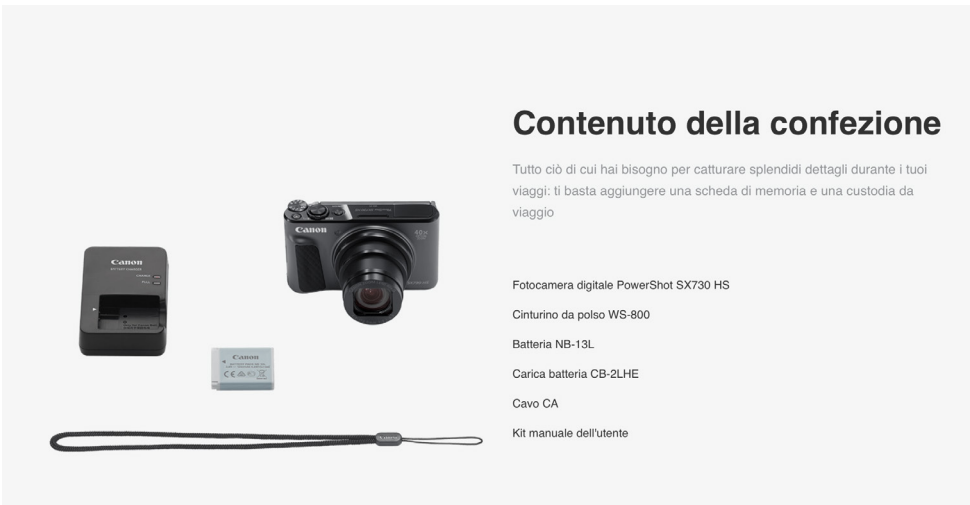
The GoPro offering it is much wider compare to the Compact Cameras competitos. It list 57 differnet accessories divided in the following categories (GoPro.com): Mounts (27), Accessories (15), Cases (10) and Lens Filter (7). Inside the website it is also proposed an other division based on the possible use in relation of specific activites: Surf, Scuba Diving, Snorkel, Travel, Family, Snow, Bike and Moto (page n).



Tab.44a Complementary products research Compact Camera Leaders

Canon	**Total Number of Complementary products: 1** **Number of categories: 1**

Not Define
1



Total Number of Complementary products: 8

Number of categories: 1

Optional Accessories

1

ACCESSORI OPZIONALI

Custodia protettiva in silicone nera W300

Custodia protettiva in silicone verde W300

Custodia protettiva in silicone arancione W300

Adattatore per cavo in fibra ottica subacqueo SR-CP10A

Cinghia da polso galleggiante

Unità di supporto subacquea SK-N10A

Cavo in fibra ottica subacqueo SC-N10A

Lampeggiatore subacqueo SB-N10

Tab.44bComplementary products research Compact Camera Leaders

SONY

Total Number of Complementary products: 16

Number of categories: 4

Easels and Remote controls	Others	Mini-monitors	Lights and flashs
9	4	2	1

Cavalletti e telecomandi

Cavalletto ripiegabile compatto
VCT-P300

Cavalletto
VCT-R100

Cavalletto
VCT-R640

VCT-VPR1 Cavalletto con telecomando
VCT-VPR1
Prezzo al Pubblico consigliato € 150,00 [1] (IVA inclusa)

Cavalletto con telecomando
VCT-VPR10
Prezzo al Pubblico consigliato € 599,00 [1] (IVA inclusa)

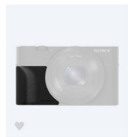
Treppiedi
VCT-MP1
Prezzo al Pubblico consigliato € 228,99 [1] (IVA inclusa)

Telecomando RMT-VP1K e kit ricevitore a infrarossi
RMT-VP1K
Prezzo al Pubblico consigliato € 70,00 [1] (IVA inclusa)

RMT-DSLR2 Telecomando wireless
RMT-DSLR2
Prezzo al Pubblico consigliato € 30,00 [1] (IVA inclusa)

VPR1 Telecomando con cavo multiterminale
RM-VPR1
Prezzo al Pubblico consigliato € 70,00 [1] (IVA inclusa)

Altri



Impugnatura per gancio
AG-R2
Prezzo al Pubblico consigliato € 15,00 [1]

Proteggischermo
PCK-LM15
Prezzo al Pubblico consigliato € 15,00 [1]

Staffa accessoria
VCT-55LH
Prezzo al Pubblico consigliato € 70,00 [1]

Cavo HDMI micro DLC-HEU15 ad alta velocità con Ethernet
DLC-HEU15
Prezzo al Pubblico consigliato € 30,00 [1]

Mirini e monitor

CLM-FHD5 Monitor LCD a clip
CLM-FHD5
Prezzo al Pubblico consigliato € 750,00 [1] (IVA inclusa)

CLM-V55 Monitor LCD a clip
CLM-V55
Prezzo al Pubblico consigliato € 450,00 [1] (IVA inclusa)

Flash e lampade

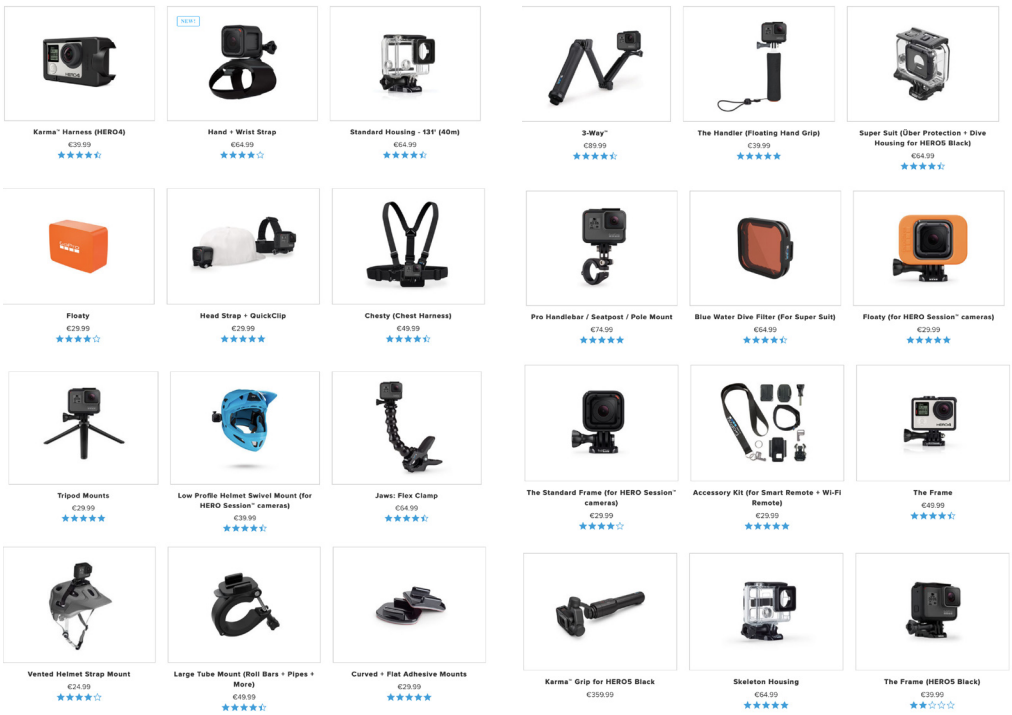
HVL-LEIR1 Batteria luce video a infrarossi
HVL-LEIR1
Prezzo al Pubblico consigliato € 173,00 [1] (IVA inclusa)

Tab.45a Complementary products research GoPro

Total Number of Complementary products: 57

Number of categories: 4

Mounts	Accessories	Cases	Lens
27	17	10	7



Tab.45b Complementary products research GoPro

Vented Helmet Strap Mount
€24.99
★★★★☆

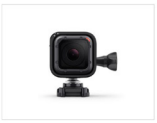
Large Tube Mount (Roll Bars + Pipes + More)
€49.99
★★★★½

Curved + Flat Adhesive Mounts
€29.99
★★★★★

Wrist Housing
€64.99
★★★★½

Gun / Rod / Bow Mount
€89.99
★★½☆☆

Pro Bike Seat Rail Mount
€49.99
★★★★★



Swivel Mount
€29.99
★★★★☆

Blue Water Snorkel Filter (HERO5 Black)
€64.99
★★★★☆

Fetch™ (Dog Harness)
€49.99
★★★½☆

Camera Tethers
€29.99
★★★★★

NVG Mount
€39.99
★★★★☆

Blackout Housing
€64.99
★★★★★

Screen Protectors (HERO5 Black)
€29.99
★★½☆☆

Gooseneck
€29.99
★★★★½

The Tool (Thumb Screw Wrench + Bottle Opener)
€9.99
★★★★★

Magenta Dive Filter (for Dive + Wrist Housing)
€89.99
★★★★★

Soft Top + Bodyboard Mount
€29.99
★★★★★

Karma™ Harness (HERO5 Black)
€99.99

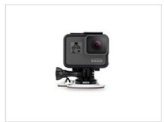
Smart Remote
€99.99
★★★★½

Helmet Front and Side Mount
€39.99
★★★★★

Suction Cup
€49.99
★★★★½

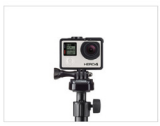
Grab Bag
€29.99
★★★★★

Handlebar / Seatpost / Pole Mount
€39.99
★★★★☆



Surfboard Mounts
€29.99
★★★★½

Magenta Dive Filter (for Standard + Blackout + Camo Housing)
€89.99



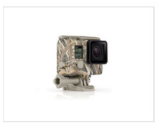
Mic Stand Mount
€24.99
★★★★★

Dive Housing – 197' (60m)
€74.99
★★★★★

Removable Instrument Mounts
€29.99
★★★★★

Mic Stand Mount
€24.99
★★★★★

Green Water Dive Filter (For Super Suit)
€64.99
★★★★★

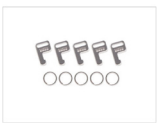


Camo Housing + QuickClip (Realtree MAX-5®)
€89.99
★★★★½

HERO4 Silver Screen Protectors
€19.99
★★★★★

Protective Lens
€29.99

Camo Housing + QuickClip (Realtree Xtra®)
€89.99
★★★★★



Attachment Keys + Rings (for Smart Remote + Wi-Fi Remote)
€19.99
★★★★★

WindSlayer (Foam Windscreen)
€29.99
★★★★½

5.4 GOPRO DIFFER TO COMPACT-CAMERA MARKET LEADERS IN TERMS OF COMPLEMENTARY PRODUCTS VARIETY AND USE

CONCLUSIONS

The results of this analysis show a clear difference between the number and the variety of accessories proposed by GoPro compare to the ones proposed by the Compact Cameras accessories. If the language of the camera it is in line with the compact digital camera sector, we can state that the real difference of this cameras have to been found on its wide range of accessories.
Indeed these complementary products allow to use the cameras in very different situation, giving a sense to its smaller dimension.
The incremental innovation found a real mean of differentiation not on the product design, but on the variety of product accessories that make it "wearable" and versatile. GoPro started to be marketed as a mountable device in 2008 (Forbes.com).
If this analysis could be considered as a way to justify the success of the GoPro and generally the action camera segment on the general compact cameras market, it is not sufficient to justify why GoPro it is the winning brand inside the action camera market segment.

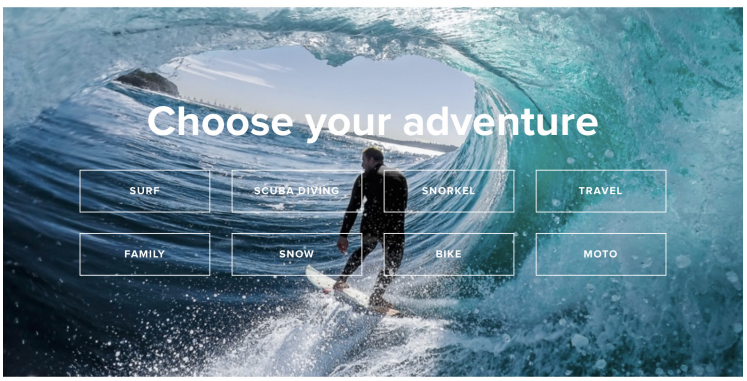


Fig. 72 Product accessories uses suggested by GoPro

5.5 ACTION CAMERA BRAND LEADERS: PRODUCT-SERVICE SYSTEM ANALYSIS METHODOLOGY

METHODOLOGY

The previews analysis allows to understand how the accessories related to the action camera make this market different from the digital camera market, but this do not justify how GoPro had 45% of the action camera market share. To do so I decided to analyse the product service system for main action camera brands according to Beige Market Intelligence research (2016): GoPro, Drift, Garmin and Sony.

To make a complete analysis of the systems I first decided to analyse the different brand proposal to understand what are the most important part of an action camera system. Then I decided to focus my research on three main interconnected areas: the product system, the communication and the services offered.

All the information that I use to make this analysis are related to what companies offers looking to their proposal on channels as: company Websites and Social Media. Each main area it is spitted in other segment that allow to better understand the complexity of the proposal. Each subsector that I analyse it is evaluated following an objective evaluation using some parameter that I elaborated taking in consideration the average results of each analysis. Once made the same research for each brand I evaluate the different categories. All the results were at the end compare to understand where I could found significant different that could make GoPro win the competition. At the end of the analysis I made a reflection about the connections between the results and the GoPro winning position.

Furthermore, I also search for historical data to better prove the results founded.

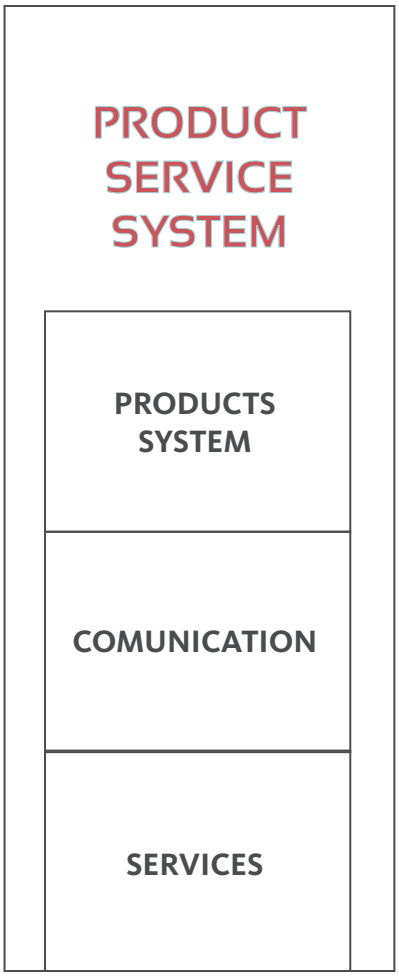
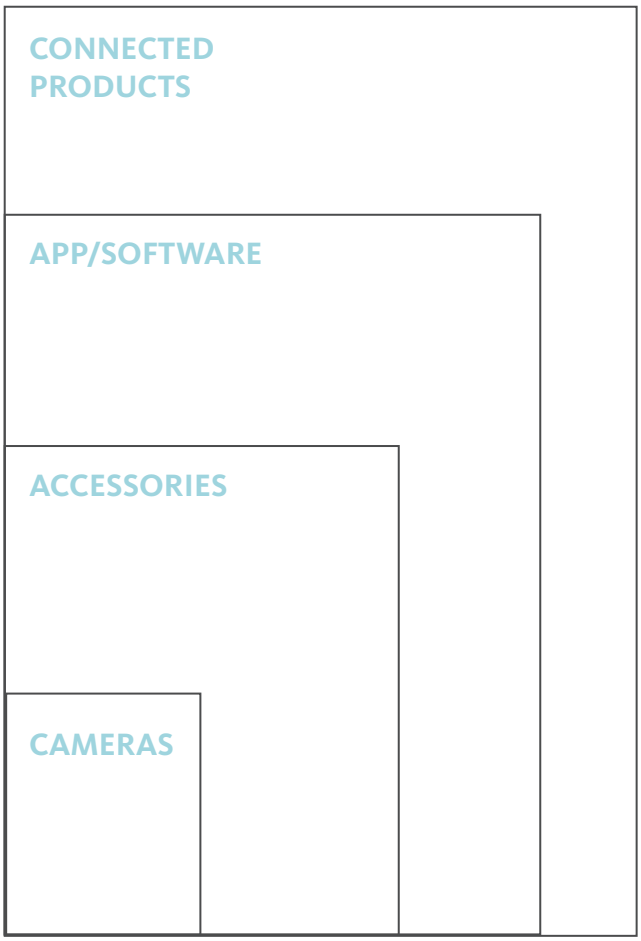


Fig. 72 Product-Service System Analysis Overview

Products System

To analyse the Product System, I decided to make a "concentric" analysis of the offers starting from the camera, moving to accessories and related apps and software. I also decided to analysed the connected products because they are relevant to make the entire system work (e.g. the app and the software are designed for devices as Smartphone, Tablet, Computer, etc.).
For the camera sub-category I considered: number of cameras proposed, the different product languages used (taken from the language analysis), the price and the technoglical quality. For the accessories, I analysed the number of accessories and their diversity. For the app/software category I analyse the different typology and the total number. Finally, for the connects product I analysed the type of connected products that can be used for different function related to the camera and the related images.

Fig. 73 Product-System Overview



Comunication

For the communication analysis, I decided to analyse in details the web communication strategy used by the company. I decided to focus on this specific fields because the communication related to other marketing strategies are very similar from the different companies and regards the use of ambassador, different partnership and the event organization. Furthermore, find precise and comparable data about them it was not easy and they could be not considered trustable.
What I analyse was the different website language and the different strategies used on social networks: product promotion, use of ambassador and costumer content creation. I also sum the total number of followers picked from each social network used for their strategies.

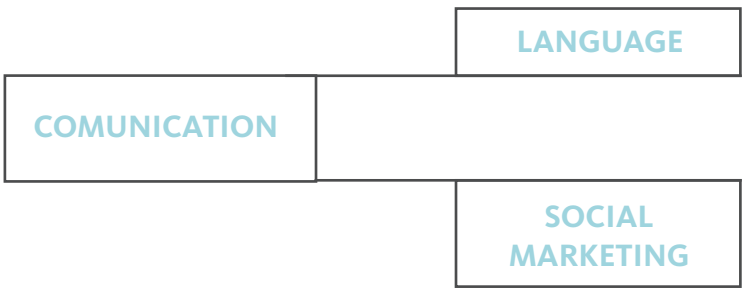


Fig. 74 Conunication analysis Overview

Service and system

In the product service system analysis I first take in consideration the entire offer of each brand (in relation to the action camera) and than I map the systems using the System Map tool.
To make the analysis of the offer I used personalize offering map tool. I divided the map in different categories: image capture device, image management and entertainment. The first group include the offer related to the purchase of the physical products: cameras and accessories. Here it is studied how it is possible buy this product in terms of possible purchase channels. The second group include the offer related to the image management and include all the services related to download relative app/software or other digital products. Here I analysed also the channels necessary to download this app, if they have to be payed and on witch connected device they run. Finally I analysed possible extra offer using the same methods.

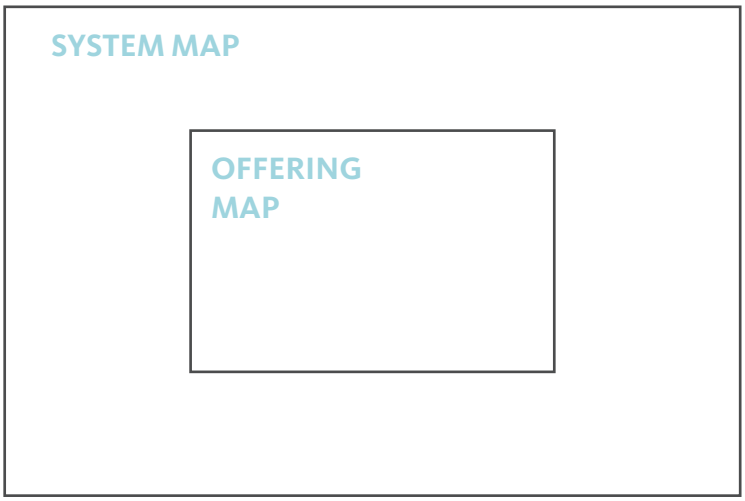


Fig. 75 Services and System analysis Overview

Comparisons and Conclusions

Finally I build a matrix for each data analysed making a comparison between the different brands.
The results that enlighten the biggest differences are treated as a relevance factor to analyse and understand the competitors relevance. After I tried to found extra information to prove the conclusions that data allow me to reach.

COMPANY NAME
GoPro

TYPE OF COMPANY
Camera Producer

CLAIM
Be a hero.

CAMERAS

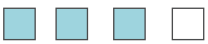
Price
From the GoPro website, it is possible found three different cameras with different price range. Two of them had a High price range (more than 300 Euro): Hero 5 Black and Hero5 Session. There is also a cheaper Hero5 Session for a medium-high range. GoPro have in its offer a multiple price target.

Product Design
The GoPro cameras are proposed with two body type and one variant design language. The Hero5 Black had a classic body type and the Hero5 Session have both a Cube form. The Variant it is the premium one.

Technology
The Hero5 have the best performance in terms of image quality and extra features. In relation to the image quality he had: 4k quality videos, Raw quality pictures and image stabilization. It had also many extra features as: Wi-Fi, Bluetooth, waterproof case, voice control, GPS and Cloud automatic upload. The 359,99 Hero5 Session have not Raw picture quality and no GPS. The cheaper Session had a HD quality, no image stabilization and except for Bluetooth and Wi-Fi have not extra features.

PRICE RANGE
HIGH (300-more Euro)

MEDIUM-HIGH (150-300 Euro)



DESIGN LANGUAGES
2 BODY TYPES
1 VARIANT

TECHNOLGICAL QUALITY
HIGH

MEDIUM

Tab.46 GoPro: Cameras analysis

Product System

Cameras

NAME
HERO5 Black

ONLINE PRICE
469,99 Euros

PRODUCT DESIGN
Body Type: Classic

Variant: Premium

TECHNOLOGICAL FEATURES

IMAGE QUALITY

EXTRA FEATURES

NAME
HERO5 Session

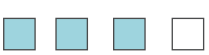
ONLINE PRICE
359,99 Euros

PRODUCT DESIGN
Body Type: Cube

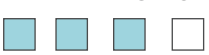
Variant: Premium

TECHNOLOGICAL FEATURES

IMAGE QUALITY



EXTRA FEATURES



NAME
HERO5 Session

ONLINE PRICE
169,99 Euros

PRODUCT DESIGN
Body Type: Cube

Variant: Premium

TECHNOLOGICAL FEATURES

IMAGE QUALITY

EXTRA FEATURES

Product System

Complementary products

ACCESSORIES

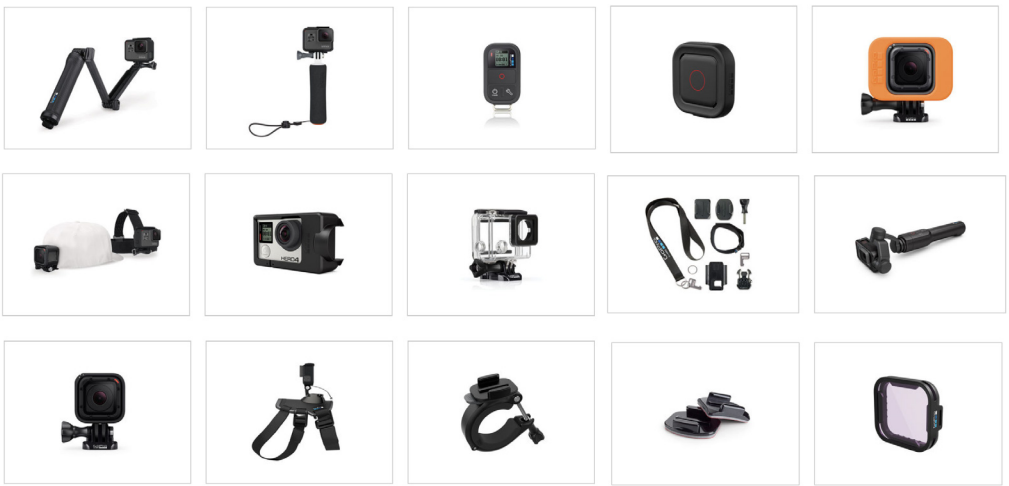
The GoPro accessories offer it is wide and diversified. It count more than 120 objects divided in 10 different categories: drone, accessories, stabilization, mounts, SD cards, batteries, housing, cases, replacement parts, cables and lens filter. They are also categorize according to different suggested activities for which the accessories could be used: bike, family, moto, scuba, snorkel, snow, surf and travel.

QUANTITY 120- HIGH

CATEGORIES: 10

SUGGESTED ACTIVITIES: 8

SAMPLE



APP & SOFTWARE

Different App could be downloaded. GoPro app allow to have a remote control of the camera and share photos. It can an generate automatic videos. Quick allow to modify video as well Splice. But the second it is more advanced of the first. There is also a Quick Desktop version that can be downloaded from the computer. The Passenger app it is a camera remote control connected to the GoPro Karma Drone.

APP
NUMBER: 4

SOFTWARE
NUMBER: 1

FUNCTIONS
REMOTE CONTROLL ☐ EDITING ☐
SHARING ☐

NAME
GoPro App

TYPE
APP

FUNCTIONS
Control
Edit (automatic)
Share

DEVICE
Smarphone
Tablet

NAME
Quick

TYPE
APP
SOFTWARE

FUNCTIONS
Edit (medium)
Share
Add dats & metrics

DEVICE
Smarphone
Tablet
Computer

NAME
Splice

TYPE
APP

FUNCTIONS
Edit (expert)
Share

DEVICE
Smarphone
Tablet

NAME
Passenger

TYPE
APP

FUNCTIONS
Live watch
Drone Controll

DEVICE
Smarphone
Tablet

Product System

Connected products

Connected products

Different App software and Services allow to connect HERO and Session cameras to different devices. These devices are the connected products that allow to extend the camera function and manage the images captured. GoPro had a complex system enabled through the following products: smartphones, tablet, smartwatch, console, television and computer.

SMARTPHONE ■	COMPUTER ■	TV & CONSOLE ■
SMARTWATCH ■	TABLET ■	WEARABLE DEVICES □

SMARTWATCH

SMARTPHONE E TABLET

Tab.48 GoPro: Connected Products System analysis

COMPUTER

GoPro CHANNEL

GoPro AWARDS

PLUS

TV

GoPro CHANNEL

PLUS

CONSOLE

GoPro CHANNEL

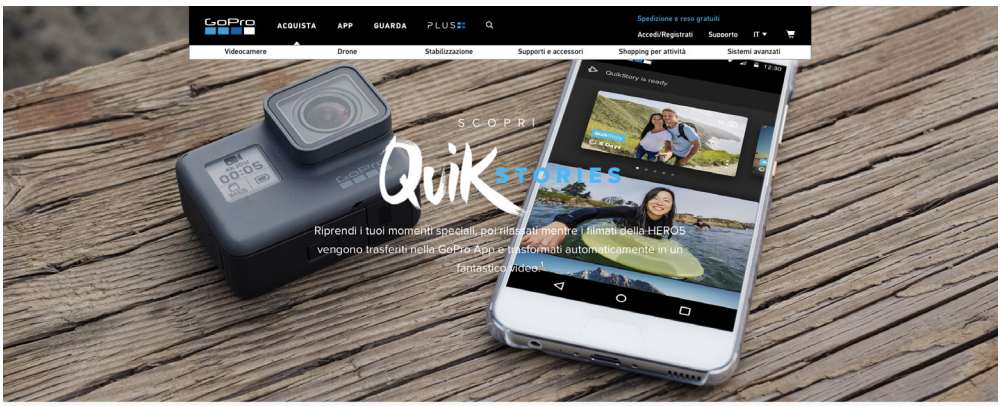
Comunication

Website

Website Language

On the GoPro website are promoted the product, the technoglical performance, but also the kind of activities that are related to this product and they concern both fun and family moment as extreme activities.The language used it is a mix fun and adventure mood, with the presence of technology attention.

TECHNOLOGY	FUN/FAMILY	ADVENTURE
■	■	■
■	■	■
□	■	■



Comunicatio

Mrketing

Social

GoPro use a strong social strategy and it had a lot of follower on all the Social used: Facebook, Twitter, YouTube, Pinterest and Instagram. The content posted on the social are mainly generated by Costumer or Ambassadors. They regards picture or video taken by them. On YouTube channel are also posted company videos in witch the new product are presented.

COSTUMERS CONTENT GENERATION	☐	PRODUCTS PROMOTION	☐
AMBASSADORS	☐		

TOTAL FOLLOWERS

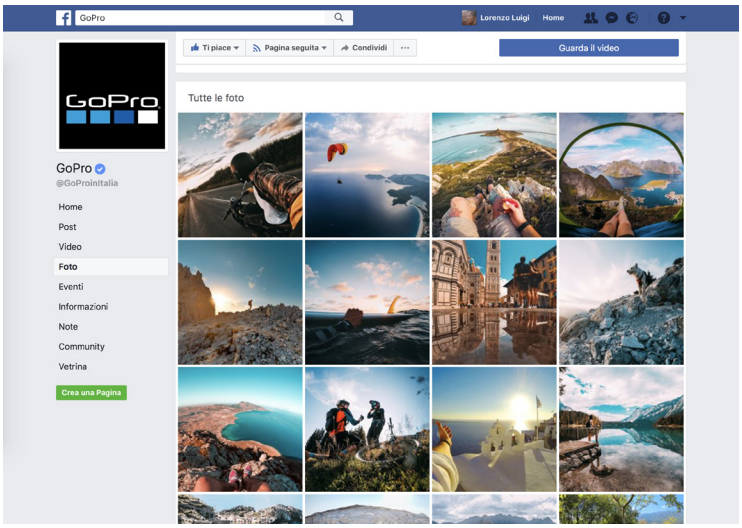
17.837.000

FOLLOWERS
10.450.000

STRATEGY

Ambassador Content

User Generated Content



5.6 GoPro: Product System, Communication Strategy and Service analysis

Comunication

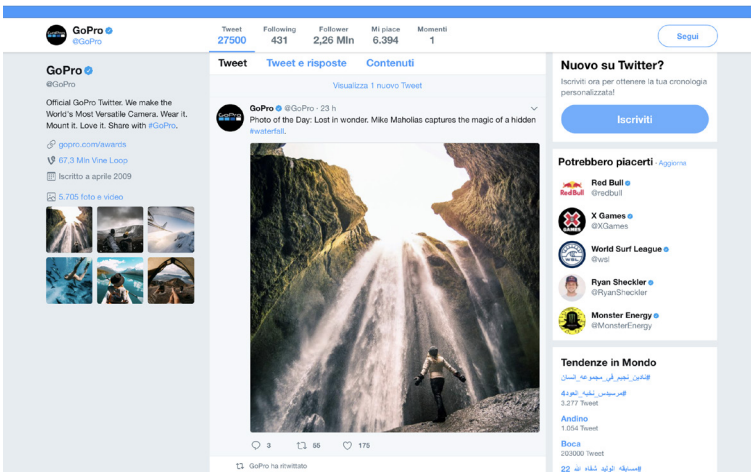
Mrketing

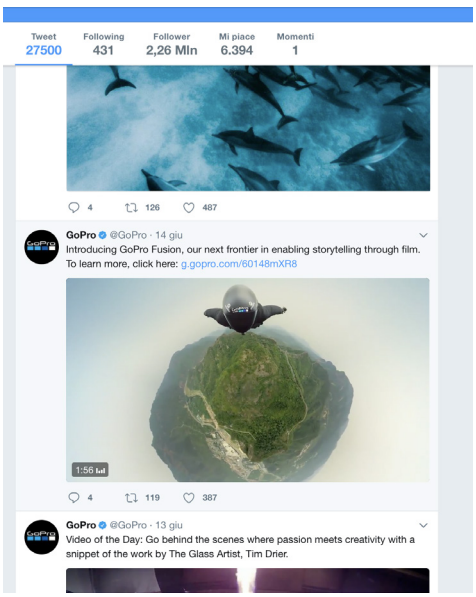
FOLLOWERS
2.300.000

STRATEGY

Ambassador Content

User Generated Content





YouTube

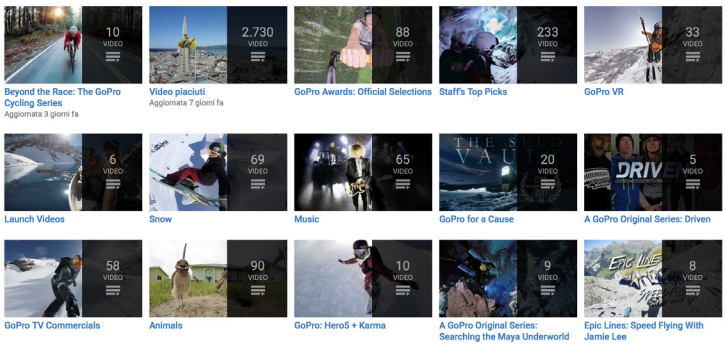
FOLLOWERS
5.000.000

STRATEGY

Ambassadors Content

Users Generated Content

Products Promotion



5.6 GoPro: Product System, Communication Strategy and Service analysis

Comunication

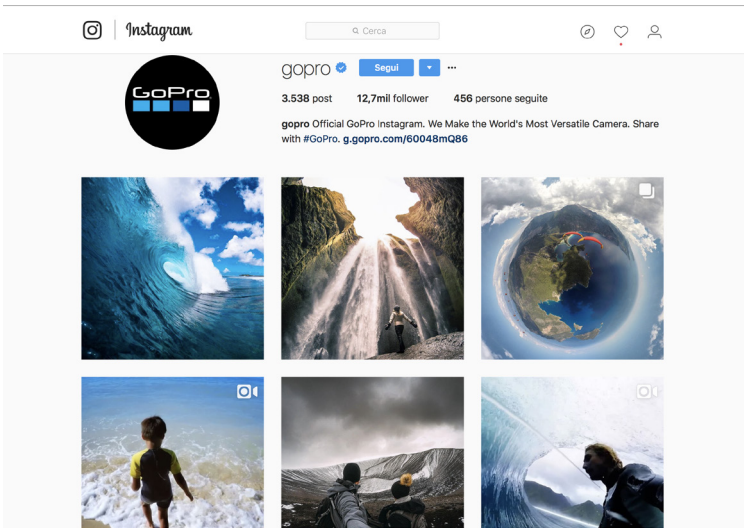
Mrketing

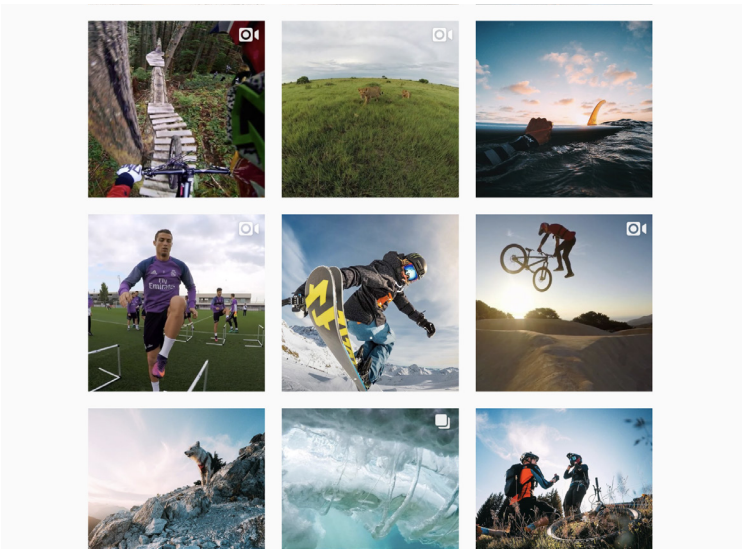
FOLLOWERS
13.000.000

STRATEGY

Ambassador Content

User Generated Content



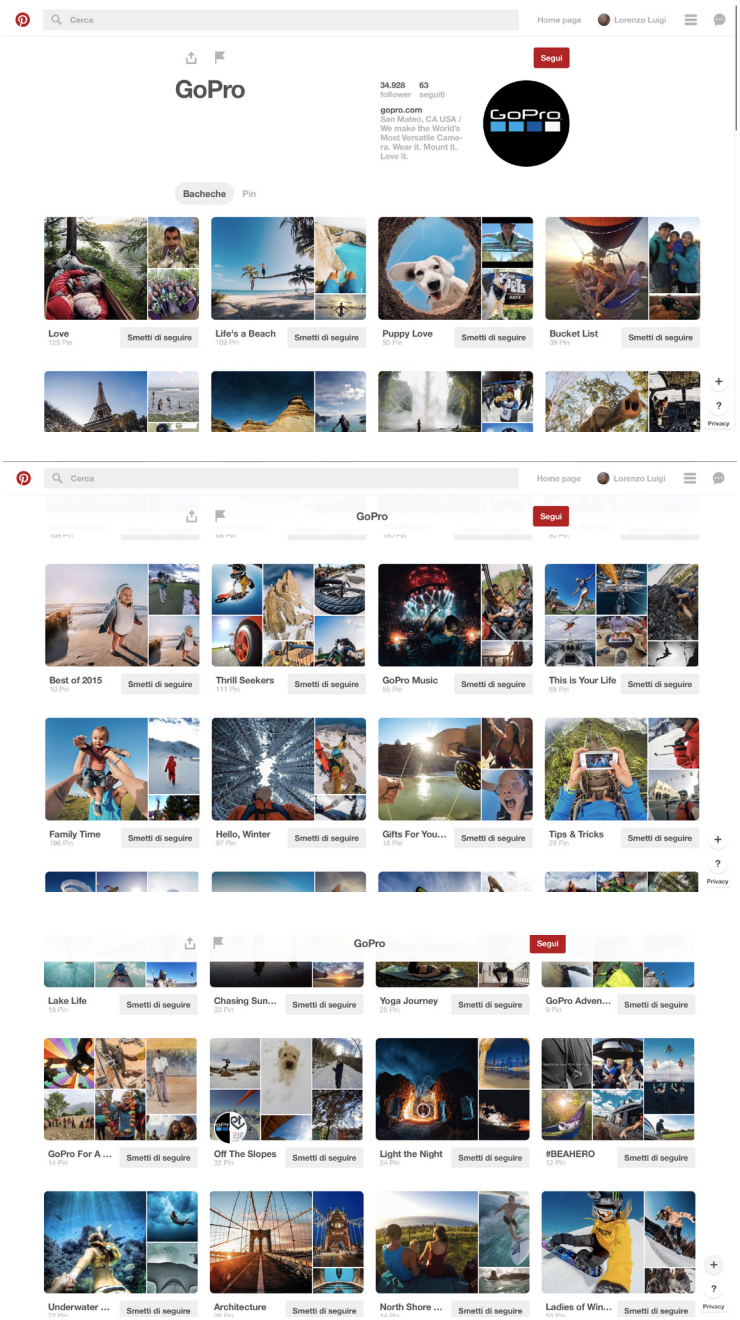


FOLLOWERS
30.000

STRATEGY

Ambassadors
Content

Users Generated
Content



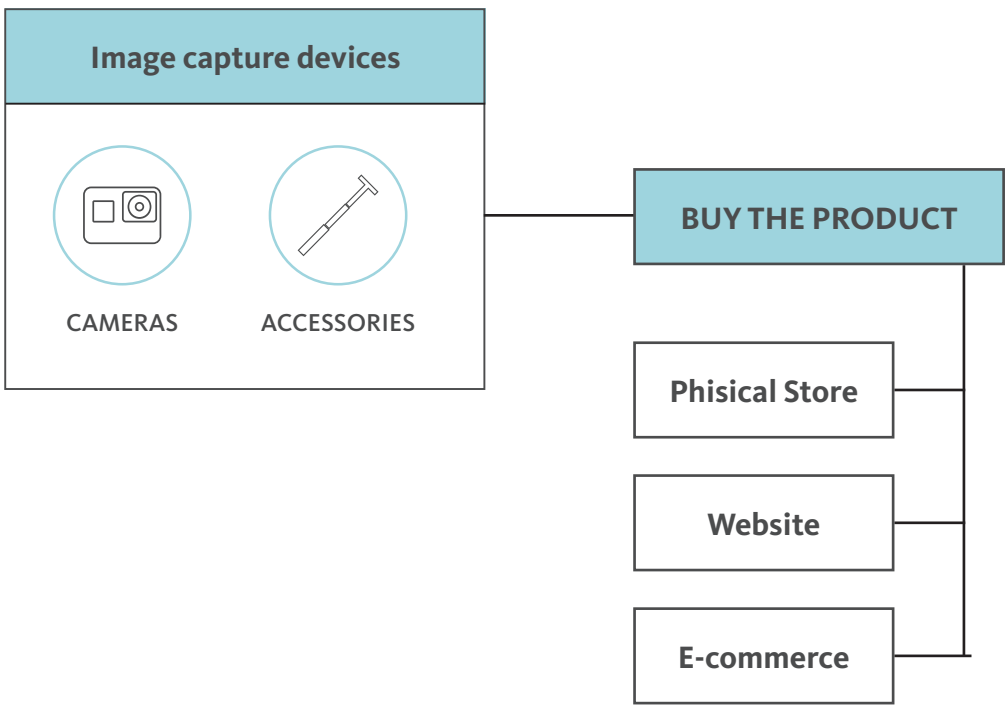
Services

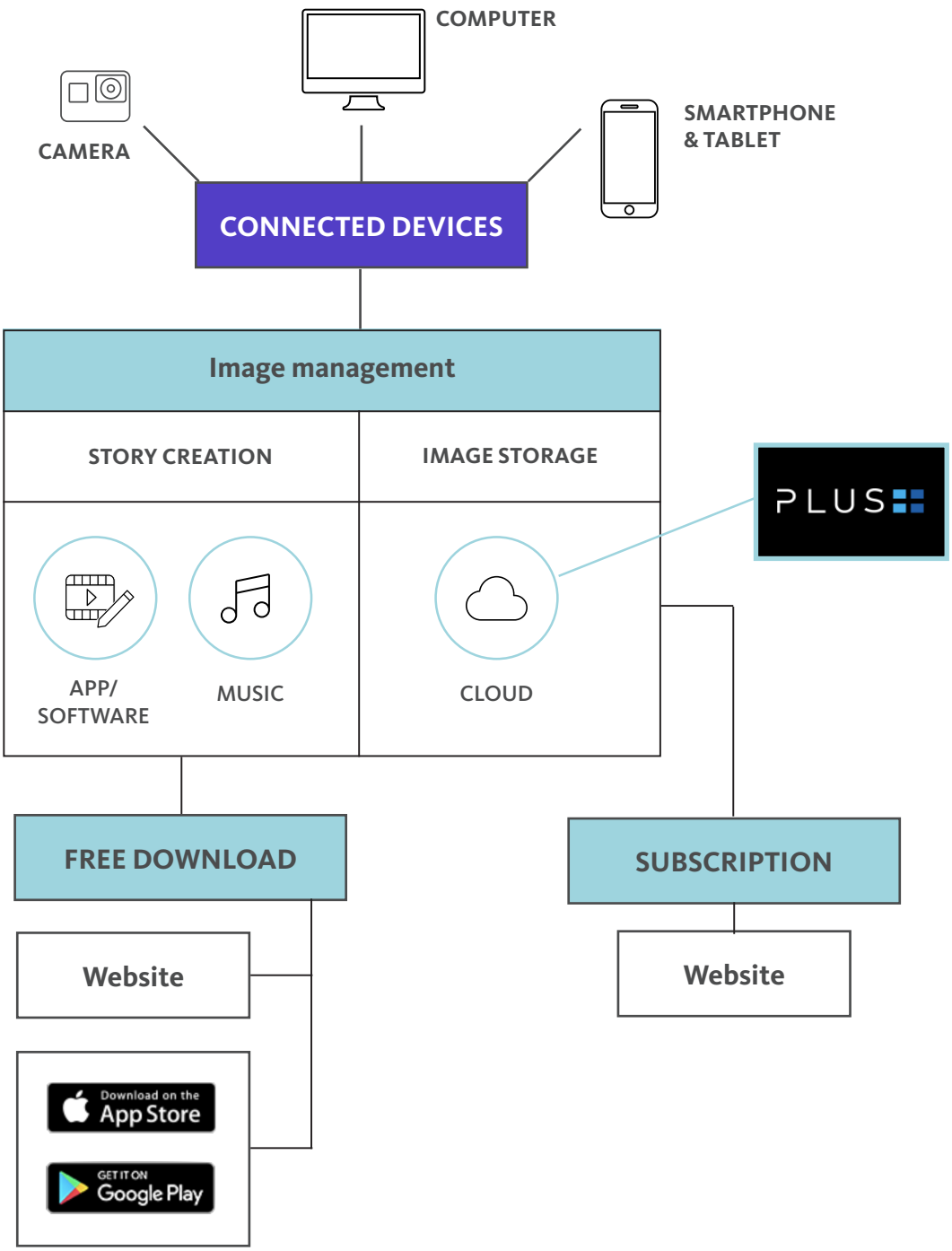
Offering Map

Offering

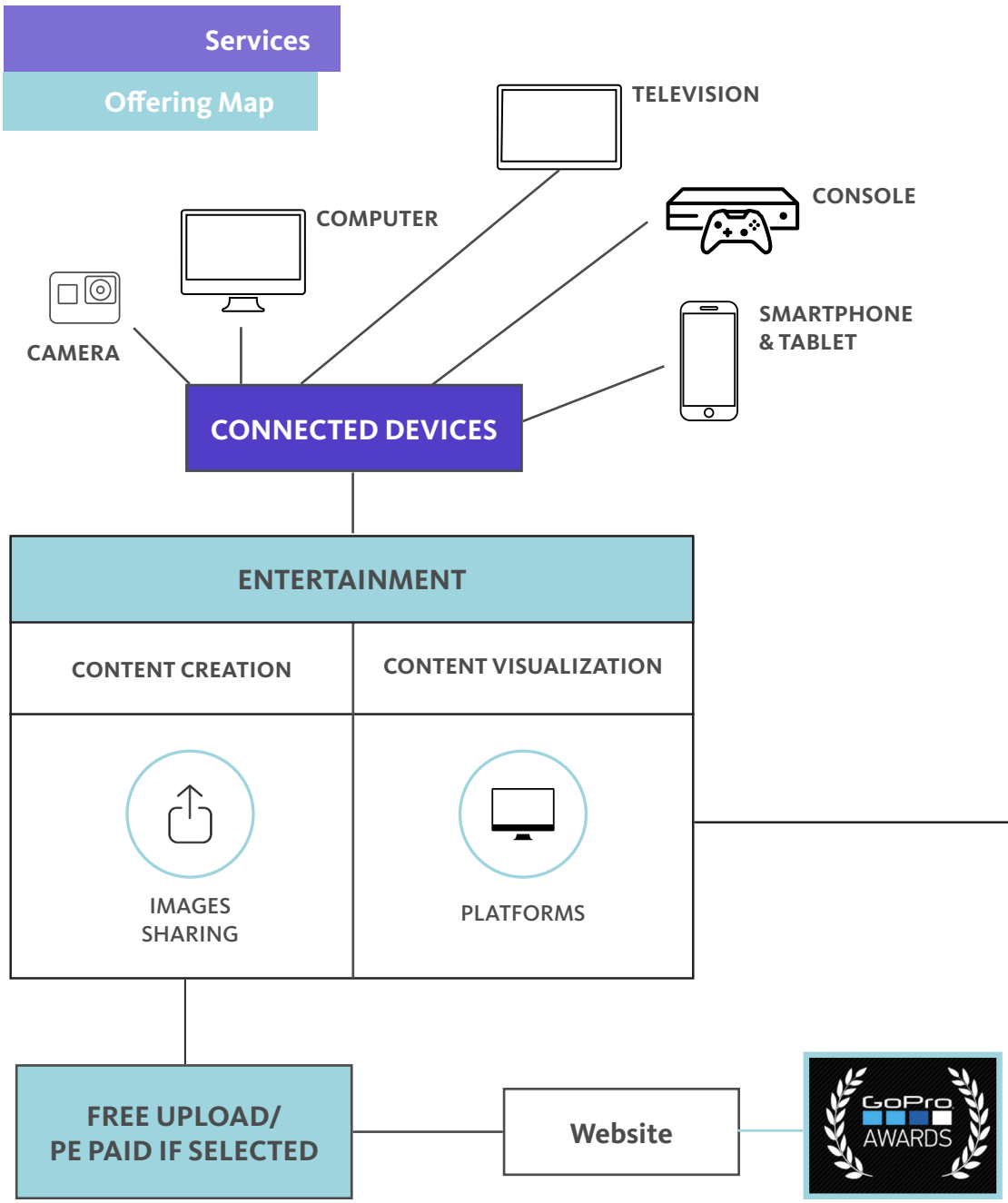
Each of these section are abilities thanks to external ecosystems owned by GoPro or external. The Image capture device as camera and accessories could be bought in physical store, on company website or e-commerce. The Image Management offer regards app/software that allow to modify and share images; and storage services (GoPro Plus). Furthermore GoPro allow also to download music to make a better videos. From the website it is possible pay to have a the GoPro Plus subscription. These services works thanks an ecosystem of connected products: camera, computer and smartphones.

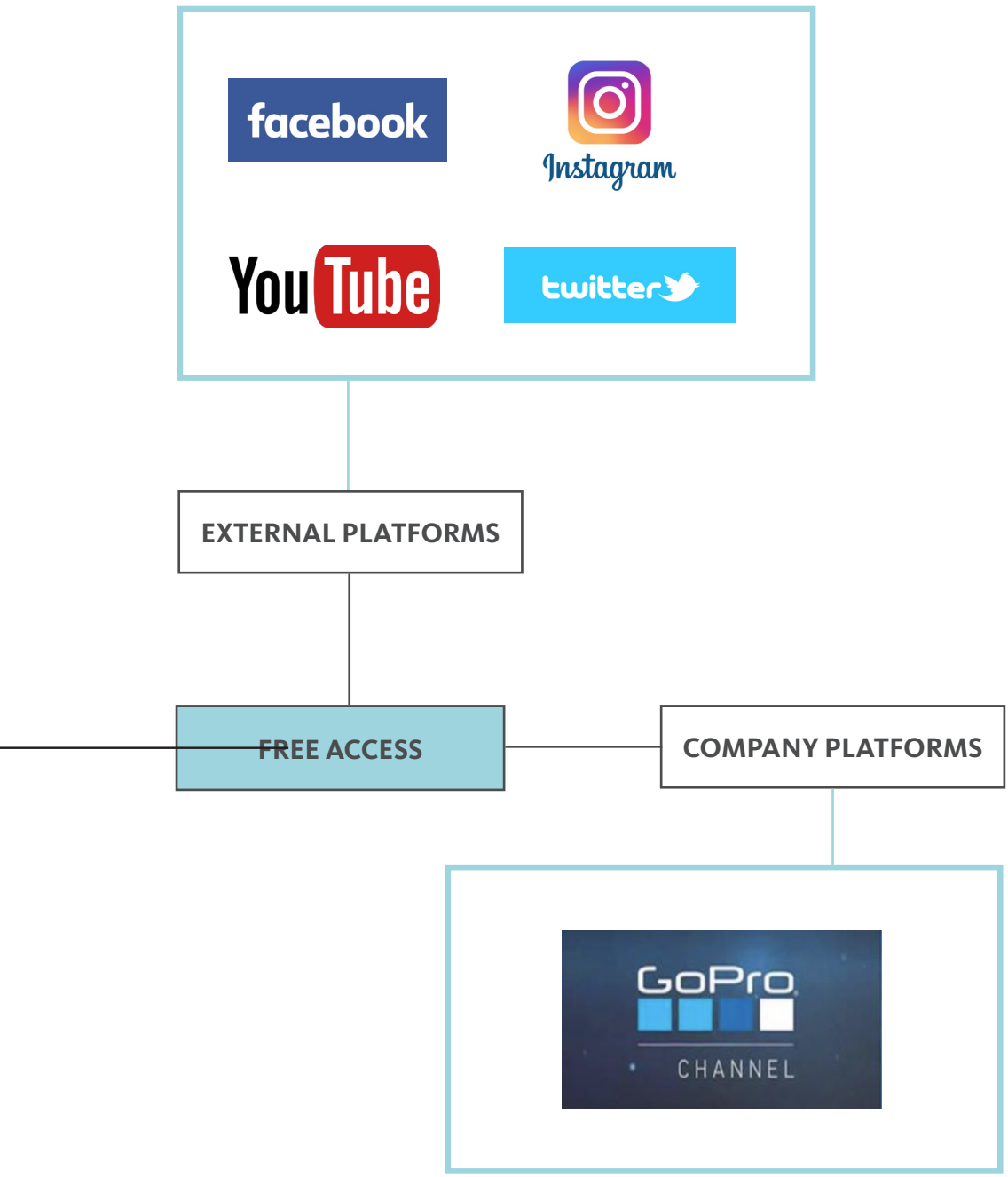
IMAGE-CAPTURE DEVICE	IMAGE MANAGEMENT	ENTERTAINMENT
☐	☐	☐




COMPUTER
CAMERA
SMARTPHONE
& TABLET
CONNECTED DEVICES
Image management
STORY CREATION
IMAGE STORAGE
PLUS
APP/
SOFTWARE
MUSIC
CLOUD
FREE DOWNLOAD
SUBSCRIPTION
Website
Website
Download on the
App Store
GET IT ON
Google Play

5.6 GoPro: Product System, Communication Strategy and Service analysis




facebook
Instagram
YouTube
twitter
EXTERNAL PLATFORMS
FREE ACCESS
COMPANY PLATFORMS
GoPro
CHANNEL

Services

System Map

Sysyem Map

The GoPro service system related to the action camera it is complex and articulated and included many actors and services.
To buy the cameras and the accessories the users need to go through the on-line store. Here we have a transition of money and information with the Company. It send the product to the user with a delivery system paid by the company.
The service related to the image download it is possible thanks to the Smartphones/Tablet use and the connection of Apple Store and Play Store. People can also share images to different external social media platforms.
If costumer want to use the Cloud service have to use the computer and send the money to the company. There is also a image/video movement from the user and the cloud. Users can also divided to directly send image to GoPro service GoPro Award. Thanks to this service, in case of image selection the user receive money. Furthermore it can sign a contract where it declare that if GoPro will sell its image to some company it will receive a percentage. The picture will than charge from GoPro company to different platforms. That could be external as Social Networks (YouTube, Instagram, Twitter, Pinterest and Facebook) or internal as the GoPro Channel.

Services

System Map

Money
Product
Digital files
Info.

TRAK DELIVERY

Camera/
Accessories

Data Storage

PLUS

GoPro
CHANNEL

Product payment

Music

Software

App

ONLINE SHOP

GoPro

Video/Photo

Reward

GoPro
AWARDS

Selected
Video/Photo

Video
Photo

Download on the App Store

GET IT ON Google Play

YouTube

5.7 Drift : Product System, Communication Strategy and Service analysis

COMPANY NAME
Drift

TYPE OF COMPANY
Camera Producer

CLAIM
Get out there

CAMERAS

Price
From the Drift Innovation website, it is possible found three different cameras with different price range. Two of them had a medium price range (less than 150 Euro): Stealth 2 and Compass. There is also a medium-high price camera: the Ghost. Drift have inside its offer a multiple price target.

Product Design
The Drift cameras are proposed with two body type and two variant design language. The Ghost 4k and the Stealth 2 have a camcorder body with a Sport variant. The Compass camera had a Wearable body type with a premium variant.

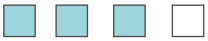
Technolgy
The Ghost have the best performance in terms of image quality and extra features. In relation to the image quality he had: 4k quality videos, 5 MP pictures but no image stabilization. It have few features as: Wi-Fi, Bluetooth. Both 99,99 Hero5 Session have HD image quality.

PRICE RANGE
MEDIUM-HIGH (150-300 Euro)

MEDIUM (50-150 Euro)

DESIGN LANGUAGES
2 BODY TYPES
2 VARIANTS

TECHNOLGICAL QUALITY
HIGH



MEDIUM

Product System

Cameras

NAME
Ghost 4k

ONLINE PRICE
299,99 Euros

PRODUCT DESIGN
Body Type: Camcorder

Variant: Sport

TECHNOLOGICAL FEATURES

IMAGE QUALITY

EXTRA FEATURES

NAME
Stealth 2

ONLINE PRICE
99,99 Euros

PRODUCT DESIGN
Body Type: Wearable

Variant: Sport

TECHNOLOGICAL FEATURES

IMAGE QUALITY

EXTRA FEATURES

NAME
Compass

ONLINE PRICE
99,99 Euros

PRODUCT DESIGN
Body Type: Wearable

Variant: Premium

TECHNOLOGICAL FEATURES

IMAGE QUALITY

EXTRA FEATURES

Product System

Complementary products

ACCESSORIES

The Drift Innovation accessories offer it is diversified. It count more than 50 objects divided in 4 different categories related to price, alphabetic name and best selling. It is also possible order the accessories according to their camera compatibility.
They are not divided according to suggested activities.

QUANTITY 55 - MEDIUM

CATEGORIES: 4

SUGGESTED ACTIVITIES: 0

SAMPLE








APP & SOFTWARE

Different App could be downloaded. Drift app allow to have a remote control of the camera. Drift Connect allow to modify video and control remotely the camera. Finally Drift Life allow to both control and share videos, but thanks to this app it is also possible the videos and photos editing.

APP
NUMBER: 3

SOFTWARE
NUMBER: 0

FUNCTIONS
REMOTE CONTROLL ☐ EDITING ☐
SHARING ☐

NAME
Drift App

TYPE
APP

FUNCTIONS
Control

DEVICE
Smarphone

NAME
Drift Connect

TYPE
APP

FUNCTIONS
Control
Share

DEVICE
Smarphone
Tablet

NAME
Drif Life

TYPE
APP

FUNCTIONS
Control
Share
Editing

DEVICE
Smarphone

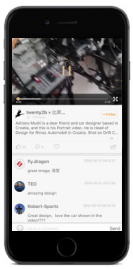
Product System

Connected products

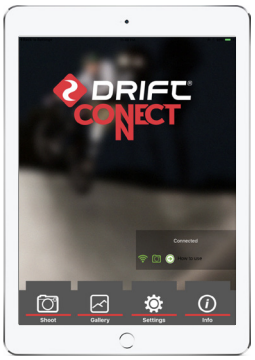
Connected products

Different App software and Services allow to connect the Drift Innovation cameras to different devices. These devices are the connected products that allow to extend the camera function and manage the images captured. Drift had a little system enabled through the following products: smartphones and tablet.

SMARTPHONE ☑	COMPUTER ☐	TV & CONSOLE ☐
SMARTWATCH ☐	TABLET ☑	WEARABLE DEVICES ☐



SMARTPHONE



TABLET

Tab.53b aDrift: Connected Products analysis
Tab.54 aDrift: Comunication analysis

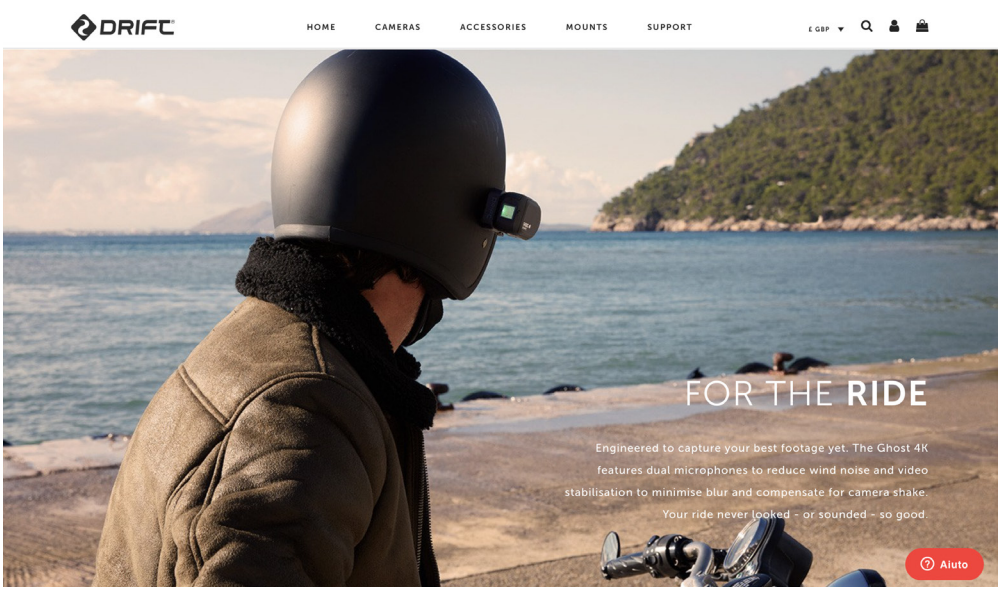
Comunication

Website

Website Language

On the Drift website are promoted the product, the technoglical performance, but also the kind of activities that are related to this product and they concern both fun and family moment as extreme activities. The language used it is a mix fun and adventure mood, with a focus on moto "adventures". There is low presence of technology attention.

TECHNOLOGY	FUN/FAMILY	ADVENTURE
☐	☐	☐
☐	☐	☐



5.7 Drift : Product System, Communication Strategy and Service analysis

Comunication

Mrketing

Social

Drift use a social strategy based on product promotion and the use of ambassadors. The Social used: Facebook, Twitter and Instagram. The content of the post are mainly created by company and regards camera innovation, discounts or events. They do not use a costumers content generation strategy.

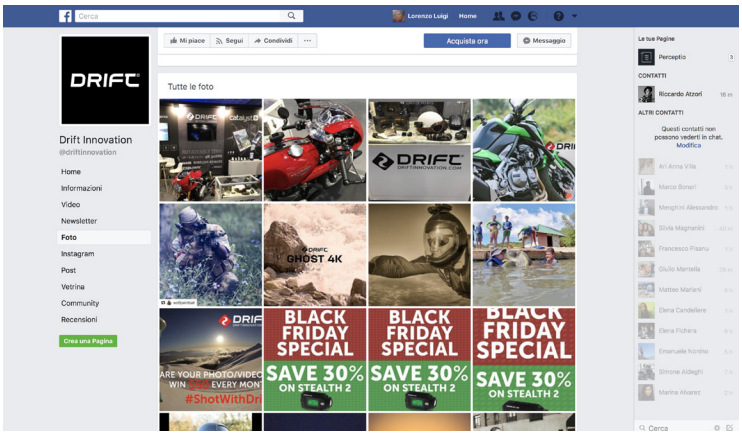
COSTUMERS CONTENT GENERATION ☐	PRODUCTS PROMOTION ☐	TOTAL FOLLOWERS	
AMBASSADORS ☐		604.000	

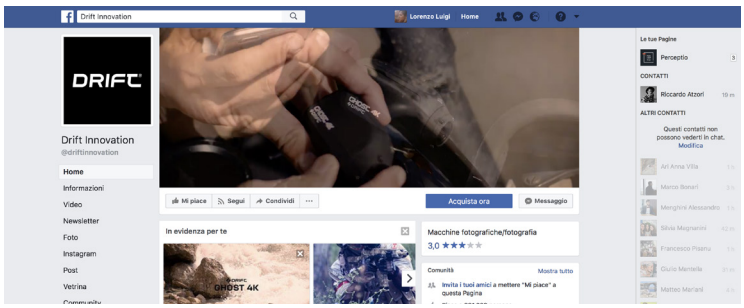
FOLLOWERS
600.000

STRATEGY

Products Promotion

Ambassadors Content



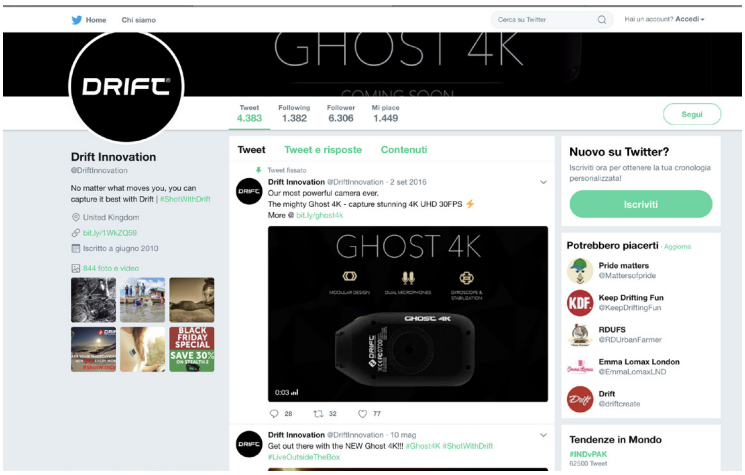


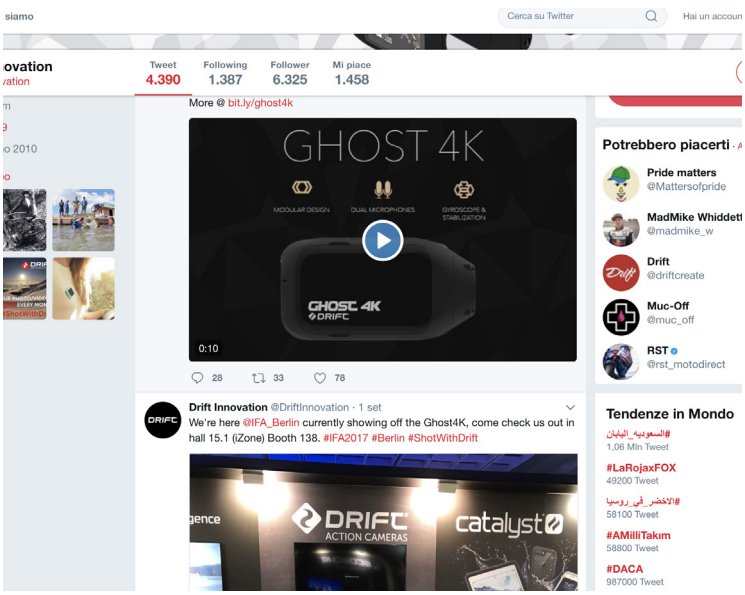
FOLLOWERS
6.000

STRATEGY

Products
Promotion

Ambassadors
Content





Comunication

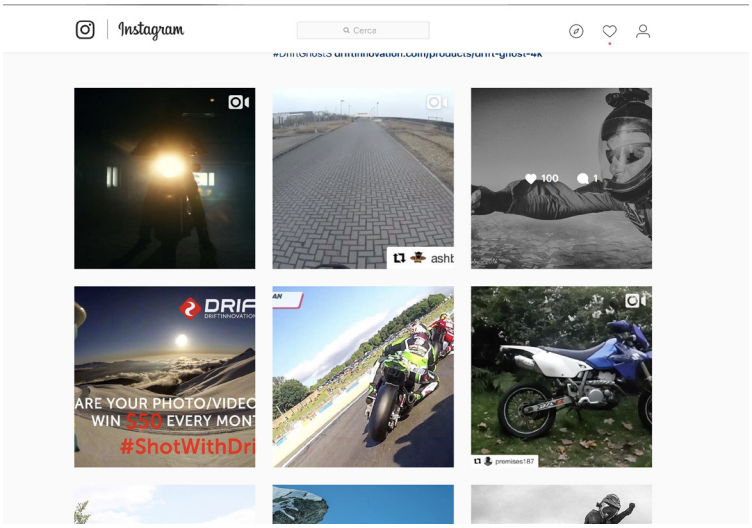
Mrketing

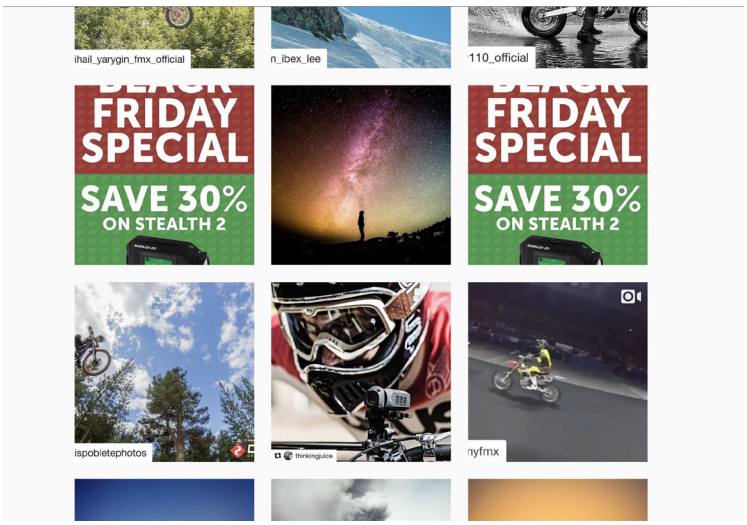
FOLLOWERS
8.000

STRATEGY

Product
Promotion

Ambassadors
Content





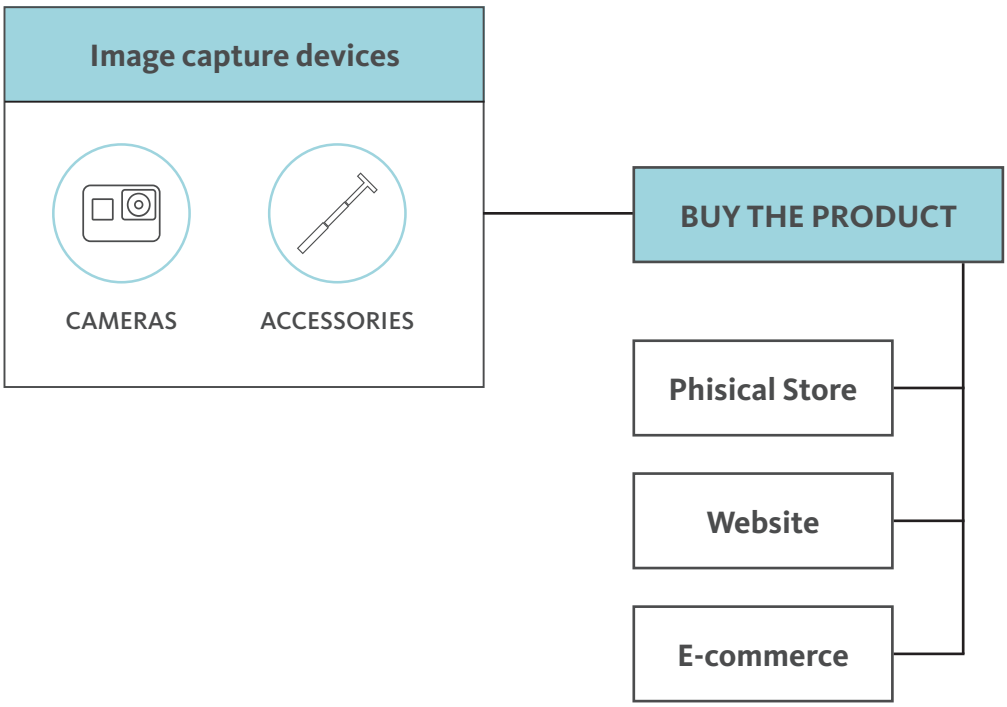
Services

Offering Map

Offering

The Image capture device as camera and accessories could be bought in physical store, on company website or e-commerce. The Image Management offer regards app/software that allow to modify and share images. It is possible download these app for free from the App Store or from the Play Store. These services works thanks an ecosystem of connected products: camera, smartphones or tablet.

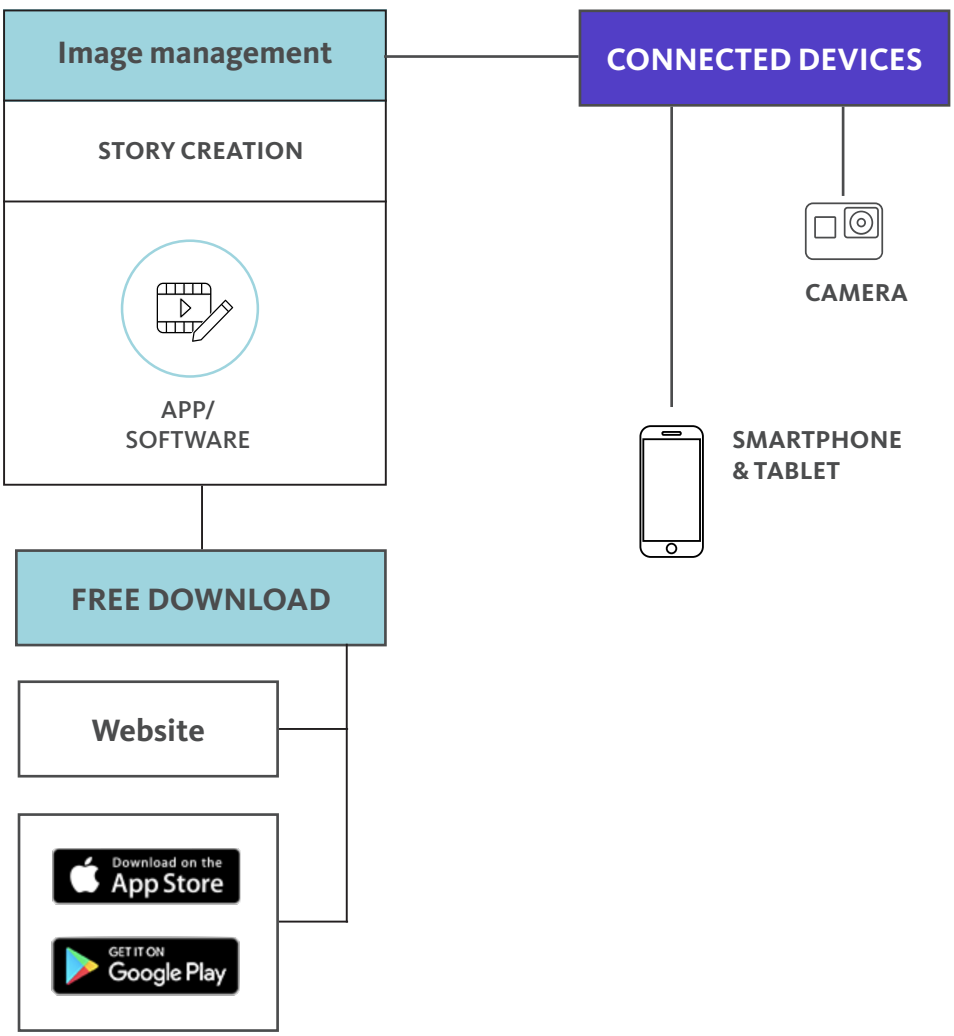
IMAGE-CAPTURE DEVICE	IMAGE MANAGEMENT	ENTERTAINMENT
■	■	□



5.7 Drift : Product System, Communication Strategy and Service analysis

Services

Offering Map



Services

System Map

Sysyem Map

The Drift Innovation service system related to the action camera it is simple To buy the cameras and the accessories the users need to go through the on-line store. Here we have a transition of money and information with the Company. It send the product to the user with a delivery system paid by the company.

The service related to the image download it is possible thanks to the Smartphones/Tablet use and the connection of Apple Store and Play Store. People can also share images to different external social media platforms.

Services

System Map

Money
Product
Digital files
Info.

TRAK DELIVERY

Camera/
Accessories

Product payment

Software

App

ONLINE SHOP

Video
Photo

Download on the App Store

GET IT ON Google Play

5.8 Garmin : Product System, Communication Strategy and Service analysis

COMPANY NAME
Garmin

TYPE OF COMPANY
GPS ans wearable device producer

CLAIM
N.D.

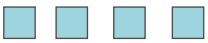
CAMERAS

Price
From the Garmin website, it is possible found two different cameras in the High price range. Their cost it is over 300 euros. The Garmin VIRB Ultra 30 it cost 429,99 Euro and the more expensive Garmin 360 cost 799,99 Euros (Garmin.com).

Product Design
The Drift cameras are proposed with two body type and two variant design language. The Garmin VIRB Ultra 30 have a classic body with a Sport variant and the VIRB 360 had a 360 body type with a premium variant.

Technolgy
The VIRB cameras have the high performance in terms of image quality and extra features. In relation to the image quality they had: 4k quality videos, 12 MP pictures and image stabilization. They have few also as many extra features: Wi-Fi, Bluetooth, GPS, voice control and Streaming connection. The 360 VIRB have even a 360 degree 5k video capabilities.

PRICE RANGE
HIGH (300-more Euro)



DESIGN LANGUAGES
2 BODY TYPES
2 VARIANTS

TECHNOLGICAL QUALITY
HIGH

Product System

Cameras

NAME
VIRB Ultra 30

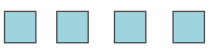
ONLINE PRICE
429,99 Euros

PRODUCT DESIGN
Body Type: Camcorder

Variant: Sport

TECHNOLOGICAL FEATURES

IMAGE QUALITY



EXTRA FEATURES

NAME
VIRB 360

ONLINE PRICE
799,99 Euros

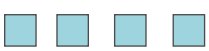
PRODUCT DESIGN
Body Type: Wearable

Variant: Sport

TECHNOLOGICAL FEATURES

IMAGE QUALITY

EXTRA FEATURES



5.8 Garmin : Product System, Communication Strategy and Service analysis

Product System

Complementary products

ACCESSORIES

The Garmin accessories offer count 45 accessories. They are divided in two main categories: mounts and accessories. The Company made an other product division suggesting possible use of these accessories: motor sports, aviation, skydiving, water sport, diving, cycling and mountain bike, climbing and skating, winter sport, drone use.

QUANTITY 45 - MODEST

CATEGORIES: 2

SUGGESTED ACTIVITIES: 12

SAMPLE







APP & SOFTWARE

Garmin VIRB App could be downloaded from Apple Store and Play Store. It allow the remote control if the camera, the image editing, the live broadcast and the image sharing. The VIRB Edit it is a software to modify and share the images. With this software it is also possible manage the visualization of GPS data and metrics capture with the device.

APP
NUMBER: 1

SOFTWARE
NUMBER: 1

FUNCTIONS
REMOTE CONTROLL ☐ EDITING ☐
SHARING ☐

NAME
Garmin VIRB

TYPE
APP

FUNCTIONS
Control
Edit
Share
Live Brodcast

DEVICE
Smarphone
Tablet

NAME
VIRB Edit

TYPE
SOFTWARE

FUNCTIONS
Edit
Share
Add dats & metrics

DEVICE
Computer

Product System

Connected products

Connected products

Different App software and Services allow to connect the Garmin cameras to different devices. These devices are the connected products that allow to extend the camera function and manage the images captured. Drift had interesting system enabled through the following products: smartphones, tablets computer and all the wearable and data trackers from the company.

SMARTPHONE ■	COMPUTER ■	TV & CONSOLE □
SMARTWATCH □	TABLET ■	WEARABLE DEVICES ■

SMARTPHONE E TABLET

COMPUTER

VIRB WEARABLE DEVICES AND GPS

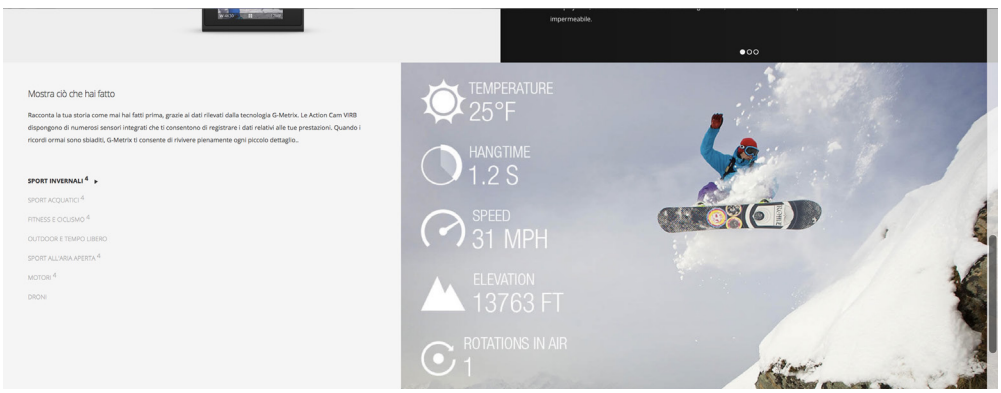
Comunication

Website

Website Language

On the Garmin website are promoted the product, the technoglical performance, but also the kind of activities that are related to this product and they concern extreme activities. The language used it is mainly based on technology. There are also different references to sport activities.

TECHNOLOGY	FUN/FAMILY	ADVENTURE
☐	☐	☐
☐	☐	☐
☐	☐	☐



Tab.6o Garmin: ComunicationAnalysis

Comunication

Mrketing

Social

Garmin social media strategy it is general and there is not a specific strategy related to the action cameras. However it is strategy it is based on product and event promotion.

COSTUMERS CONTENT GENERATION	☐	PRODUCTS PROMOTION	☐	TOTAL FOLLOWERS
AMBASSADORS	☐			-

5.8 Garmin : Product System, Communication Strategy and Service analysis

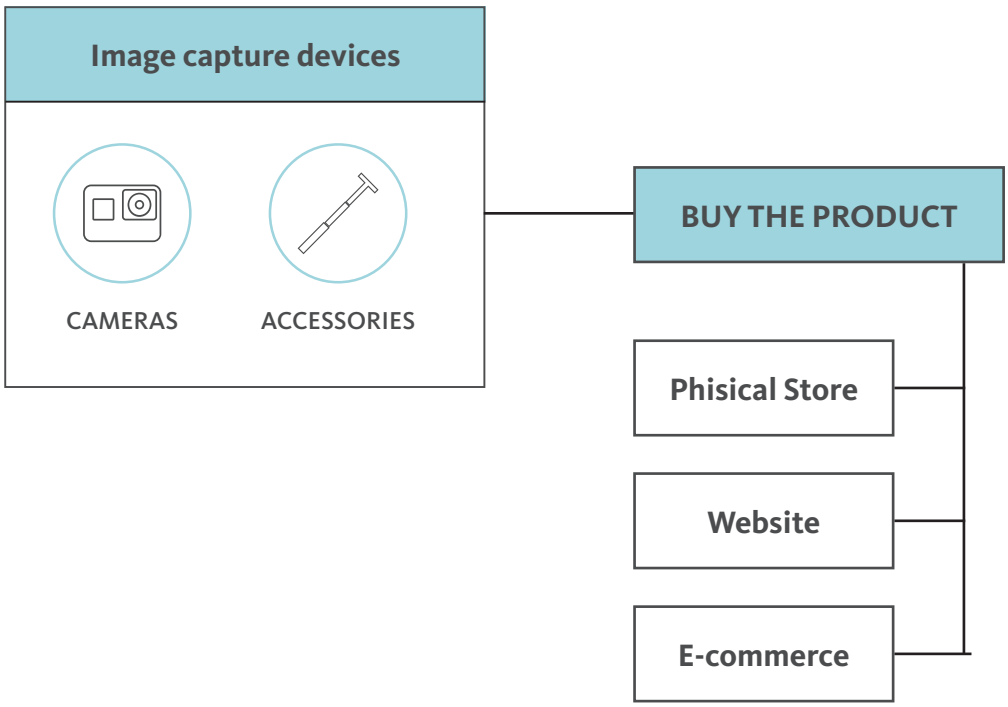
Services

Offering Map

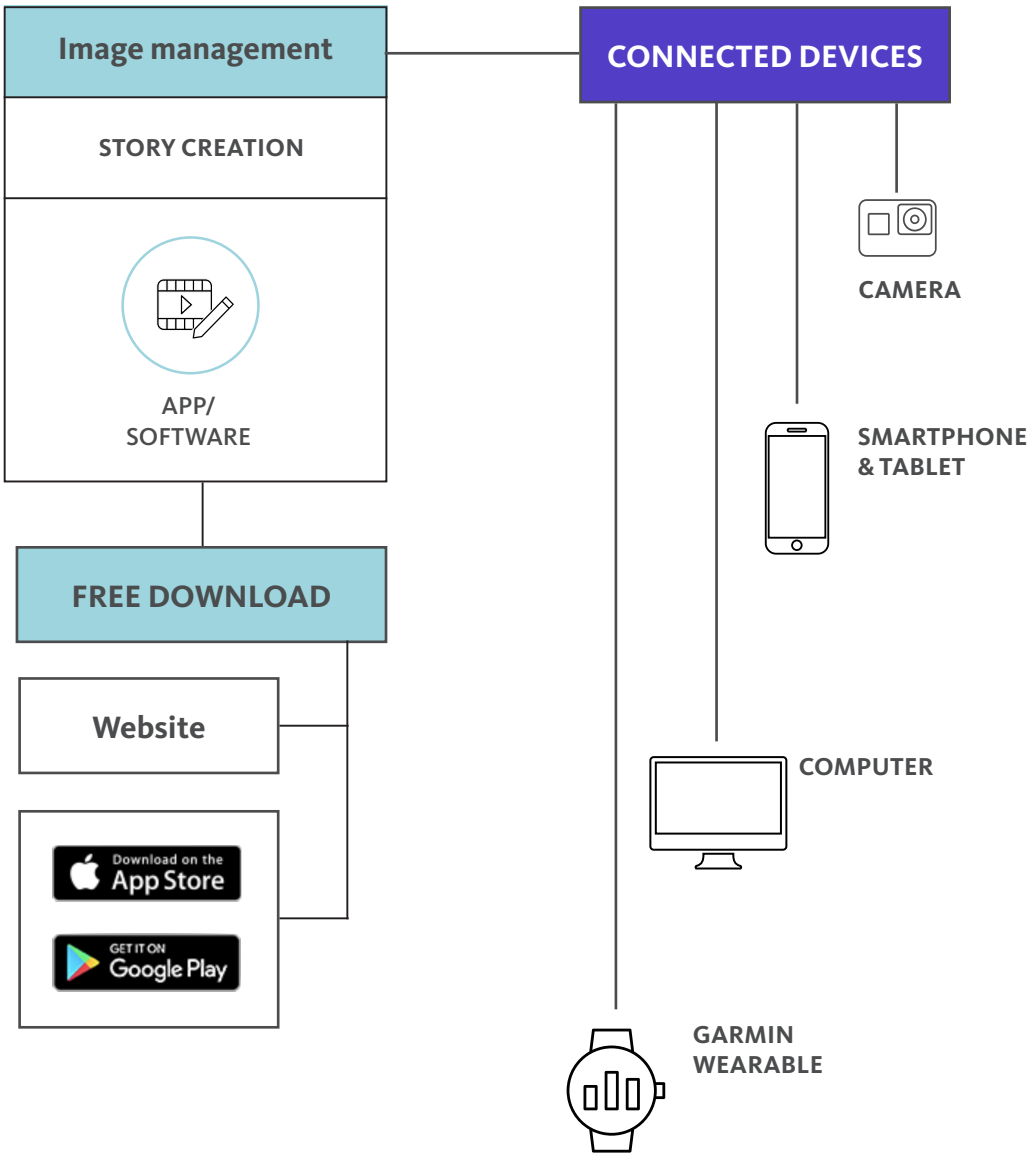
Offering

The Image capture device as camera and accessories could be bought in physical store, on company website or e-commerce. The Image Management offer regards app/software that allow to modify and share images. It is possible download these app for free from the App Store or from the Play Store. These services works thanks an ecosystem of connected products: camera, smartphones, tablets and wearable devices.

IMAGE-CAPTURE DEVICE	IMAGE MANAGEMENT	ENTERTAINMENT
■	■	□



Tab.61 Garmin: Service System Analysis



5.8 Garmin : Product System, Communication Strategy and Service analysis

Services

System Map

Sysyem Map

The Garmin action cam service system related to the action camera it is simple

To buy the cameras and the accessories the users need to go through the on-line store. Here we have a transition of money and information with the Company. It send the product to the user with a delivery system paid by the company.

The service related to the image download it is possible thanks to the Smartphones/Tablet use and the connection of Apple Store and Play Store. People can also share images to different external social media platforms.

Services

System Map

Money
Product
Digital files
Info.

TRAK DELIVERY

Camera/
Accessories

Product payment

Software

App

ONLINE SHOP

GARMIN

Video
Photo

Download on the App Store

GET IT ON Google Play

YouTube

5.9 Sony : Product System, Communication Strategy and Service analysis

COMPANY NAME
Sony

TYPE OF COMPANY
Consumer electronics

CLAIM
Prove Yourself

CAMERA

Price
From the Sony website, it is possible found six different cameras that could be placed on two different price range. HDR-AS300R, FDR-X-1000VR, HDR-AS200VR and HDR-AZ1 KIT costs more than 300 Euros. The HDR-AS20 and the HDR-AS50 could be placed on medium-high range because they cost less than 300 euros and more than 150 (220 and 200 Euros respectively).

Product Design
All six cameras are proposed with the same body type and the premium variant. They main difference could be found on colours: black or withe.

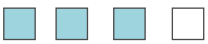
Technolgy
The Sony cameras could be categorized according to their technological quality in two main categories: medium/high and medium.
Indeed it have cameras with 4k video capabilities and image stabilization and cameras that reach maximum the HD quality. However the range of extra features it is not rich as the one of Garmin or GoPro.

PRICE RANGE
HIGH (300-more Euro)

MEDIUM - HIGH (150-300 Euro)

DESIGN LANGUAGES
1 BODY TYPE
1 VARIANT

TECHNOLGICAL QUALITY
MEDIUM/HIGH



MEDIUM

Tab.63 Sony: Cameras analysis

Product System

Cameras

NAME
HDR-AS300R

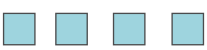
ONLINE PRICE
600 Euros

PRODUCT DESIGN
Body Type: Camcorder

Variant: Sport

TECHNOLOGICAL FEATURES

IMAGE QUALITY



EXTRA FEATURES

NAME
HDR-AS50

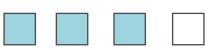
ONLINE PRICE
220 Euros

PRODUCT DESIGN
Body Type: Wearable

Variant: Sport

TECHNOLOGICAL FEATURES

IMAGE QUALITY



EXTRA FEATURES

NAME
FDR-X1000VR

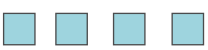
ONLINE PRICE
450 Euros

PRODUCT DESIGN
Body Type: Wearable

Variant: Premium

TECHNOLOGICAL FEATURES

IMAGE QUALITY



EXTRA FEATURES

Product System

Cameras

NAME
HDR-AS200VR

ONLINE PRICE
350 Euros

PRODUCT DESIGN
Body Type: Camcorder

Variant: Sport

TECHNOLOGICAL FEATURES

IMAGE QUALITY

EXTRA FEATURES

NAME
HDR-AZ1 KIT

ONLINE PRICE
350 Euros

PRODUCT DESIGN
Body Type: Wearable

Variant: Sport

TECHNOLOGICAL FEATURES

IMAGE QUALITY

EXTRA FEATURES

NAME
HDR-AS20

ONLINE PRICE
200 Euros

PRODUCT DESIGN
Body Type: Wearable

Variant: Premium

TECHNOLOGICAL FEATURES

IMAGE QUALITY

EXTRA FEATURES

Tab.64 Sony: Product System analysis

Product System

Complementary products

ACCESSORIES

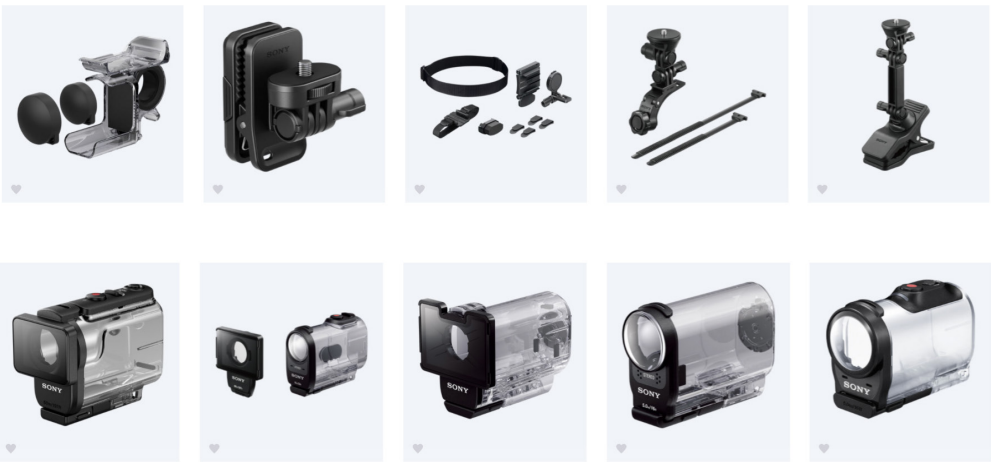
The Sony accessories offer count 30 accessories. They are divided in four main categories: mounts, cases, batteries and other accessories. The Company made an other product division suggesting possible use of these accessories: car, moto, bicycle, winter sport, skateboard, surf, kayak e canoe, snorkelling, diving, hiking, fishing, travel, music and dogs.

QUANTITY 30 - MODEST

CATEGORIES: 4

SUGGESTED ACTIVITIES: 14

SAMPLE



5.9 Sony : Product System, Communication Strategy and Service analysis

Product System

Complementary products

APP & SOFTWARE

Sony Action Cam App allow to edit the images. The Play Memories have an app version and a Software version and allow to edit, store and share videos. The Action Cam magazine give suggestion and tips for different camera use and about the action cam performance. Finally Movie Creator software to edit video and integrate the GPS data and metrics inside the video.

APP
NUMBER: 3

SOFTWARE
NUMBER: 2

FUNCTIONS
REMOTE CONTROLL ☐ EDITING ☐
SHARING ☐

NAME
Action Cam App

TYPE
APP

FUNCTIONS
Edit

DEVICE
Smarphone
Tablet

NAME
PlayMemories

TYPE
APP
SOFTWARE

FUNCTIONS
Control
Share + Cloud

DEVICE
Smarphone
Tablet
Computer

NAME
Action Cam Magazine

TYPE
APP

FUNCTIONS
Informative

DEVICE
Smarphone
Tablet

NAME
Movie Creator

TYPE
SOFTWARE

FUNCTIONS
Edit
Add dats & metrics

DEVICE
Computer

Product System

Connected products

Connected products

Sony App software and Services allow to connect the cameras to different devices. These devices are the connected products that allow to extend the camera function and manage the images captured. Drift had system enabled through the following products: smartphones, tablets computers and smartwatch..

SMARTPHONE ☐	COMPUTER ☐	TV & CONSOLE ☐
SMARTWATCH ☐	TABLET ☐	WEARABLE DEVICES ☐

SMARTWATCH

Action Cam

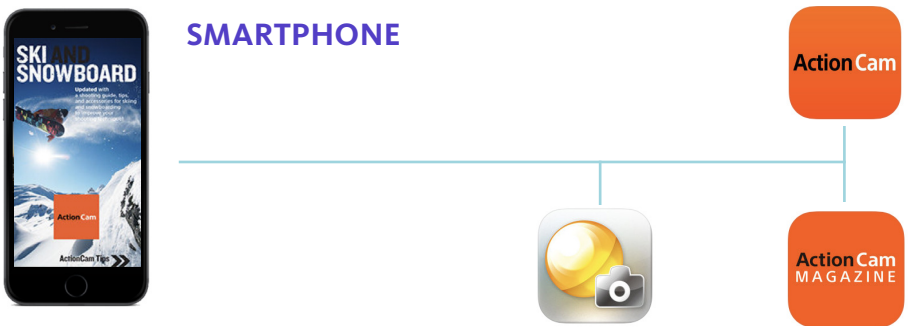
COMPUTER

Action Cam

5.9 Sony : Product System, Communication Strategy and Service analysis

Product System

Connected products



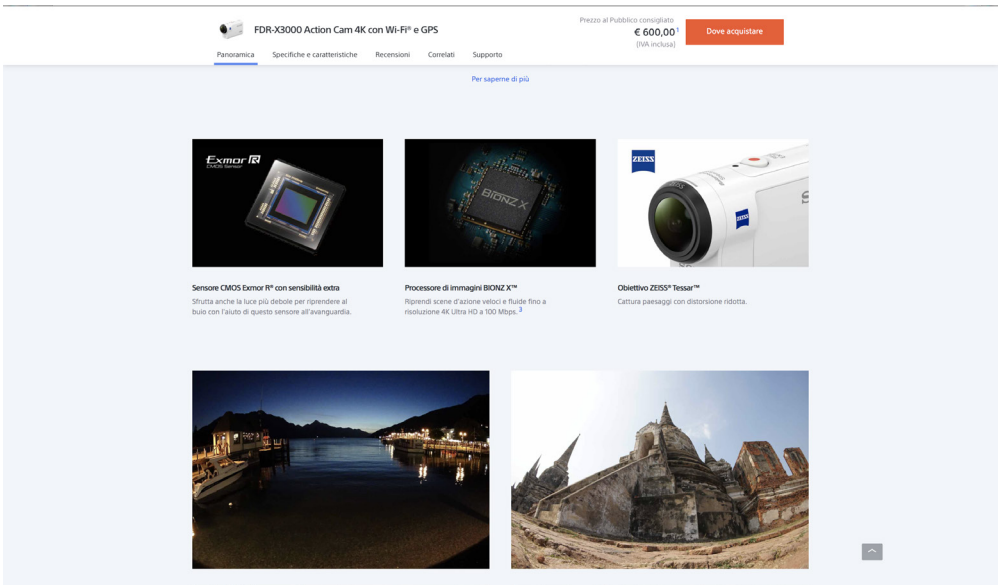
Comunication

Website

Website Language

On the Sony website are promoted the product, the technoglical performance, but also the kind of activities that are related to this product and they concern extreme activities and fun. The language focus it is the techngoly technology. There are also little references to sport activities and fun.

TECHNOLOGY	FUN/FAMILY	ADVENTURE
☑	☑	☑
☑	☐	☑
☑	☐	☐



5.9 Sony : Product System, Communication Strategy and Service analysis

Comunication

Mrketing

Social

Sony social media strategy it is based on the following social networks: Facebook, Instagram and YouTube. It use on both Twitter and Instagram an ambassador and costumer content creation strategy. On YouTube it promote Ambassador videos and camera promotion videos.

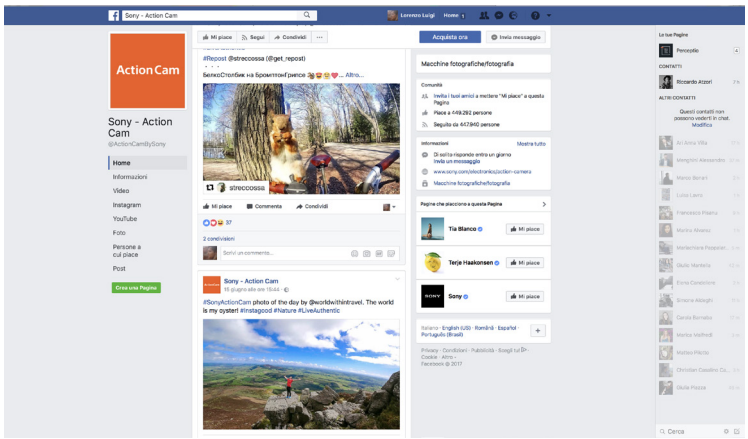
COSTUMERS CONTENT GENERATION ☐	PRODUCTS PROMOTION ☐	TOTAL FOLLOWERS	
AMBASSADORS ☐		549.200	

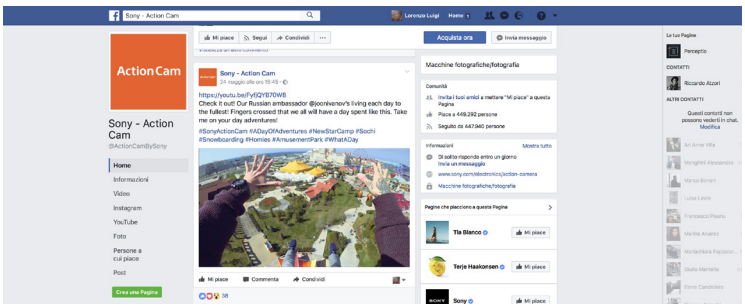
FOLLOWERS
450.000

STRATEGY

Costumers Content

Ambassadors Content





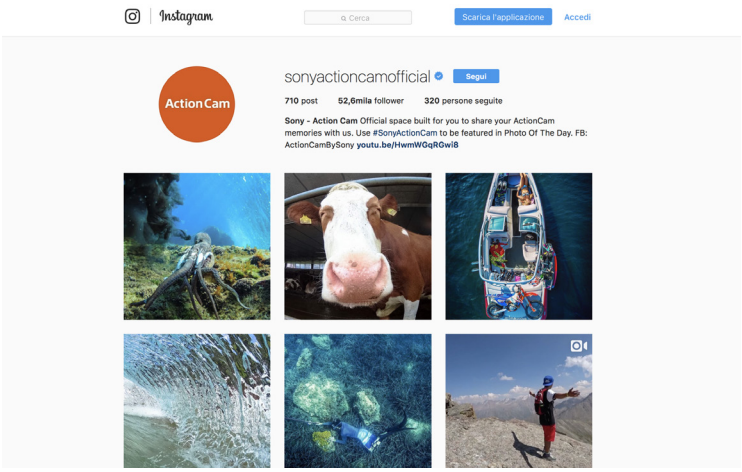
Tab.66 Sony: Comunication Anlysis

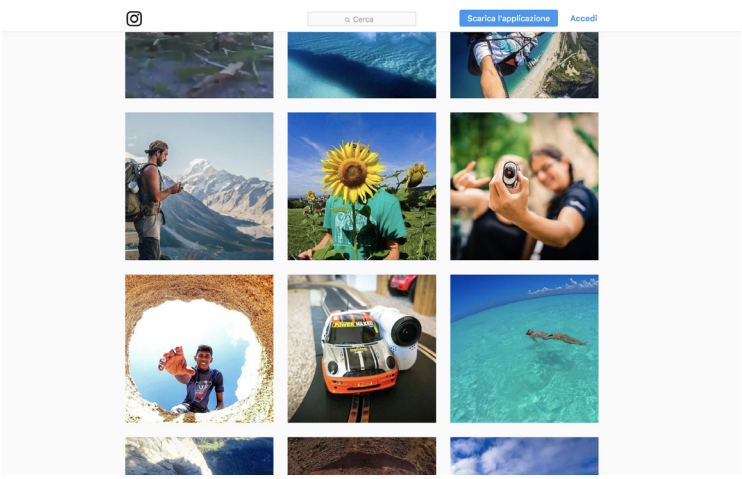
FOLLOWERS
52.000

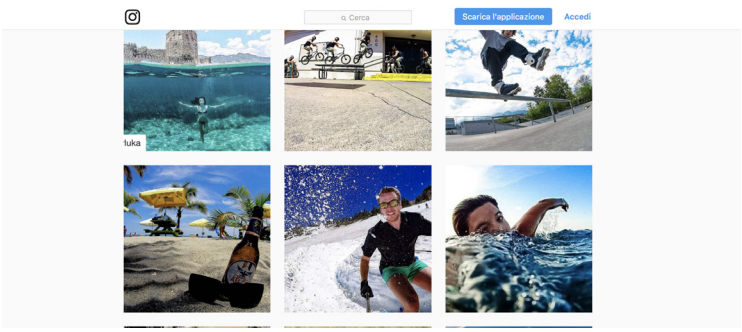
STRATEGY

Costumers
Content

Ambassadors
Content







Comunication

Mrketing

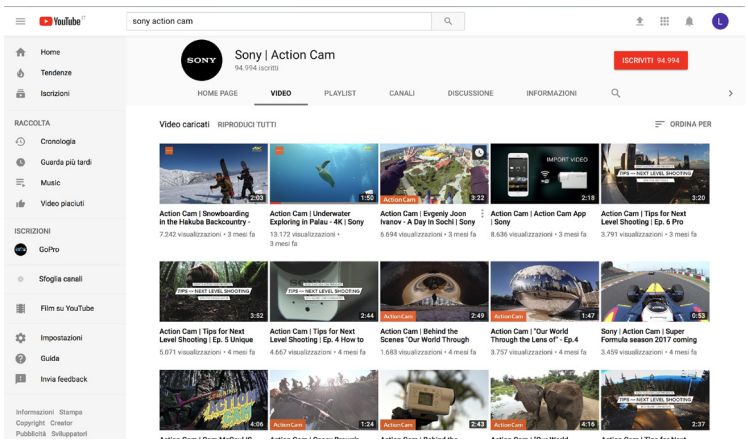
YouTube

FOLLOWERS
94.000

STRATEGY

Product
Promotion

Ambassadors
Content



Tab.67 Sony: Service System analysis

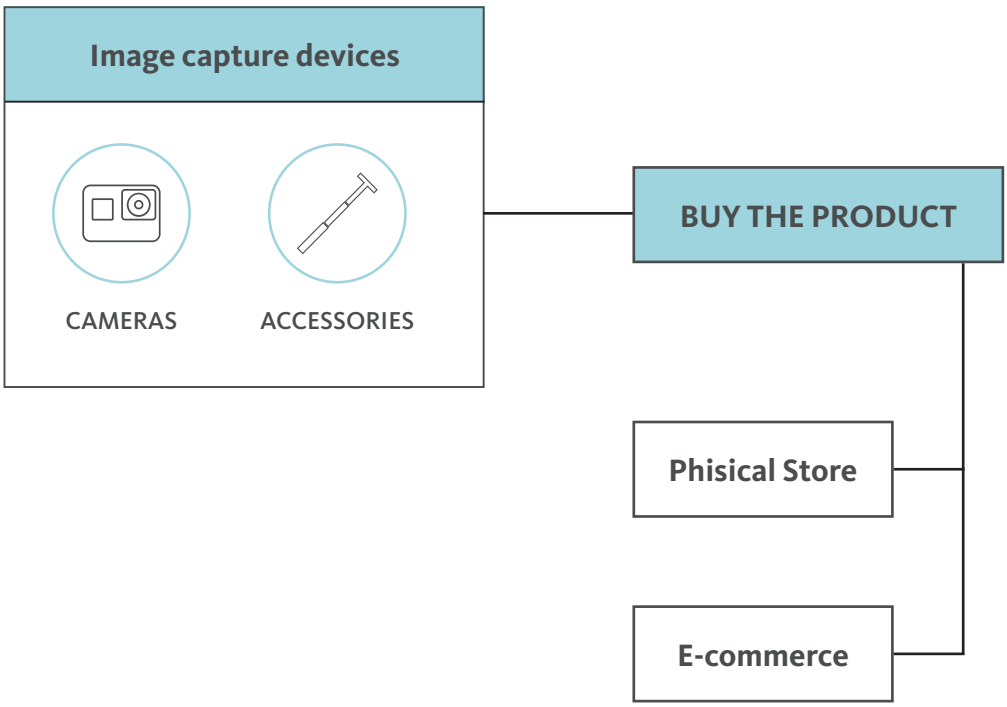
Services

Offering Map

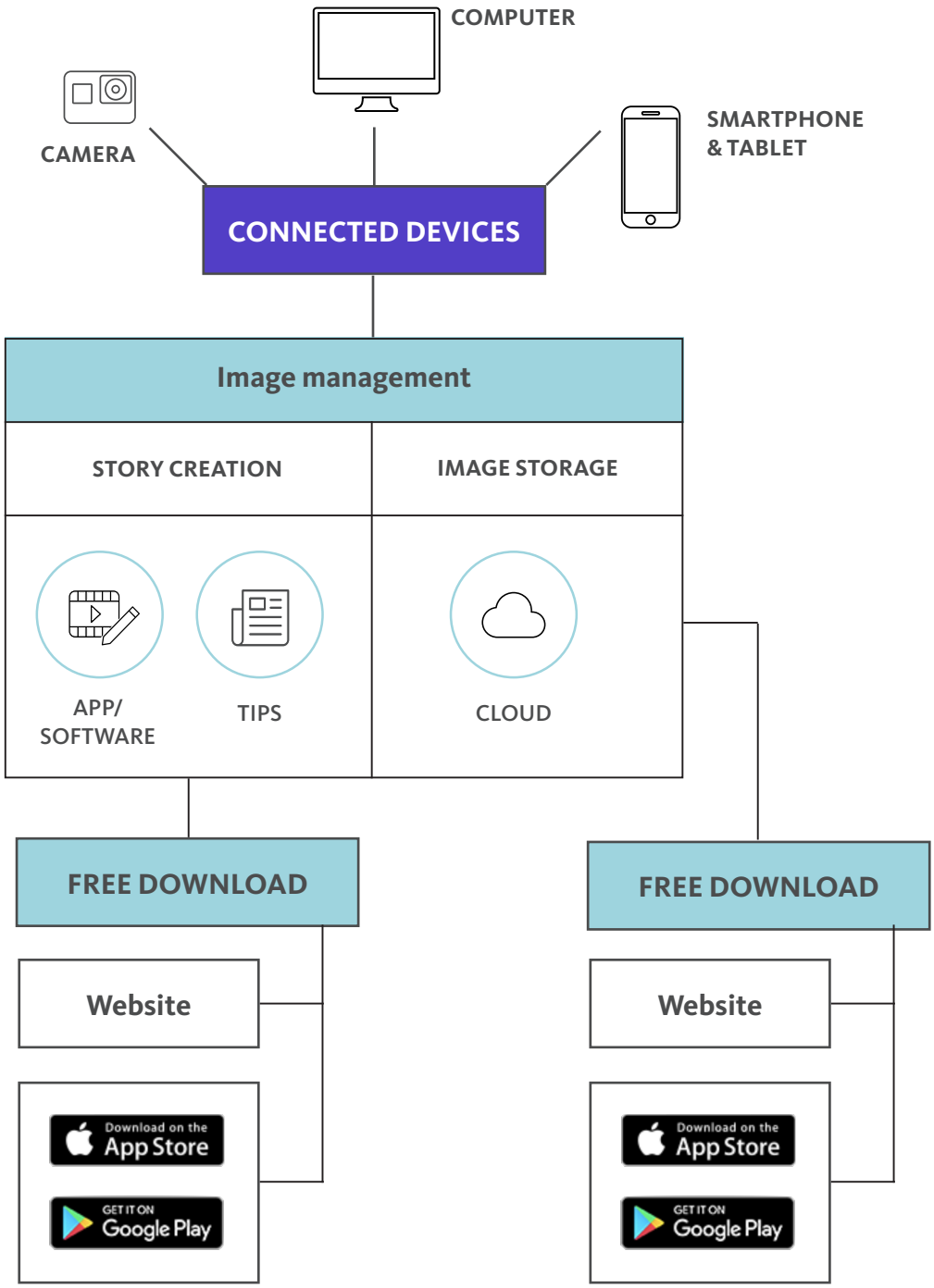
Offering

The Image capture device as camera and accessories could be bought in physical store, on company website or e-commerce. The Image Management offer regards app/software that allow to modify and share images. It is possible download these app for free from the App Store or from the Play Store. The Cloud service it is linked to an app that could be download from the same stores.
These services works thanks an ecosystem of connected products: camera, smartphones, tablets and wearable devices.

IMAGE-CAPTURE DEVICE	IMAGE MANAGEMENT	ENTERTAINMENT
■	■	□



5.9 Sony : Product System, Communication Strategy and Service analysis



Services

System Map

Sysyem Map

The Sony action cam service system related to the action camera it is simple To buy the cameras and the accessories the users need to go through the on-line store. Here we have a transition of money and information with the Company. It send the product to the user with a delivery system paid by the company.
The service related to the image download it is possible thanks to the Smartphones/Tablet use and the connection of Apple Store and Play Store. People can also share images to different external social media platforms.
The costumer can also send image and video data on a cloud (PlayMemories).

Services

System Map

Money
Product
Digital files
Info.

TRAK DELIVERY

Camera/
Accessories

Product payment

Software

App

ONLINE SHOP

GARMIN

Video
Photo

Download on the App Store

GET IT ON Google Play

YouTube

5.10 RESEARCH FINDINGS

Product System
Product

Price

Looking to the results it can be observe that in terms of price proposed and number of variant inside different price levels there are no huge difference between the companies. All the four companies are selling cameras between 50-300 more Euros range. Particularly Sony and GoPro have both proposal for High and medium high price range. It can be state that in this comparison there are not important difference that could be considered as a advantage factor.

	GOPRO	DRIFT	GARMIN	SONY
0-50 Euro				
50-150 Euro		●		
150-300 Euro	●	●		●
300 - more Euro	●		●	●

Tab.69 Action Cameras Brand Leaders: Price Comparison

Technological quality and extra features

Looking to the results it can be observe that in terms of technological quality proposed and number of variant inside different quality levels there are no huge difference between the companies. All the four companies are selling cameras between medium and high technoglical camera performance. All the companies, except for Garmin, are proposing different cameras qualities. GoPro have a direct competitors in terms of technoglical level.

	GOPRO	DRIFT	GARMIN	SONY
LOW				
MEDIUM	●	●		●
MEDIUM/HIGH		●		●
HIGH	●		●	

Cameras Offering

Looking to the results it can be observe that all the companies are proposing different camera. Garmin it is offering 2 cameras, Sony 6 and both GoPro and Drift are proposing to the market three different cameras. It means that also the number different of cameras offered to the market it is not an interesting data to take in considereation to find a competitive advantage.

	GOPRO	DRIFT	GARMIN	SONY
1 Camera				
2 Cameras			●	
3 Cameras	●	●		
More than 3				●

Tab.70 Action Cameras Brand Leaders: Cameras offering Comparison

Product System
Accessories

Quantity

If we look at the results we can observe that both Garmin and Sony have a modest number of accessories (respectively 45 and 30). Garmin enter in the category of a medium quantity with 55 with just 5 more than the limits to be inside this category. GoPro have more than 120 accessories. This number it is double compare to the second placed brand.
This can be considered an important point to be analysed.

	GOPRO	DRIFT	GARMIN	SONY
0-20				
20-50			●	●
50-80		●		
80-110				
110-more	●			

Tab.71 Action Cameras Brand Leaders: Accessories offering Comparison

Type

Looking to different type of App and Software it appear that there is not a huge difference between the companies. All companies sold software and app that allow to editing, share pictures. They also have App that allow the camera remote control.
There are not significant differrences between their App ans Software offer.

	GOPRO	DRIFT	GARMIN	SONY
REMOTE CONTR.	●	●	●	●
EDITING	●	●	●	●
SHARING	●	●	●	●

Tab.72 Action Cameras Brand Leaders: App/Software Comparison

Number

Looking to number of App and Software proposed offered it appear that there is not a significant difference between companies. Garmin offers the lowest number of software and app (2) followed by Drift with 3 Apps.
Both Sony and GoPro offers in this field it is wide with 5 different proposal from each company.

	GOPRO	DRIFT	GARMIN	SONY
2			●	
3		●		
4				
5	●			●

Tab.73 Action Cameras Brand Leaders: App/Software Comparison

Product System
Connected Products

Type

Looking to number of connected product and variety the difference between the company it is not interesting. Indeed Just Drift have just 2 connected products. Garmin and Sony have 4 connected product and GoPro 5. The difference on this field it is not relevant to define a competitive advantage.
At the same time it look interesting that three of the best action camera company are providing an offer that it is supported to a certain quantity of connected products.

	GOPRO	DRIFT	GARMIN	SONY
SMARTPHONE	●	●	●	●
TABLET	●	●	●	●
SMARTWATCH	●			●
TV & CONSOLE	●			
COMPUTER	●		●	●
WEARABLES			●	

Tab.74 Action Cameras Brand Leaders: Connected ProductsComparison

Comunication
Marketing

Strategy Type

From the result can be observed that all the companies in their social promote their product and they use Ambassador to promote products and their use.
Both GoPro and Sony use a strategy of user generate content. As we see later this strategy could be linked with the next results analysed.

	GOPRO	DRIFT	GARMIN	SONY
CONSUMERS C.G.	●			●
PRODUCT P.	●	●	●	●
AMBASSADORS	●	●	●	●

Followers number

If we look at the total follower number taken from different social network it is clear that GoPro dominance. If Garmin have not a specific action camera social media strategy, companies as Sony and Drift can count more then 500.000 flowers. On the other side GoPro with more than 12.000.000 of followers have a 40 time bigger impact on this filed. This can be considered an import point to be analised.

Tab.75 Action Cameras Brand Leaders: Followers Comparison

Services

Type

If we look at the offering map proposed by the different competitors we can observe how all of them proposed cameras and accessories in the image capture offer. They also propose instrument as app and software for the management of the images.
But only GoPro offered a structure services that allow to use these images created by its costumers with a service offer that can be called "Entertainment"

	GOPRO	DRIFT	GARMIN	SONY
SELLING DEV.	●	●	●	●
IMAGE. MAMAG.	●	●	●	●
ENTERTAINMENT	●			

Tab.76 Action Cameras Brand Leaders: Service Type Comparison

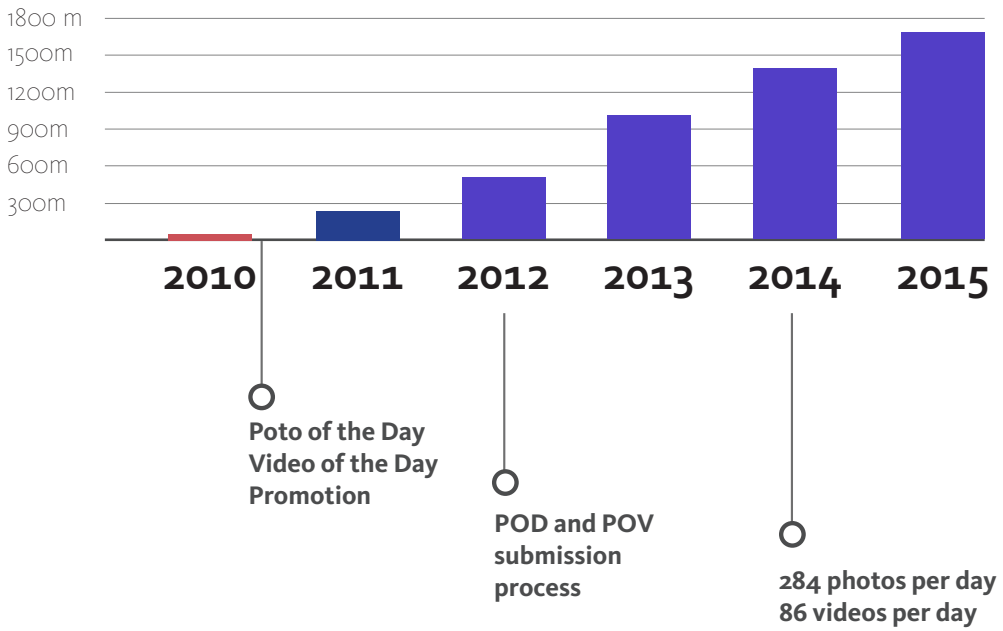
CONCLUSIONS

IFrom the analysis results we can observe that GoPro have a substantial difference on other companies for what regards the number of accessories proposed, the number of social media follower and the offer of a "entrainment" service. Furthermore looking to its system maps it is the more complex and interconnected.

Indeed we can not prove that the number of accessories it is a consequence of the cause of its success its enlighten the relevance of the accessories use in this camera typology. Furthermore looking at action camera competition history GoPro promote its offer as "mountable devices" (Forbes.com). If before it was a "wrist camera" that was competing with "Helmet" cameras it enlarge its usability. In 2010 the year of its first market grow it enlarge its accessory offer. Many competitors state in their product description that they cameras are compatible with GoPro accessories.

Many article talk about the power of the costumer content marketing strategy used from GoPro e instead it is used also by Sony we can state that GoPro was the first to introduce it. In 2010 GoPro launched the promotion Photo of the Day (POD) and Video of the Day (VOD) to reward users that produce amazing photo and video content. The marketing stuff needed to find these videos and photo on the web, select the best ones, proposed them on social

Graph.45 GoPro revenwe grouth since 2010
Statista 2015



media community giving to user the visibility and showcase the best videos and phots that consumer share.
In 2012 the POD and VOD became more structured whit a submission program where consumers could directly share their content. In addition to tagging the users in the post, for the selected material GoPro give to the customer a 50% discount to use inside GoPro website.
In 2014 the submission process was improved with the development of an easy to find landing page and a easier-to use portal format. This process became more and more used by costumer and in the same 2014 most of marketing photo materials was taken from POD submission and the VOD submission became the main source to find and acquire the best of User Generated Content for social media distribution.
The improvement had an impact also on number of content submitted. From 137 daily photo submission for day in 2013 to 258 in 2014; from 86 per day video submitted in 2013 to 164 in 2014. Since the submission-based process was introduced in 2012, GoPro users have submitted more than 128,000 photos and 93,000 videos for POD and VOD consideration.
In 2013 the videos upload on YouTube with the world GoPro on the title were about 6000 per days, it means about 100 hours or videos upload every minutes (Landau, 2014). The amount of video views on YouTube for its own generated videos has tripled in 2014 compared to the same time in 2013. Almost 100 of its videos have reached more than 1 million views (Landau, 2014).
In 2015 the submission process was introduce with the name GoPro Award and in case the videos are selected costumer receive a monetary prize. Once the content t is stented it is also possible accept a GoPro Content Licensing Program (GoPro.com) to continue to monetarize the proper content in case of GoPro would use sell them to world publicity brands (30% commission per license). This strategy not only improve brand awareness, costumer commitment and increase camera selling. It had also an other strong impact on GoPro marketing expenses if we think that in 2013 the company earned $60.6 million on just $157k marketing budget (Hum, 2015).
Different GoPro platforms channels connected users to a complete experience in witch are reinforced the relation between the use of the product and the content generation.
If we look behind this marketing strategy we can observe a well done and coherent product service system. More than the marketing strategy itself I think that it is more relevant to observe the ability to develop a product service system in line with the camera use and the new meaning proposed. Indeed also Sony propose a similar marketing strategy but without a service structure as the one of GoPro. The service enabled the marketing strategy.
This product service structure it work on an external ecosystem and thanks the support of connected products.

Than to conclude this analysis I will state that: the product itself is nothing without considering complementary products and service accessories; the PSS it is enabled in a complex and coherent ecosystem; The Product/Service experience need to be completed on collaterals that result on other Systems.

RESEARCH FINDINGS

Company leader *did* ***not innovate*** *the* ***product language*** *and did* ***not*** *propose multiple* ***product language variants***

The ***company leader*** *leverage on* ***complementary products*** *and* ***service accessories*** *to generate value from the technological innovation*

The ***company leader*** *product offering it is completed by services* ***touch points*** *derived from the* ***technological ecosystem***

The ***company leader*** *product-service system* ***experience*** *it is* ***reliant*** *on other* ***external systems***

6 THE PROPOSAL OF A TOOL FOR STRATEGIC AND PSS-DESIGNER TO FACE TECHNOLOGICAL INNOVATION

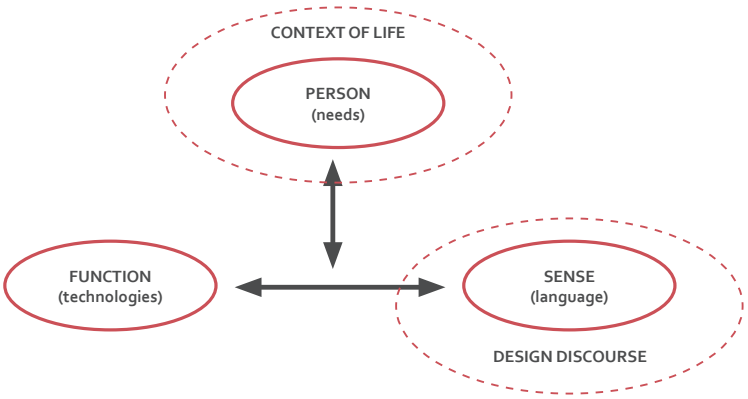
6.1 THE TOOL INTRODUCTION: FRAMEWORK

INTRODUCTION

The result of my research allows to point out that in case of technological innovation the role of the design it is not relate to product language innovation. It seems that to unveiling the "hidden" potential of a new technology the PSS innovation play a central role. I think that PSSD approach it is a good to face meaning innovation leveraging on a more complex system instead to focus just on product innovation.
For that reason, I decide to use my research Insight to build a tool that can be used by strategic designer and pssd designer to face the technoglical innovations.

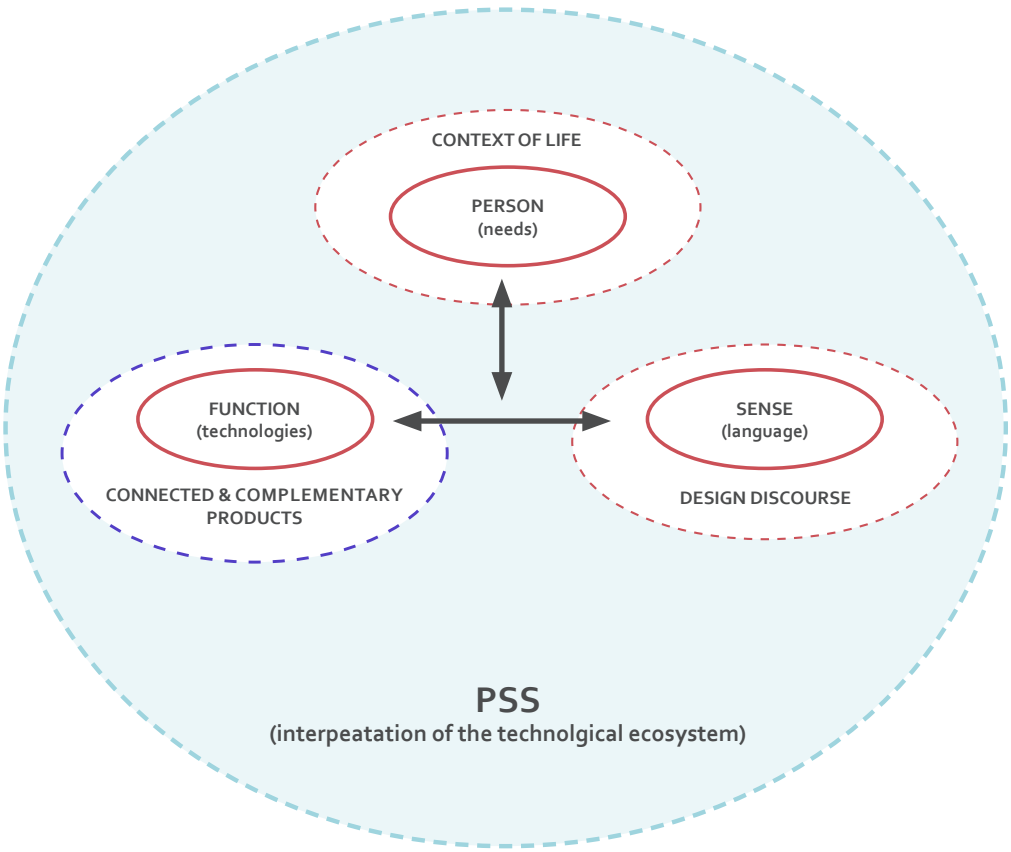
The first step before to create the tool it was to conceptualize my findings. To do so I started to from a general framework already adapted by Verganti (2003) to explain the Design-Driven Innovation. I Also added around the Person and Sense circles their field of investigation: relatively Context of Life (Verganti, 2017) and Design Discourse ration (Verganti, 2007).

GRAPH.46 DESIGN-DRIVEN INNOAVTION PRODUC CENTRIC MODEL



That general framework considered the function as a product technology consequence. However, he give no instruction to how found new possible functions. According to my research findings i decide to add a new level of function research that go over the product itself and concern possible connected and complementary products.
Furthermore my model it is not product oriented, but it have a more wide prospective. Its objectives it is to explain that the innovation can be considered radical in case of a Product-Service System innovation. For this reason the three original three circle are surrounded to a bigger one. It means that the new technology ecosystem have to be organize on a innovative Product-Service System to propose a "technoglical epiphany". To do so I think that the role of the Product Service System designer could be perfect as I will explain later.. This general framework it is at the base of my tool development.

GRAPH. 47 DESIGN-DRIVEN INNOAVTION PRODUCT-SERVICE SYSTEM MODEL



OBJECTIVES

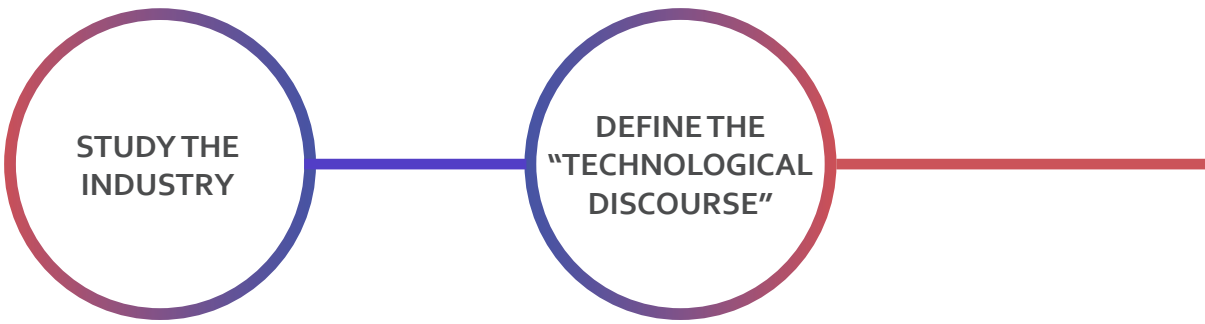
The tool main objective it is to help Strategic Designers and PSSD Designer to apply design driven innovation in case of technoglical changes of different magnitudes. I wanted to make a complete tool with a wide sets of opportunities in terms of different strategies to apply according to: technological change magnitude and company strategic orientation. For that reason inside my tool I have proposed and organize the already existing strategies about product language innovation, adding two new personal proposal that are the result of my research insights.
Furthermore I wanted to helps practitioners to understand and analyse the technological context to make a more precise decision. For that reason elaborate my research path in a tool that can be used to get the right information about the "technology discourse" and to visualize them.
This tool it is a strategic tool, and except for the new two proposal do not give answer about how to realize the strategies. The literature and the ability of the designer will be a key factor during the development moment. F
or what regard the PSS innovation proposal the tool can be useful to built a conversation between designer and engineers during the research of new functions inside the technoglical ecosystem. Furthermore with the introduction of new variables taken from the external technological ecosystem I wanted to open the problem setting area, to allow designers to reframe problem and help them to find more radical solutions.
This tool it is build taking in consideration that the design-driven innovation applied on technology fast paced industry it is not yet well explored. There are many study about its strategic relevance and to how generate new meaning, but it is not clear how to develop features to express these meanings especially for what regards services and product-service systems (Buganza, Dell'Era, Pellizzoni, Trabucchi & Verganti, 2015). Especially the "PSS Technology Epiphany" tool will help to solve this phase, it even open the possibility to continue to explore the "hidden" opportunity of the technology, considering all the ecosystem as a part of the technology itself.

CONTEXT AND USE

Now I will explain in witch context my tool can be used and in witch phase of the project. I will also give other guide lines to better use it.
My tool it is based on literature research and case study research about the relation between technoglical innovation and design strategies application, with a focus on fast-paced technoglical innovation industries. For that reason I suggest to use my tool tools for these industries. This tool it can be considered more useful whit a clear consciousness of the company technology capabilities and innovation directions. My tools could be use both when a company it is facing a technoglical transition or an incremental one. It also offer the guideline to understand the general industry situation in terms of technoglical innovation. This could help to understand if the company could use new technoglical that could be considered radical instead the general market it is more focus on incremental innovations. Once understand the technoglical strategy direction it is important understand the strategic direction of the company in terms of meaning innovation. Only after understand or define these two direction the tool could be guide to the right design strategy selection. The tool do not give indication about witch strategy could fit better with the company. These strategic decisions are very specific and they concern factors that could change from company to company. By the way the tool offer a guide line to understand the possible strategies that the company have chosen. This is a fundamental step to the design strategy selection.
For each general strategy selected there are different design strategy options. These strategies help to getting value from the technoglical innovation in the best way.
They are also explained guideline examples. Methodological instruction are given only for the development of the new strategy that I have proposed.
I built a linear framework to make more easy the use of the tool, in a first phase it is important understand the general company strategic direction, than there is design strategy selection phase and finally the guide lines for the strategy application.

STRATEGIC DESIGNER AND PSSD DESIGNER ROLE

Cautela and Simoni (2015) have already develop a complete managerial strategic guideline related to the possible language strategy to follow and the consequence in terms of product design selection. However there were not studies about how the PSS Design could be considered relevant in case of technoglical epiphany.
I developed this tools for both strategic designer and PSSD designer. For the strategic Designer it could be an useful tool to select the right strategy to apply on a fast-paced innovation technoglical industry. Furthermore it could be also very useful also from PSSD designer that need to face technoglical innovation an propose disruptive product service systems.



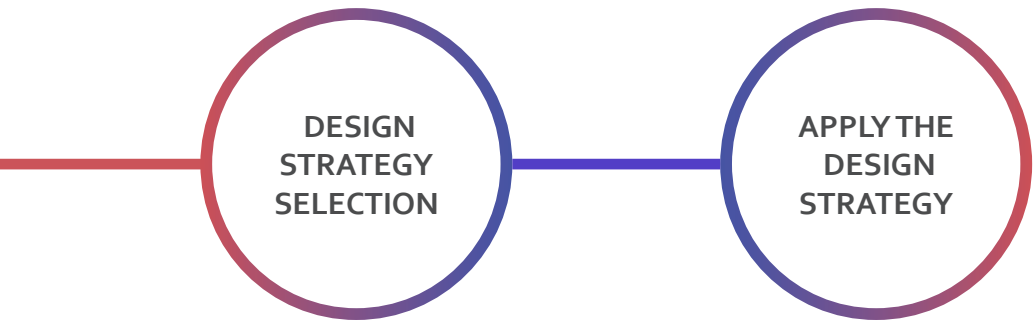
STEP 1

The first step it is characterized by an extensive research about the industry and the selected market. It is fundamental to understand what already exist in the market in terms of meaning and technology. Furthermore it is essential understand how the different innovation changes influence the market, especially for what regards the product design and the introduction of new Service and Systems.

STEP 2

It is important establish if the general market it is living a transitional period or an incremental innovation period. Thanks to these information it is easier understand the technoglical company direction according to its possibilities. If company have know the magnitude of the innovation changes o it could also take a more clear decisionn terms of new meaning proposals.

Fig.76 Model Framework



STEP 3

After mapped the technoglical innovation magnitude and the related strategic its important understand how to lavage the value of this strategy through the right design strategy. For this step are proposed different design strategic options that the practitioner could choose according to company direction and possibilities. They concern both language innovation and PSS innovation.

STEP 4

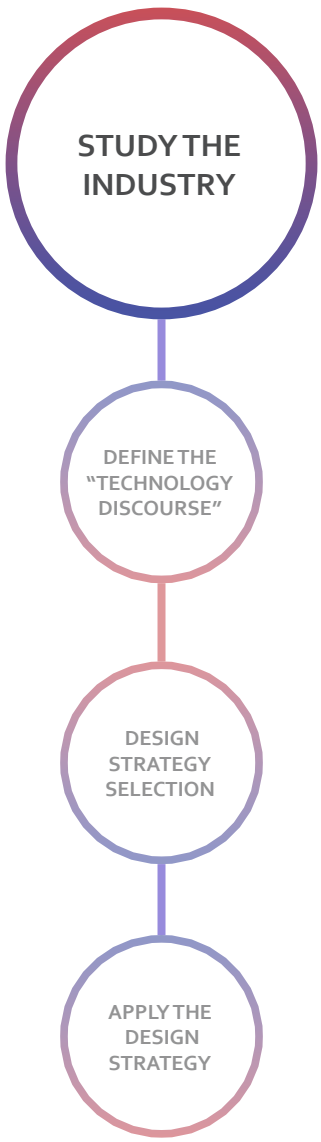
The last step it is related to the application of the design strategy selected. For this step I make a focus on the strategy guide lines for the strategic direction that I have elaborate and propose. For what concern the other strategies it is easy found information about them. looking to the literature research. I propose explanatory examples to facilitate this work. This part could be particularly useful for PSS designers.

6.2 INDUSTRY ANALYSIS AND "TECHNOLOGICAL DISCOURSE" DEFINITION

How to study the Industry

The first step it is characterized by an extensive research about the industry and the selected market. It is fundamental to understand what already exist in the market in terms of meaning and technology.

To help better solve this task I developed a card that can be use as a guide line to research the right information. First of all it important to define in witch Industry sector make the research.
Than the tool suggest to make a general research to understand the radical technoglical change that influence the industry. Than it is important understand how fast is the pace of innovation inside the sector. All the technological innovation have an impact on product design evolution, product design language, product features ant the introduction of a technoglical ecosystem. It is also important understand witch new services and systems the technoglical innovation enable until now.
Inside the same sector industries from different market could be involved . It is important understand witch are these companies and their related market. this could be useful to define new market s. Finally it is important understand if different meaning are proposed in side the markets and how these are communicate to the costumers.
This research have to be complete and accurate an concern the last more relevant innovation periods.
After define all these information it is also fundamental understand the distance from the radical innovation introduction . this could help to understand if the industry it is living a transitional period or a period characterized by incremental innovations.

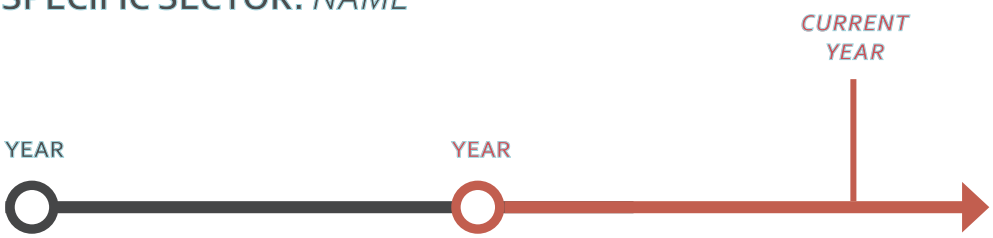


Tool Part 1: “Study the industry”

Fig.77 Tool: Study the Industry

INDUSTRY: *NAME*

SPECIFIC SECTOR: *NAME*



Previus Radical Innovation

New Radical Innovation

Previous Radical Innovation Research and Insights

TECH. INTRODUCTION

TECH. EVOLUTION

INNOVATION PACE

CONSEQUENCE ON:

a) Product Design
b) Product Language
c) Product-Service System
d) Uses

MARKETS INVOLVED

NEW MEANINGS PROPOSED

New Radical Innovation Research and Insights

TECH. INTRODUCTION

TECH. EVOLUTION

INNOVATION PACE

CONSEQUENCE ON:

a) Product Design
b) Product Language
c) Product-Service System
d) Uses

MARKET SEGMENTS INVOLVED

NEW MEANINGS PROPOSED

How to define the "Technological discourse"

I called "Technological Discourse" the generically industrial technological situation. Indeed when a radical shift happened it involve all the Industry. It is important understand if the industry it is generically involved in this situation. After understand that, the Company have to understand of also if its technology research and possibilities fits with the "technoglical discourse" or could change it.

According to this reflection it is possible understand the technoglical direction of the company. I propose three options that could be guide to the next phase:

Option A1: the general Industry it is in Transitional Period and there is a active technoglical movement around it. Also the company capabilities and research are focused on this technoglical shift.

Option A2: the general industry it is living a phase of incremental innovation, the radical innovation could not more considered something new or unexplored. However the company it is developing new technologies or integrating technology already affirmed in other sectors, but that could radically innovate the actual proposal. In this case indeed the industry generic "technoglical discourse" it is incremental the company could be considered involved in a radical innovation period.

Option B: The radical innovation its taken from granted and the Industry it is living a incremental technoglical innovation period. The technoglical capabilities of the industry are in line with the "technological discourse".

After understand the Option that better fit with the company technoglical orientation it is possible move to the next step.

Tool Part 2: “Technological discourse”

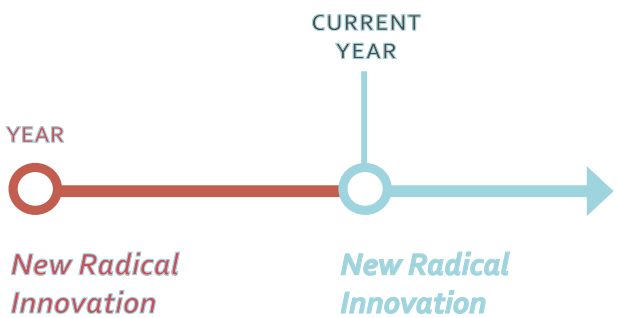
Fig.78 Tool: Technological DIscourse

OPTION A1

TRANSITIONAL PERIOD

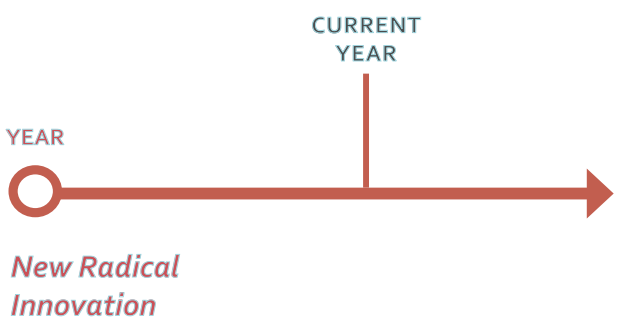
OPTION A2

COMPANY CHANCE TO INTEGRATE A NEW RADICAL TECHNOLOGY



OPTION B

INCREMENTAL INNOVATION PERIOD



6.3 MAP OF DESIGN STRATEGIES: ALTERNATIVES FOR DIFFERENT TECHNOLOGICAL INNOVATION MAGNITUDE

Select the right design strategy according to the company s strategic direction

In the follow pages I will offer the tools to understand the possible direction that a company could choose according to the different "Technology discourse". In the case of Options A1 and A2 there are two main direction that a company can applied: a tech-push innovation or a Design-Driven innovation, proposing in that way a "Technological Epiphany". It is clear that in case of technoglical push innovation there are many strategy that a company can follow without take in consideration the strategic use of Design. In this case I suggest to follow a Robust design approach (Cautela &, Simoni, 2015). In the case of a new meaning proposal inside the industry I suggest two different options: involve only the product language in the process or innovate the language together to the PSS. This allow to better exploit the radical innovation potential. In case of Incremental innovation companies could follow three main strategies: Tech Push Innovation, find a niece new market to address the innovation or try to propose a Technological Epiphany leveraging on a new meaning and exploiting the innovation as the other companies have not yet done. For both the tech push innovation and the new market exploration I suggest two different language strategies: relatively a Robust Design or Topological innovation (Uzumeri, 1995). If also suggest that a Topological Innovation that involve the product system differentiation. Finally I propose to radical innovate the PSS without innovate the language (in case of a design-driven strategy).

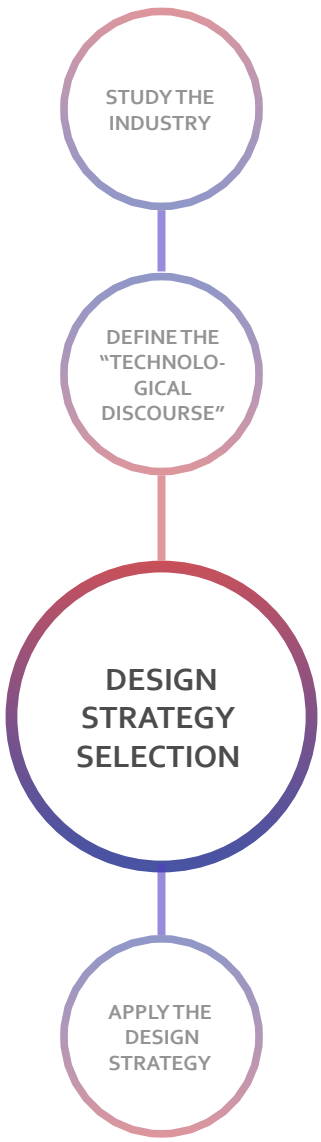


Fig.79 Tool: Strategic Map Option A1/A2

OPTION: A1/ A2

Possible Company Strategic Directions in relation to the Technological Innovation magnitude

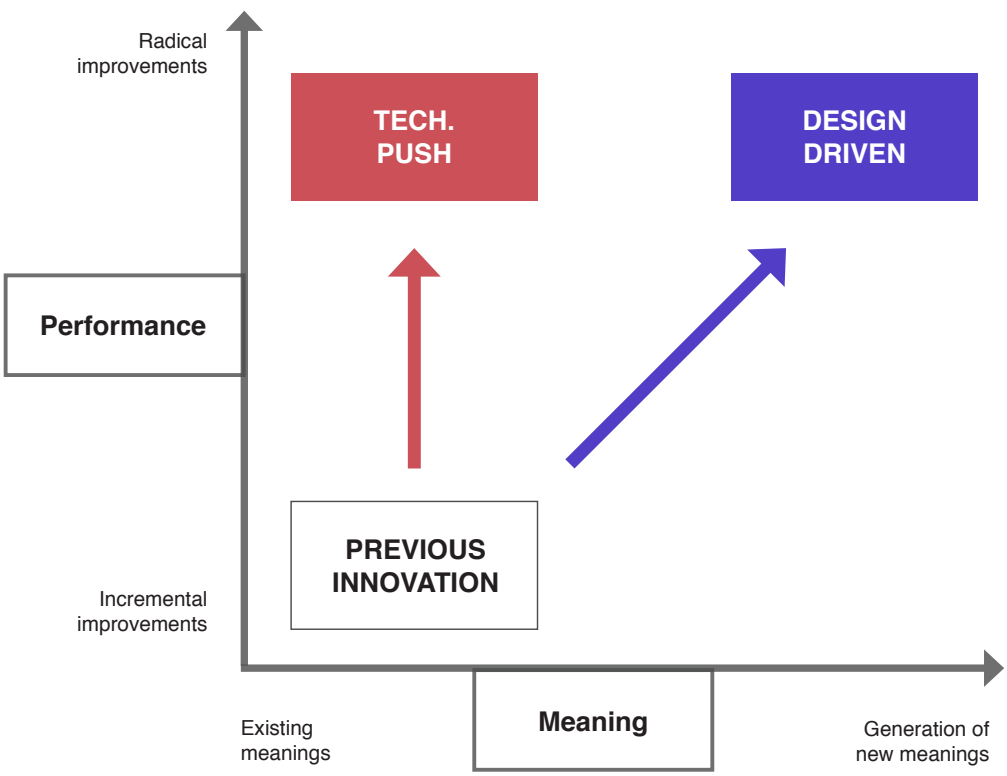
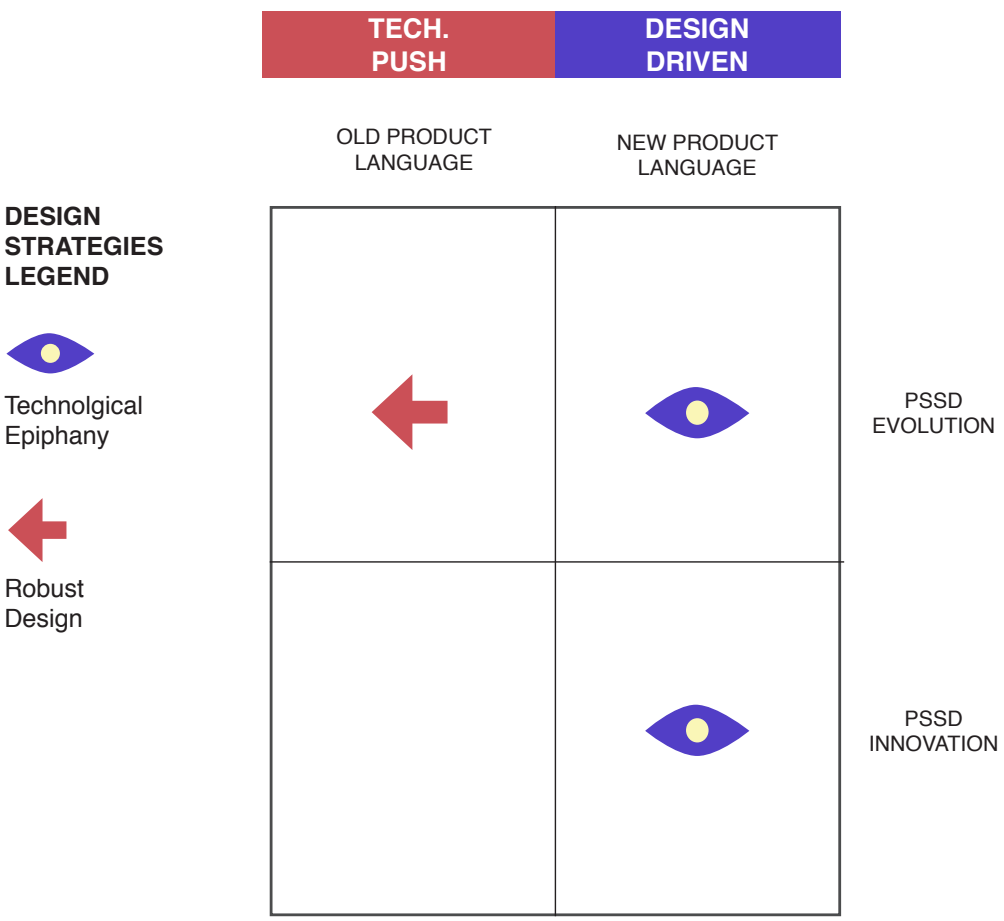


Fig.80 Tool: Strategic Map Option A1/A2 + Examples

OPTION: A1/ A2

Possible Design Strategies in relation to the Company Strategic Direction



EXPLANATORY EXAMPLES

TECH. PUSH | Robust Design | OLD PRODUCT LANGUAGE + PSSD EVOLUTION

Kerosene Bulb Lamp

Electrical Energy introduction

Edison Bulb Lamp

DESIGN DRIVEN | Tech. Epiphany | NEW PRODUCT LANGUAGE + PSSD EVOLUTION

High-end Swiss watch

Quartz movements introduction

Swatch watch

DESIGN DRIVEN | Tech. Epiphany | NEW PRODUCT LANGUAGE + PSSD INNOVATION

Sony Walkaman

Digital Audio Encording introduction

iTunes

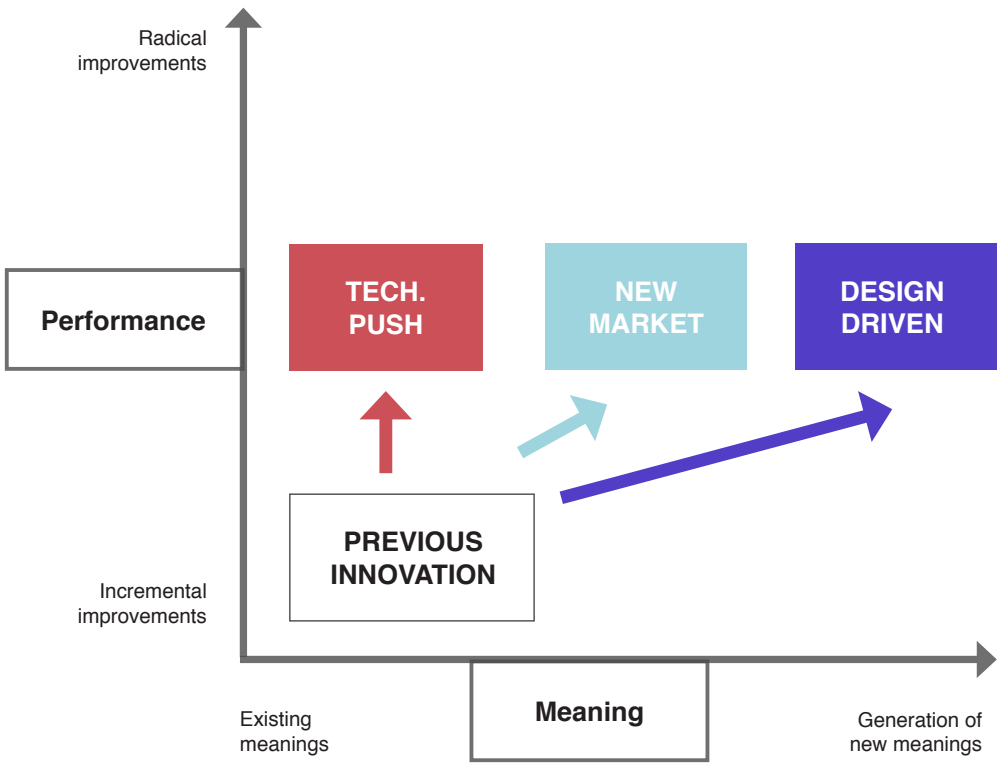
iTunes Store

Apple iPod

Fig.81 Tool: Strategic Map Option B

OPTION: B

Possible Company Strategic Directions in relation to the Technological Innovation magnitude



OPTION: B

Possible Design Strategies in relation to the Company Strategic Direction

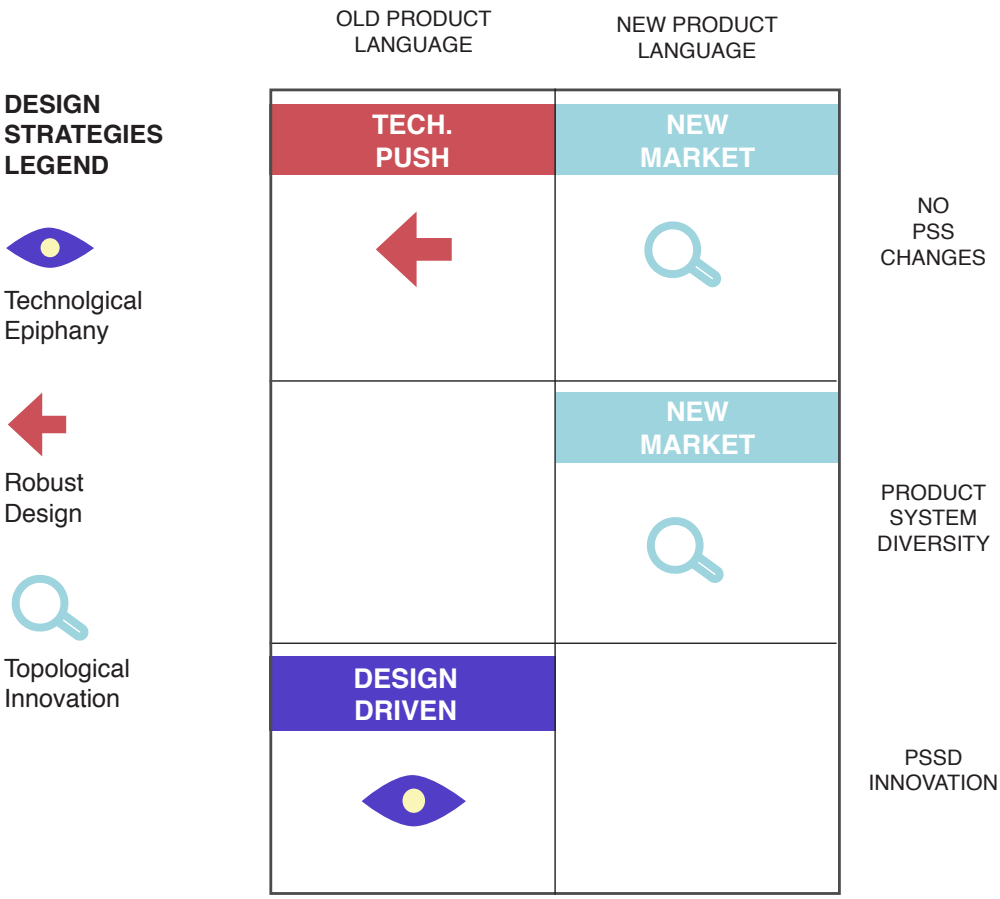
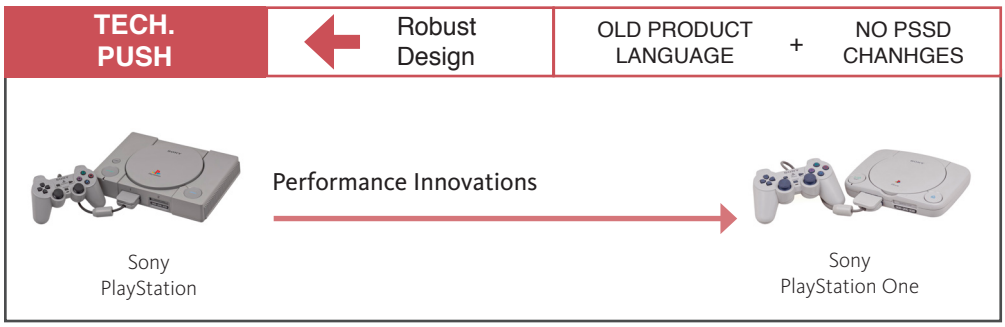
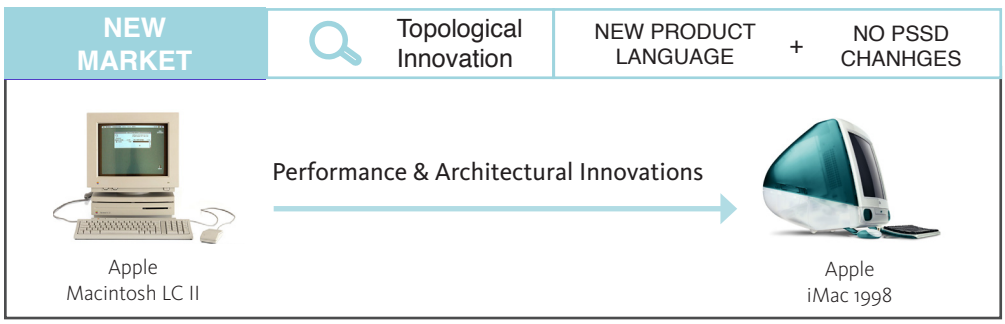


Fig.82 Tool: Strategic Map Option B + Examples

EXPLANATORY EXAMPLES





NEW MARKET	Topological Innovation	OLD PRODUCT LANGUAGE + PRODUCT S. DIVERSITY

Canon
Poweshot 450

Architectural Innovation

Polaroid
Cube

NEW MEANING	Tech. Epiphany	OLD PRODUCT LANGUAGE + PSSD INNOVATION

Canon
Poweshot 450

Architectural Innovation

GoPro
Hero3

6.4 THE PROPOSAL OF TWO NEW STRATEGIES IN CASE OF INCREMENTAL TECHNOLOGICAL INNOVATIONS

APPLY THE DESIGN STRATEGIES

In this last part of the chapter I will explain how to apply the different design strategies that I have proposed.
They concern the incremental technological Innovation "design discourse". More precisely the Topological Innovation regarding also the Product System and the "Technological Epiphany regarding" involving the PSS innovation.

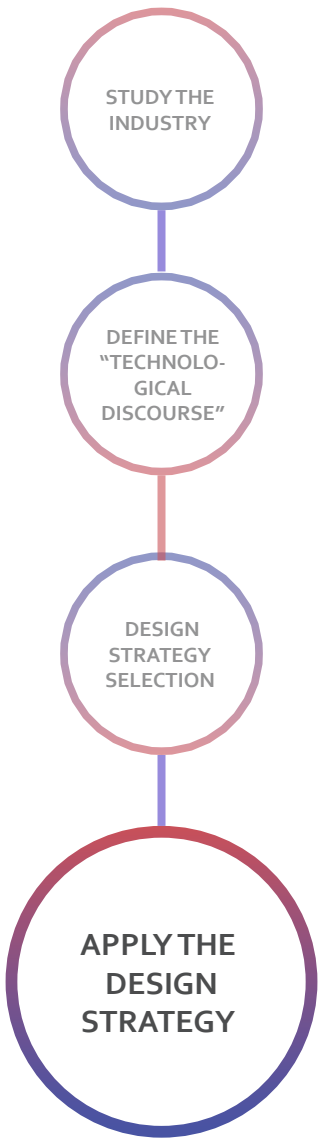
The tools that I proposed are organized in the followed way:

a) **Understanding of the general framework** and the area of exploration

b) **General guide line** about the **methods** to follow to achieve this kind of innovation.

c) **Specific Steps** to obtain the innovation (these steps are very different for each strategy).

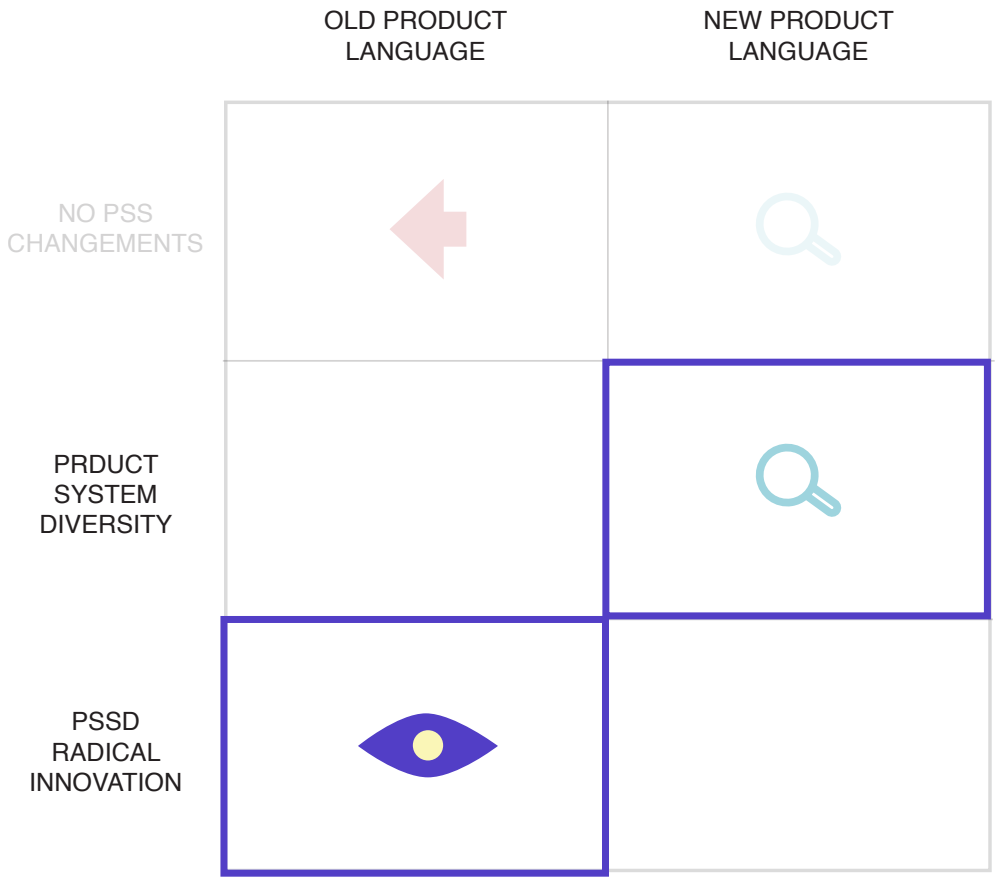
In the next pages I will enter in the details of the specific action that have to be taken in each phase to leverage the value of the technoglical innovation. All the step are explained graphically and with the support of explanatory examples taken from my research.



FOCUS ON

Technological incremental innovation: two new design strategy proposals

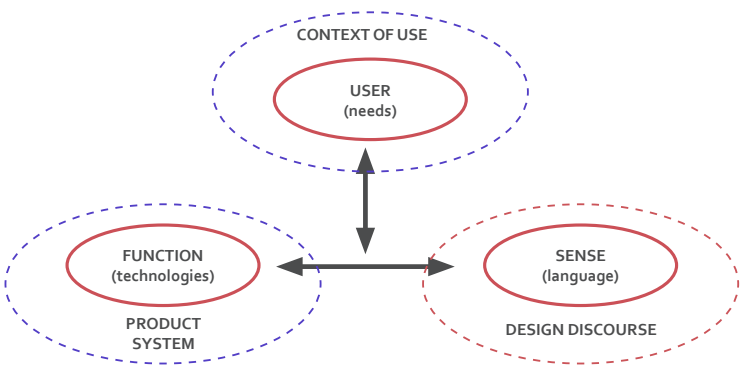
I have mapped four different strategies that could be applied in case of technological incremental innovation. In case of Technology-Push Approach I suggest a Robust design: no language innovation and no modification on the PSS. In the case of addressing a new niece market I suggest two different option. The first one regard a topological language innovation, the second one concern both a tech-noglical language innovation with a differentiation of the product system. Finally I propose to explore the new technology proposed with a focus on the proposal of a new radical product service system. The last two cases will be analysed in the following chapters.



6.5 TOPOLOGICAL INNOVATION: PRODUCT LANGUAGE INNOVATION AND COMPLEMENTARY PRODUCTS DIFFERENTIATION

General Framework and Methodology

Before apply the strategy, in this case the Topological Innovation with PS differentiation, it is important understand the general framework. The users need have to be analysed on a specific context of use, the design discourse have to be selected from a different language discourse compare the one used by the general industry, It is important use a language coherent with the new specific use. The function of the product could be extended with the development of a product system.
I suggest to Define a very specific User to be analyse on a very specific Scenario. The function have to be improved to better solve the specific tasks.
The language have to be found in an other market or sector that involve the sane kind of user (as the iMac case study already cited in the literature section). Finally I suggest to use a User-Centre methodology.
In the next pages it will be proposed a step by step guide to create this kind of topological innovation. Each step will be explained in three different ways, with a text, with a graphical support and a real case study taken from my research.



Tool Part 4: “Topological Innovation” with Product System differentation

Fig.83 Tool: Topological Innovation General Guideline

Technological Innovation magnitude: INCREMENTAL

Company strategic direction: NEW MARKET

NEW PRODUCT LANGUAGE

PRDUCT SYSTEM DIVERSITY

TOPOLOGICAL DESIGN STRATEGY

Define: **SPECIFIC TARGET USER**

Scenario: **SPECIFIC CONTEST OF USE**

Function: **EXPANDING POTENTIAL USE**

Language: **BROCKE SECTORIAL LANGUAGE**

Method: **USER-CENTER DESIGN**

Tool Part 4: “Topological Innovation” with Product System differentation

Fig.83a Tool: Topological Innovation Steps

STEP 1

Define the language variety
inside the old market

STEP 2

Define a radical new language
in comparison to old market

STEP 3

Define a radical new language
in comparison to competitors

STEP 4

Improve the product system to
be more in line with new specific
useand the new functions

STEP 5 (optional)

Create coherence between product
language and the product system

STEP 1

Define the language variety inside the old market making an extensive research considering all the relevant competitors and their product language proposals. Than develop a comparison guide selecting the most relevnat languages.

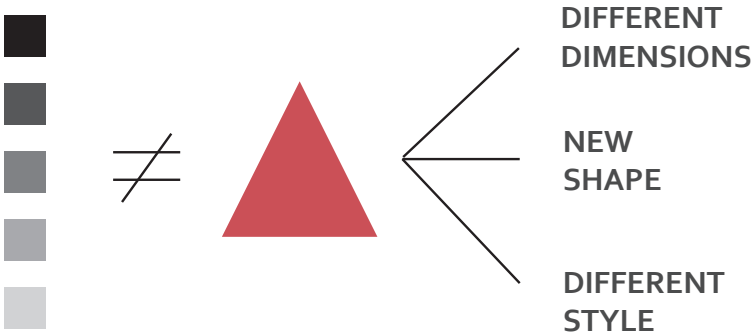
PL = product language

Example: Compact-Camera market

Fig.83b Tool: Topological Innovation Steps

STEP 2

Define a radical new language in comparison to old market. Develop the new language with strong changments on: product dimensions, product overall shape, colours and style.



Example: Compact-Camera vs Polaroid Cube

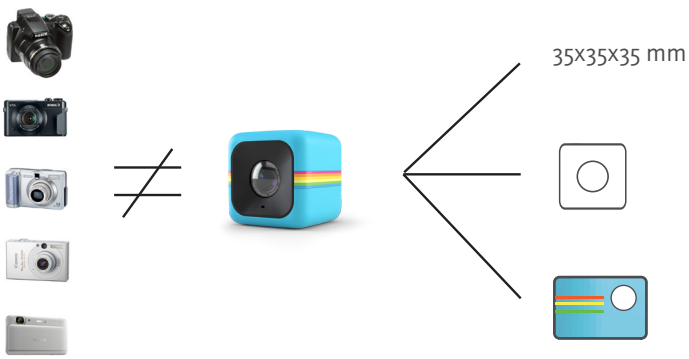
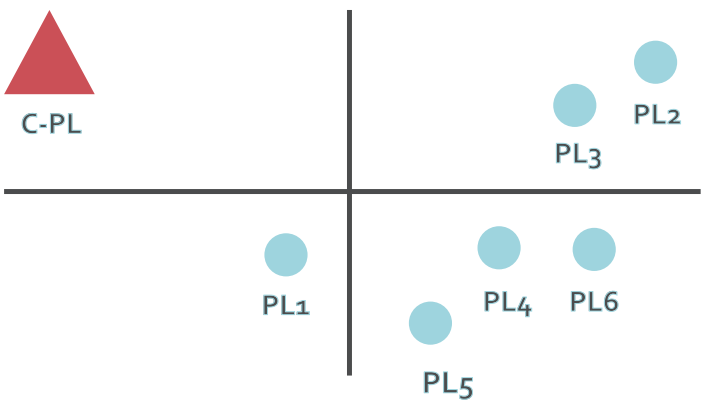


Fig.83c Tool: Topological Innovation Steps

STEP 3

Define a radical new language in comparison to competitors. Define the new targeted market. Define and categorize the competitors' product languages and develop a strong language distance.



PL = product language

C-PL= company product language

Example: Polaroid Cube in Action Cam market

Fig.83d Tool: Topological Innovation Steps

STEP 4

Improve the product system to be more in line with new specific use and the new functions. Understand how user could benefit from the use of the new product system, looking for specific and well contextualized needs.

STEP 5 (optional)

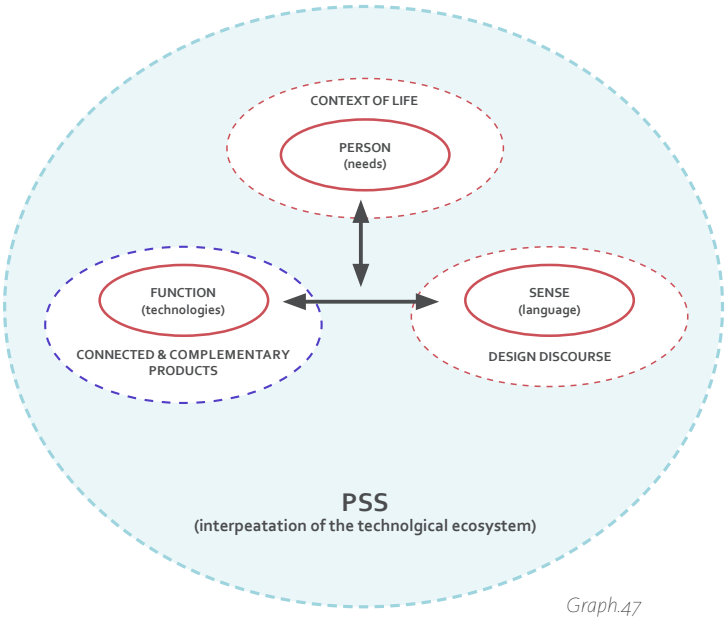
Create coherence between product language and the product system.

Example: Polaroid Cube and Accessories for acreative and fun uses

6.6 "PSS TECHNOLOGICAL EPIPHANY": INTERPRETATION OF THE TECHNOLOGICAL ECOSYSTEM TO PROPOSE NEW MEANINGFUL PRODUCT-SERVICE SYSTEMS

APPLY THE DESIGN STRATEGIES

In this case the "PSS Technology Epiphany", the users need have to be analysed on a wide range prospective, taking in consideration all the "person" context of life , the design discourse have to be selected from a the already existing proposal inside the industry. The function of the product have to be generate taking in consideration possible connected products and complementary products. Finally all the piece of the system have to be coordinate inside a coherent PSS that could be organize starting from the technoglical Ecosystem. I suggest to define a Radical New meaning starting from the reflection about the person context of Life (Verganti, 2015). The experience consequently have to be envision on a total new scenario. The function of the objects have to expanded and innovate through the PSS. For this strategy I suggest to apply a mix between the new meanging generation methods explained by Verganti in its last Book Overcrowded (2015) and the PSSD Approach. .



Graph.47

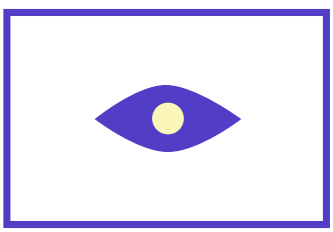
Fig.84 Tool: “PSS Technological Epiphany”General Guideline

Technological Innovation magnitude: INCREMENTAL

Company strategic direction: NEW MEANING

OLD PRODUCT
LANGUAGE

PSS
INNOVATION



TOPOLOGICAL DESIGN STRATEGY

Define: **DISTRUPTIVE NEW MEANING**

Scenario: **ENVISION A NEW EXPEREINCE**

Function: **INNOVATION INSIDE THE PSS**

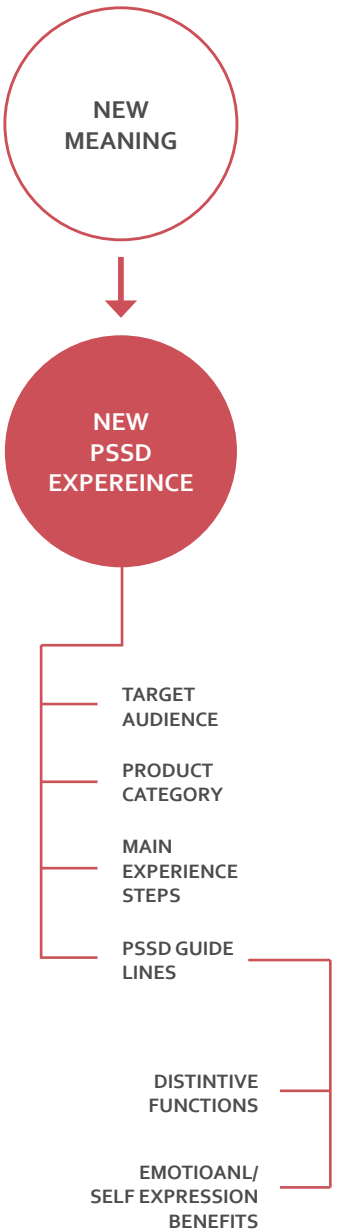
Language: **NOT FOCUS ON PRODUCT**

Method: **DESIGN-DRIVEN INNOVATION**

Guidelines definition

Before to start to define in details the new strategy it is important to understand the best moment in witch this toll can be used.
I suggest to start from an already define new meaning. When this new meaning direction it is define it is important translate it in a new experience in witch It is important to think in terms of PSS.

To facilitate this task I suggested to fix some cardinal point that will be useful for the next steps.
First of all it is important understand and define the person that we are addressing, considering it in a wide life context.
Than it is important define in witch category we want to place the new product, it could be also a total new category in comparison to the competitors.
Than It is crucial define the most important and relevant steps around the experience. keeping in mind that these steps are strictly linked with the new meaning proposed.
The experience will be embedded using a PSS than it is important also define before to start the disinvite functions and emotional/ and self expression benefit that will allow to generate the meaning through the new PSS. I did not propose tool for this phase because its a well affirmed literature about them.
After define these cardinal point the PSS radical proposal will be generated following 3 main steps that will be proposed and explained on the following pages. Each step will be explained in three different ways, with a text, with a graphical support and a real case study taken from my research.
These steps will allow to open a new problem setting phase in witch the designer could be explore new radical path to propose a new radical PSS to exploit the technology hidden potential wit hout the need to radical technolgy innovations.

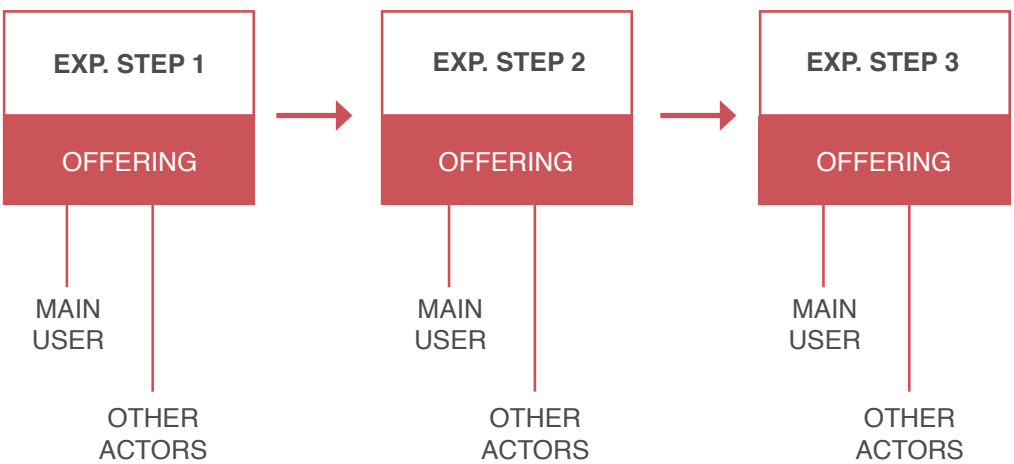


Graph.48 General Guide lines for the "PSS Tech. Epiphany"

Fig.85b Tool: "PSS Technological Epiphany"General Guideline

STEP 1

Generate a first general offering map according to the main experience steps. Define who il be the main user and the other relevant actors. Keep in mind the main benefits and distinctive functions that we need to offer to propose the new meaning. It will be possible define as many steps as needed. In this moment the offering is just a first proposal.



GoPro Example

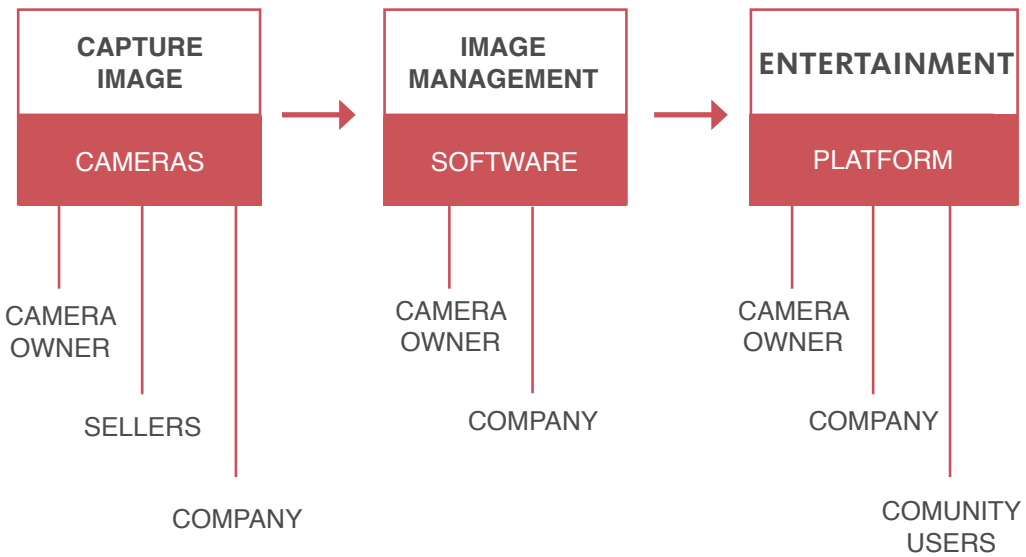
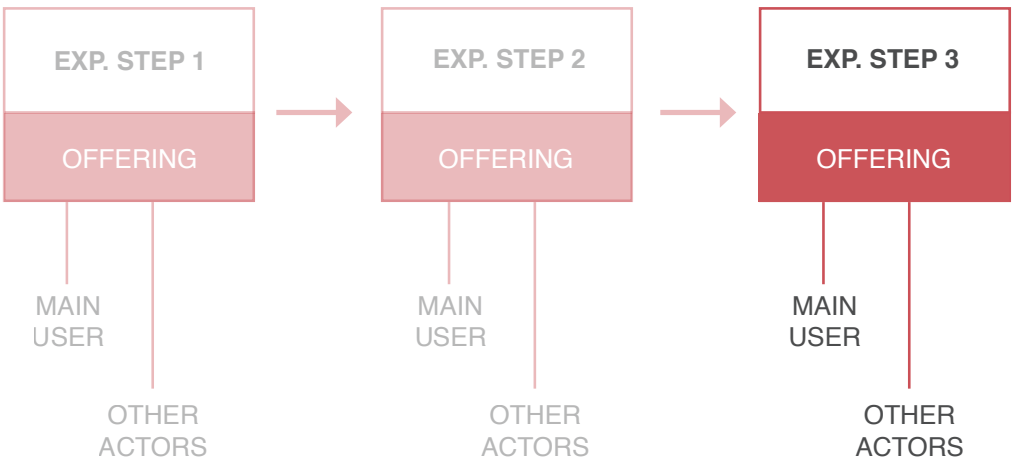


Fig.85c Tool: "PSS Technological Epiphany"General Guideline

STEP 2

Select a expereince step. According to its offering look inside the technological ecosystem to expand and innovate the PSS functionalities and benefits. Take in consideration possible complementary products, digital platforms, possible connected products and also the possibility to change the main product functions. After having explored new possible functions related to the ecosystem select the most interesting ones. Each selected object or platform could already have its proper meaning. Understand how integrate it with your PSS meaning, and if it needed re- define it. Repeat this proced for each expereince step. This step it is usefull to open again the Problem Setting phase.



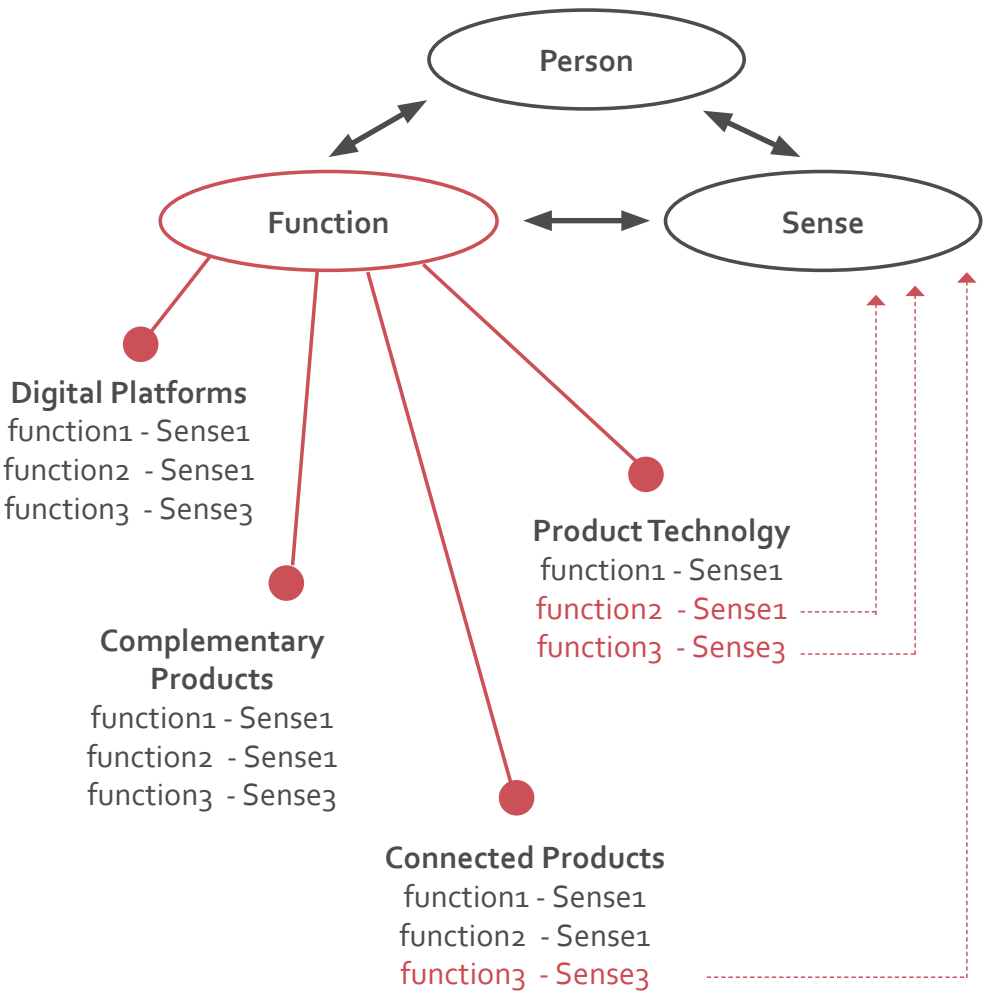
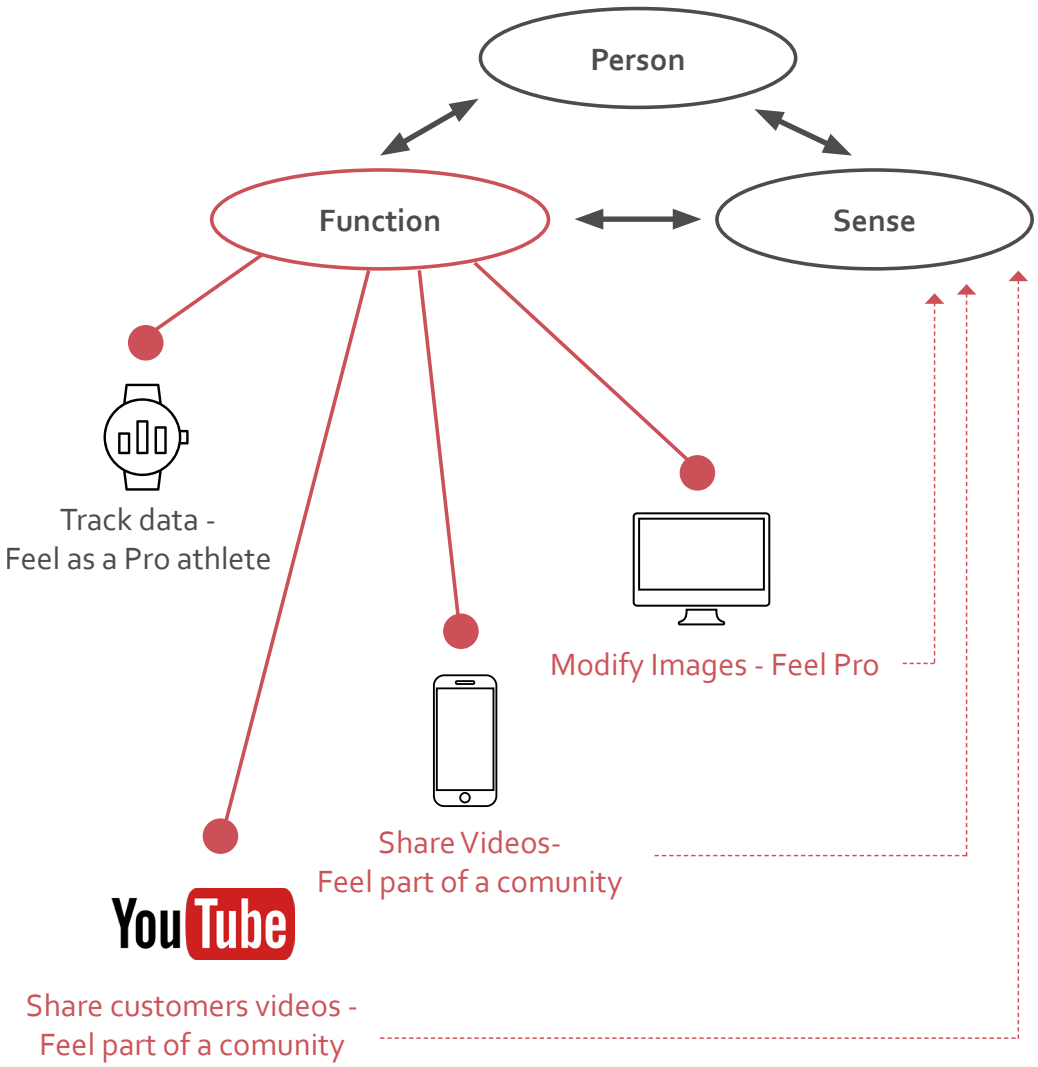

Person
Function
Sense
Digital Platforms
function1 - Sense1
function2 - Sense1
function3 - Sense3
Complementary Products
function1 - Sense1
function2 - Sense1
function3 - Sense3
Connected Products
function1 - Sense1
function2 - Sense1
function3 - Sense3
Product Technolgy
function1 - Sense1
function2 - Sense1
function3 - Sense3

Fig.85c Tool: "PSS Technological Epiphany"General Guideline

GoPro Example (partial)



STEP 3

After selected the new product and function insert them inside the offering map. This allow to better adapt them to the PSS meaning and to define the connection and coherence between the technological ecosystem and the service offering. This process has to be done for each experience step. After built the offering map it is suggested to create a system-map to obtain a general overview of the PSS (and improve it).

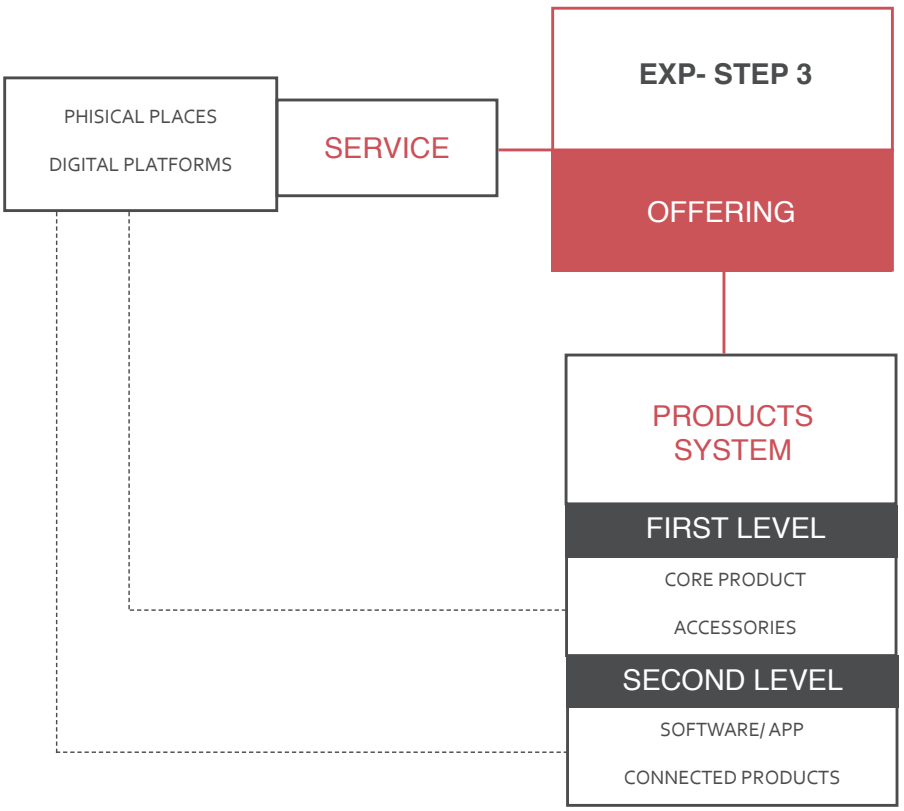
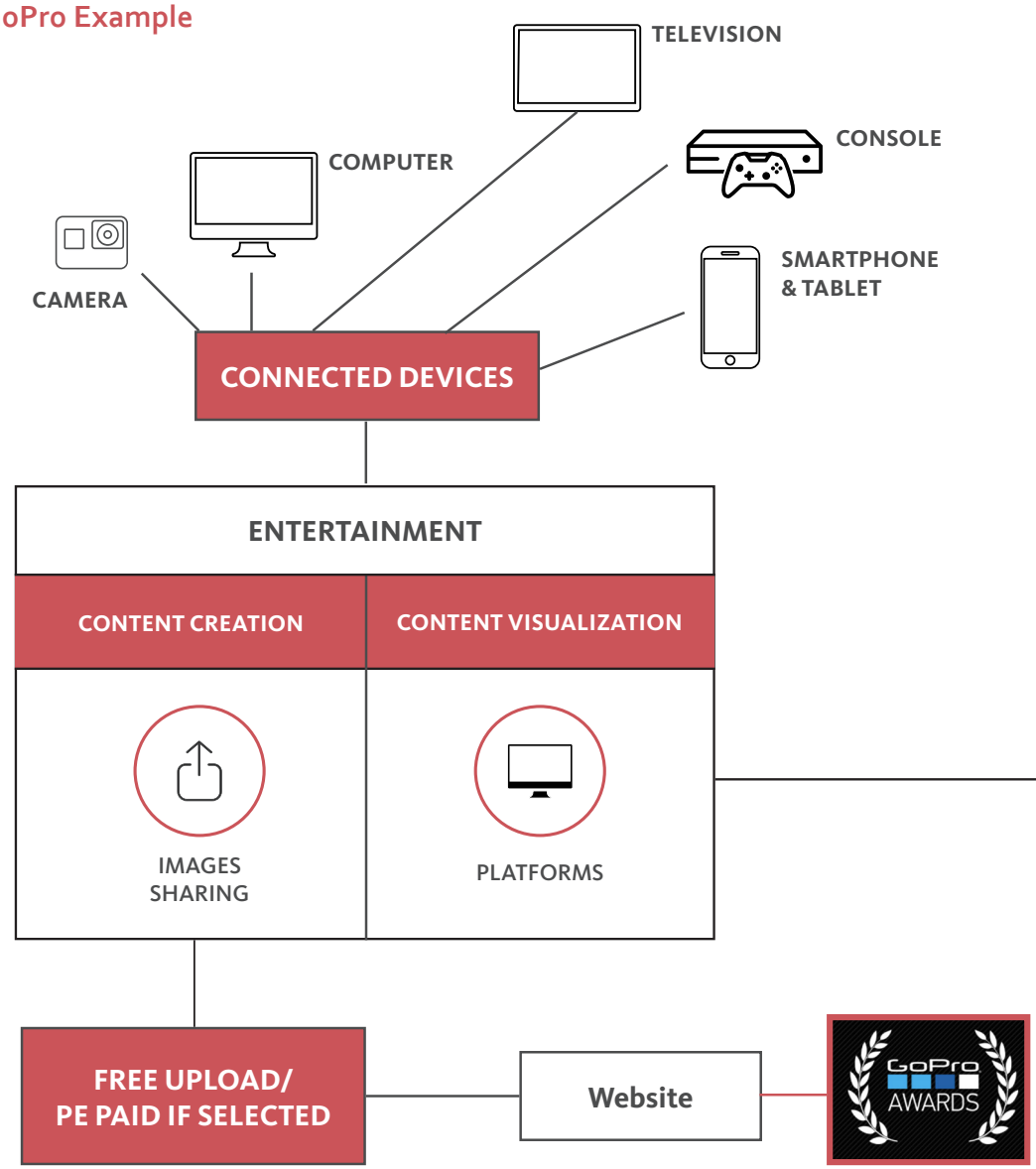
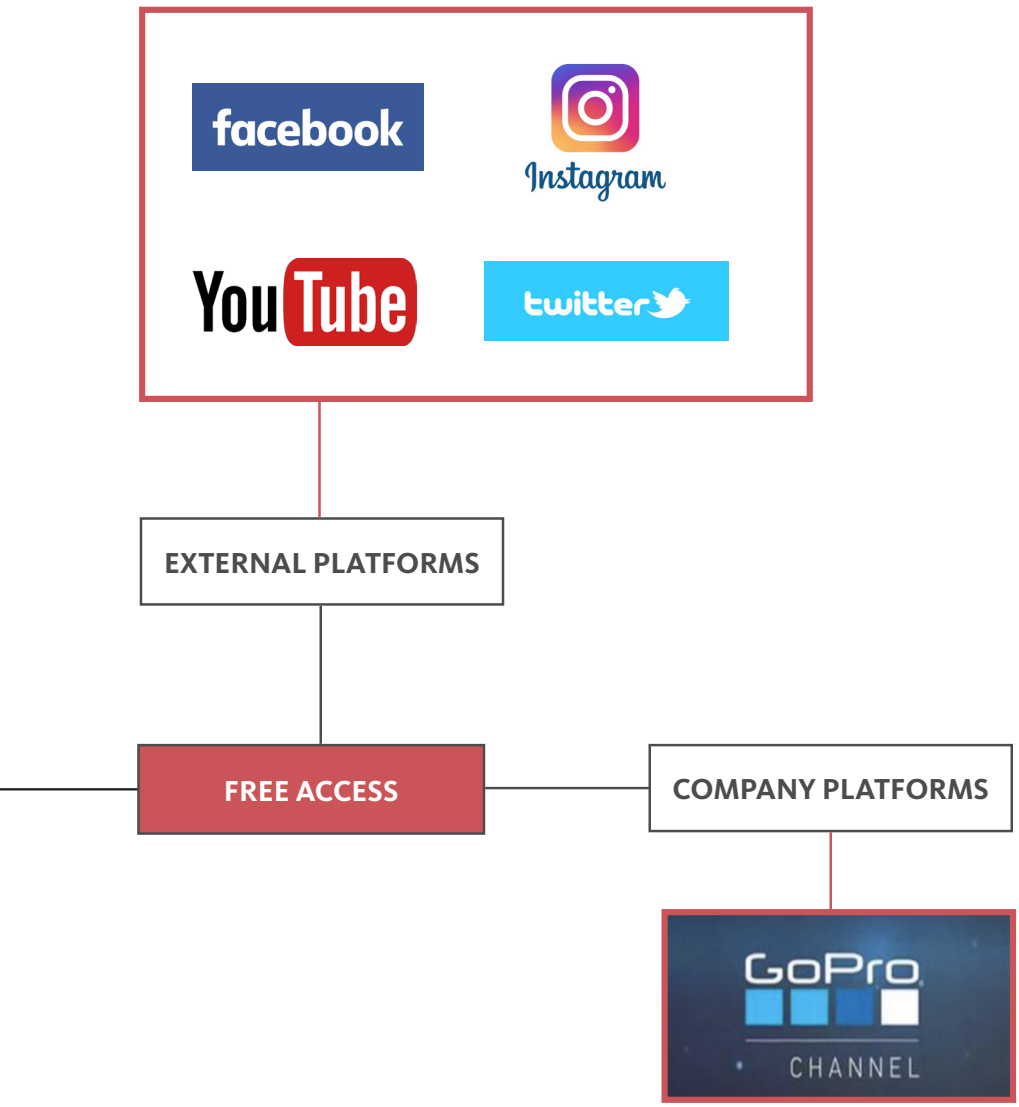


Fig.85d Tool: "PSS Technological Epiphany"General Guideline

GoPro Example




facebook
Instagram
YouTube
twitter
EXTERNAL PLATFORMS
FREE ACCESS
COMPANY PLATFORMS
GoPro
CHANNEL

7 CONCLUSIONS: CONSIDERATIONS AND NEXT STEPS

Final considerations and next steps

This model it was developed starting from the idea to give a guideline to help Strategic Designer, PSS Designer and maybe also manager to face technoglical innovation in fast-paced technology innovation sector.

The reason behind this choice are many, but like to point out the most relevant.
If we think at the sector traditionally known as design-intensive industries as fashion and furniture it is to easy understand that all these sectors are strongly linked with every day life. I strongly believe that design have a central role in the evolution of socio-cultural models and since technology is more and more present in our everyday routine, design is going to have a central role in translate the "inner soul" of theologies in meaningful products that are going to really improve and change people life. The design-driven innovation proposals do not just add more layers to what already exist, as in a frenetic run where it seems that companies are blind in following technology innovation, but they questioning what technology will be for people, making technology a means of meaning and not a manning itself.
Probably if we considered the design-intensive industries in which the design role it is already affirmed the consequence of the transformation of technology innovation as design inputs could be considered logic. On the other side, if we considered the fast-paced technology sectors, in which we have a proved an clear contamination from the design methodology, this transition need to be better explored. Tthe same design discipline need to be adjusted and redefined to better fit with this sectors.
If from one side the design discipline is evolving and becoming more and more systemic, it seems that the application and the consideration of design inside the fast-paced technology have been study until now with a product centric prospective.
This tool can have a double role. From one side could help designer to face technology complexity in a world in witch technology research running faster and faster. From the other side could be useful for manager that want to exploit the meaning of new technologies using the PSS Designers ability to both propose new meaning and organise them inside a complex PSS where product, service and people interact as in new radical way.

This tool could be improved trying to understand how other design approach could be used to propose new meaning during technology innovation. It could be done both applying and improving the tool itself or analysing case study related to new innovation that regard smart-connected product and new meaning solution related to other product-oriented PSS, use-oriented-PSS or Result-oriented PSS.
It could also be interesting study witch other designer roles could be involve in this process of new meaning generation.
Could be also intersting understand how design-driven innovation and PSSD approach view could fit from a methodological poiny of view. Untill now the PSSD it is manly a user-center approach.

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