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School of science
AMIS Master's program

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How to accelerate and increase user involvement in camping product development?

Master thesis.
Passy (FRANCE), 10/08/2019.
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Abstract

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Title of the thesis: How to accelerate and increase user involvement in camping product development?	
Number of pages: 70	Date: 10/08/2019
Major or Minor: Innovation & entrepreneurship	
Supervisors: Elina Kähkönen & Robin Ras	
Thesis advisor: Guillaume Palladini	

This study has been performed in the conception site of Decathlon Quechua Nature Hiking in France (Haute-Savoie, 74). It proposes the evaluation of two methods for accelerating and increasing user involvement in the product development process without reducing the quality. Co-creation, which consists in ideating products in collaboration with users, is performed in order to accelerate the ideation step. Fast prototyping experiments coupled with efficient feedback collection are proposed in order to make conception choices faster. These two methods are applied to the development of a product named inflatable shelves and evaluated in this context.

A presentation of Decathlon traditional product development with timelines associated with each step is proposed in the beginning of this study. A comparison between the traditional approach and the development of the inflatable shelves gives an idea of the efficiency of the two methods used for accelerating the product development. Quality of the methods used is evaluated according to two definitions. Individual quality of each experiment is assessed by comparing the initial objectives and results obtained. Global quality of the product is determined by the user centeredness of ideation and conception choices.
This study shows that co-creation and user involvement increase strongly the coherence of conception choices. User centeredness is at the heart of co-creation. Collaboration with users and potential customers is not the right solution for accelerating the ideation step but makes it more concrete.
Fast prototyping experiments coupled with feedback collection from targeted populations have been performed. These experiments were based on continuous improvement of very rough prototypes, for function validations step by step. It reduced the conception time by half. Thanks to fast prototyping, conception step of inflatable shelves took four months instead of height for a traditional development.

A new methodology for accelerating the product development process is proposed as a perspective of this study. It has been elaborated by redefining co-creation and fast prototyping real added values. Co-creation will be used for elaborating a coherent product brief and generate ideas for technical solutions. Fast prototyping experiments will be performed in order to collect feedback from experts and customers and increase the user centeredness of the product development.

Keywords: Collaborative development Prototyping	Publishing language: English

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Introduction

Decathlon company

Decathlon is a French group developing and selling sport articles all over the world. More than 88 000 people work for this group. The Decathlon group realized a turnover close to 17 billion euros in 2018. It exists more than 1513 stores in the world

The conception site of Passy in France opened in 2014 and is located at the foot of the Mont Blanc. Thanks to this strategic location, engineers, designers, testers and communicators can work together in the same offices. By opening this site, the company is seeking for closer collaboration with the user community.

The present study has been realized in the “Quechua Nature Hiking” team. This team develops bags, shoes and clothes for hiking on flat pathways and products for camping. The main insight for Nature Hiking engineers is to develop extremely comfortable and easy to use products. The target user scenario is “I set up my camp somewhere, I go hiking every-day and I come back every evening to this camp.”

Context of this study

Quechua team is willing to come closer to customers and accelerate the whole product development process. The present study is focused on an experimental product development of an innovative product for Decathlon. Company is willing to increase user involvement and find methods for accelerating product development. Methods for reaching this target will be processed in this project, for the first time. By analyzing this case study from ideation to final prototype, research target is to evaluate the efficiency of specific processes for ideation and prototyping. A comparison between these methods and traditional Decathlon product development process will help for success evaluation of time consumption and coherence of conception choices.

The first part of this study will be focused on a bibliographic review about the product development and several approaches that have been proposed in the literature in order to implement and accelerate a development. This review will also present the typical way

to develop a product in Decathlon and camping product companies in general. In the second part, this report will present experiments realized in order to accelerate the development process. These experiments will mainly be focused on the optimization of the ideation and prototyping steps. As the implementation is made by taking some risks, the last part will be dedicated to a success evaluation of the methods used to implement the development of the innovative product, and their impact on the quality of the final product. The possible ways to accelerate the process will be underlined by the combination of the bibliographic review and the evaluation of the experiments realized on the inflatable shelves. A new process based on successes and failures of these methods will be proposed as a perspective for next product developments.

I. Bibliography

1. Product development project

a. Definition & specificities of the product development project

The product development is defined as the period during which the conception team translates the user needs in a technical solution. It is a key process which will determine the success of the product on the market. Morgan & Liker (2006) define the product project as the most difficult process of a company. It is based on a serie of successive and interdependent activities involving knowledge, competences and feedback collection. The most difficult part is to gather, organize and converge all the information from the members of the project team, to the concepts, shapes, prototypes, drawings, materials and every tool used to transform a need in a commercializable product.

All the decisions taken during the product development can impact the rest of the associated services. As the choices of the technology and the materials will determine the production services in terms of raw material supplies or quality, every decision taken during this development must be balanced by thinking about the whole lifecycle of the product. The product development is based on a serie of internal resources (technologies, knowledge, know-how, network, etc…) and focused on the customer needs in order to ensure the compromise between customer satisfaction and industrial feasibility (Brown & Eisenhardt 1995).

Several papers propose different approaches to define the product project in the literature. One universal model has been proposed by Ulrich & Eppinger (2015). This model summarizes all the steps, from the customer needs to the production, in six distinct phases.

0/ Project potential

During this step which precedes the development project of a new product, all the strategic incomes are considered by evaluating the technological development and the

potential market. At the end of this “zero” phase, the project team must have all the information about the target market, the commercial objectives and the main potential constraints. Gruber & al. (2008) present the example of simulation software. Teams developing advanced software make studies about their potential customers before to elaborate it. They make surveys in companies and universities in order to predict by who, why and how it will be used.

1/ Concept development

All the customer needs have been identified and the conception team proposes several alternatives. These potential solutions (products) are generated and evaluated in order to choose one or two that will be developed further. In the case of Gruber & al. (2008), several software functions or interfaces are proposed.

2/ Global conception

The architecture and components of the product are fixed during this step. A geometry and global view are expected. Each separated subsystem of the product is defined by a functional specification. A first version of the operation diagram of the final assembly process is also expected. In the example of the¡ software product, a global overview of how it operates and what are the incomes and outcomes is performed (Gruber & al. 2008).

3/ Detailed conception

All the materials, component tolerances and suppliers are identified. The conception team knows how to industrialize every piece of the final product. Two main incomes are evaluated during this step: The production costs and the quality of a prototype.

4/ Tests and improvements

At this stage, several prototypes are evaluated. Two different prototype categories can be distinguished.

The *Alpha* prototypes are used to verify if the product fits with the customer expectations and operates correctly. These prototypes are realized in order to have the same properties as the final industrialized product but are not necessarily built in accordance with the right industrial process.

The *Beta* prototypes are more advanced. Most of the time they are built with the right industrial process. Their main purpose is to be used by customers, in real use environment. The target is to collect information about performances and reliability in order to improve it for the final version. At this stage, Gruber & al. (2008) explains that software is offered to a batch of customers in order to know their opinion and the way they use each function.

5/ Production

The final product is built by applying the right production process. A first batch is evaluated in order to identify potential defects. After several validations, the product production is launched at a big scale.

These steps summarize the main workloads for the product project team, this vision is shared by DuPlessis & Lequepeys (2019). With the new technologies and the expansion of big retail companies, more and more approaches try to improve and accelerate the product project (Li & Qiu 2007). Before to present these new methodologies, specificities of the product development will be analyzed. These specificities include some clues in their definitions, to implement or accelerate the process.

The main activity for the project team is to take decisions by balancing it with the risks. Fernandez (2019) describes the notion of uncertainty for decision taking in the product project. The conception team tries to optimize some parameters in order to reduce the uncertainty of the environment for decision taking. Any uncertainty can lead to a wrong or incomplete information for taking the right decision. This lack of information associated with working hazards are the main reason for retards in the project. The parameters on which the team tries to reduce the uncertainty are mostly the technology, the industrial methods, the group member competencies and the market (Fernandez 2019). Dewett (2007) presents the link between decision taking and risks, by taking the example of the French company Mavic. In 1993, this company specialized in bicycle equipment decided to take a risk. Until 1993, cycle wheels were sold in three separated parts. The rubber, metal and inner part were sold separately. Mavic took the risk to assemble these three parts directly in factories, in order to sell only one product. This rupture innovation multiplicated the turnover by 10 in only one year (Dewett 2007).

The operations realized during the product development are much longer than the industrial operations. Innovation is one of the main reasons why the development can take a long time. Bluntzer & al. (2009) show that 80% of the tasks realized by the conception team are routine actions. These routine actions regroup any classical communication in the team or instantaneous data treatment. Innovation and creation can involve several tasks for which the team must collect information, gather knowledge, test and implement. It does not necessarily mean thinking outside the box. Even reusing a mastered technology or design for a new product involves a long documentation process before to test it for a different application (Bluntzer & al. 2009).

All these specificities of the product development process contribute to its complexity. It is at the strategic heart of a company, in order to reach the best customer satisfaction. For reaching this goal efficiently, the conception team must develop a coherent methodology based on organization and communication, in order to take the right decisions. Schneider & Hall (2019) shown that half product developments fail. Mehta (2019) explains that failure is a key step for innovation. Companies trying to innovate always faced failures. What matters is how they transformed failure into success. Sloane (2019) presents the example of Post-it. Engineers wanted to develop a very strong glue at the beginning. However, what they created was a mixture with very weak sticky properties. They had the idea to transform this failure into post-its, easy to stick and unstick. Many reasons can explain failures. Haley (2014) makes a link between failure and lack of user centeredness.

b. Product development of camping goods

Camping equipment is a growing market (Lucintel 2014). It regroups several outdoor product categories (tents, sleeping bags, inflatable mattresses, camping furniture, outdoor hygiene products, outdoor cooking stuff etc…). More than 60 brands are developing camping goods.

Main functions developed on camping goods are usually:

- Easy assembly (for tents, camp beds, furniture)
- Comfort
- Durability

These functions are very abstract and user dependent. Developing camping goods requires wide knowledge about user perception. In order to conceive camping equipment adapted to a wide range of customers, tests and continuous improvements are the keys for product success (Schmid & Schweitzer 1996). Outdoor product brands are more and more involving users in developments, in order to reach these targets. Methods for involving users in camping product development will be developed in a next section of this study.

2. Approaches for improving the product development project

a. Informatics & communication tools

Li & Qiu (2007) realized the state-of-the-art of technologies improving product development. Several methodologies have been developed in the literature for implementing and accelerating the product development. The following numerical tools are especially cited because they can represent eventual solutions for optimizing the development process, in accordance with the main drawbacks mentioned in the previous part.

- **Authoring tools:** they regroup all the computer assisted conception tools such as simulation or decision taking. They now represent a very efficient way to create and simulate technical solutions to test it virtually. For example, 3D simulation is used very early in the development of plastic pieces, in order to test it several times before to open a mold for industry which is long and very expansive.

- **Data management tools:** Gathering and sharing data is a key factor for an efficient communication in a product project. Nowadays, clouds and other online platforms are widely used in companies. They make the data storage and sharing easier by allowing different actors to work on the same document at the same time.

- **Activity piloting tools:** These tools can be used in order to coordinate the tasks and activities of the different team members. By fixing the expected dates for each deliverable and project actor, the project team can reorganize the whole project in small entities and make the fluctuations easier. However, these tools necessitate a huge experience in product development in order to build a very precise retro-planning at the very beginning of the project.

Piller & al. (2012) presents some case-studies about user connections in product development thanks to social media. Social media (like Facebook or any other communication platform) are a key for involving customers and users in a collaborative

product development. As these platforms enable a quasi-instantaneous communication, it makes feedback collection or discussion very fast. Instantaneity of customer reactions can be coupled with open sharing platforms. Piller & al. (2012) mentions the possibility to share written documents, tables, drawings on social media. Most used open sharing platforms is Google drive (Decathlon). Google documents, sheets, drawings, slides etc… can be shared very quickly and modified by users. These easy to read and easy to modify documents make communication with users faster.

b. Lean approach

This part is based on a study realized by El Gamoussi (2016). She proposed a methodology based on Lean approach, for implementing the product development process. Usually, the lean approach is used in order to implement the production process. It was born in the 1950' in the company Toyota. Its main purpose is to increase yield by reducing the wastes. This methodology based on a continuous improvement of the process can be split in three steps:

1/ Added value definition: The first step is to identify the activities giving a value to the product. This added value is translated by the functionalities desired by the customer. All the other activities that are not adding value are considered as wastage. For example, in industry El Gamoussi (2016) mainly underlines unnecessary manutentions.

2/ Value stream identification: This step consists in realizing an overview of the production process and identifying the steps that are giving an added value to the product. The goal is to identify the steps to eliminate such as over stocks, useless manutention etc…In the case of a product development rather than industrialization, steps to eliminate will mainly concern long tasks, during which engineers are losing time.

3/ Value optimization: After removing the non-added-value operations, the production chain is designed in order to follow an ideal rhythm and a continuous added value stream which is not interrupted by wastage. The lean thinking consists in repeating this added value evaluation in order to reach a more and more perfect process. For product

development El Gamoussi (2016) translates this step as a step during which conception team recycles good method, for example quick communication tools or efficient data sharing.

The analogy between lean approach for industry and lean product development is sometimes difficult to translate. The added value definition in the lean product development consists in identifying all the activities allowing to develop some functionalities for the product, which will satisfy the customer needs. All the conception actions which do not fit with the expectations of the customer is a wastage. However, it is important to remember that a conception choice failing to satisfy a customer need is considered as a good lesson to do not reproduce. For a better understanding of the potential application of the lean method to the product project, it is easier to identify the potential wastage instead of the potential added value (Ward & al. 2014).

c. User-centered approach & problem solving

Understand user's needs is a key factor for companies to succeed on the modern market. According to Schneider & Hall (2011) the potential success of a future product is evaluated by its ability to satisfy customer needs. Several methods have been developed since the 2000' in order to involve customers in the product project. For example, Hyysalo (2014) expressed the benefits of a user-centered design, involving customers at the very early stages of the product development. Any information obtained from the customers, about any aspect of the project such as design, colors, convenience, feelings etc… are a gain of cost and time.

Dupont (2009) describes his notion of "market ready" as follows: A market is ready to host a product if customers feel the need of this new product. In order to be successful, the very first step of a product development is to investigate a user problem. There is no business opportunity where there is no customer need or pain. Thinking user centric can represent a huge wastage according to the lean approach. Identifying customer pains is a long observation task. This task is now easier thanks to numerical tools such as social networks and communication platforms. Customers are directly in contact with the

conception teams and can share feedback and ask questions. However, before to set a clear problem and associated requirements in a brief, a long investigation is still required (Dupont 2009).

The efficient ways to identify user needs have been investigated by Kallonen (2016). For the ideation step, during which the conception tries to ideate the problems and elaborate a brief in accordance with customer needs, three methods are mainly used:

- Direct interviews, consisting in asking direct questions to customers about their feelings, opinions, preferences etc…. For an efficient interview, it is important to prepare clear questions with examples or comparisons.
- User observation, consisting in observing users in real conditions, manipulating products without any indication. This method is relevant when it comes to see if customers understand the product and its functions.
- Anonymous surveys are a way to remove a psychological barrier making customers lying to direct questions. People have difficulties to give their real opinion when they are asked directly. Most of the time, anonymous surveys give more objective feedback.

These methods regroup questions, observations and anonymous feedback collection. By analyzing the data obtained with these methods, the team must be able to write the brief. Main limitations of this data collection are the important lead time and the possible misunderstandings and wrong interpretations. Asking users is more and more common for brief elaborations. Antorini & al. (2012) present the example of Lego. The Danish toys group gives the opportunity to fans, to create their own Lego collection. More than 36% of the global Lego collection comes from fans imagination.

d. Quechua & Camping goods development

Arnulf (2019) reports the results of a study realized in the Kalenji conception team. Kalenji is the Decathlon’s running & jogging brand. He explains that on the 76 collaborators of Kalenji team, 55 can run a marathon in less than 3 hours. This data means that Kalenji team is mostly composed of experts in running. Their way to practice running and their expectations concerning products are completely different than their target customers.

Thanks to this article, Kalenji team realized the importance of involving customers during conception phases. Nature Hiking team proposed to investigate methods for increasing user involvement in product development, in order to share it with all other Decathlon brands.

All Decathlon conception teams feel the same concern. Quechua team is mainly composed of campers and expert hikers. There is also a crucial need to find ways to involve beginners and users while conceiving camping goods and hiking stuff. Thouvenin (2004) proposed a method for involving users in the design of camping goods in a small company. It consisted in distributing camping products such as tents or tables, to campers. By distributing different models, more or less advanced, he asked campers to make comparisons and succeeded to classify the most appreciated functions on each camping good. Limitations of this study were the population choice and timescale.

- Selected campers were only experts. Experts usually have strong opinions because of their level of practice. For example, expert campers do not like functions making the assembly of tents easier. They already know how to assemble a tent, even models with complex structures. However, easy assembly is what beginners want.
- Distributed models were very advanced. For example, one table has been prototyped more than ten times, with ten different functions or dimensions. Making advanced prototypes takes a lot of time and efforts. This study has been three years long.

Ruggiero (2019) presents how the American outdoor brand REI involves its customers in product development. In 2005, REI created an “insight community” composed of 5000 members. This user community can share opinions, comments and potential improvements on products. This community is also invited to “cooperative design sessions”. The target of these sessions is to prototype with users, test products and improve existing prototypes in accordance with their feedback. These methods aim at conceiving more user-centered products.
Another outdoor brand NEMO is involving users in a testing program (Nemo). This program proposes to customer to test and give feedback about new or existing products.

Customers can have product with special discounts and conception team collects feedback for free.

The following study is focused on the example of the inflatable shelves commercialized by the brand Quechua in February 2020. Next section will present all the experiments realized in this context, in order to accelerate the product project and involve customers in the development step, to realize a commercializable prototype in a record time.

e. Efficient prototyping

A prototype is a communication tool for engineers. It is a very efficient way to communicate an idea in order to test it, confront it to reality, evaluate and improve Huet (2019). This article presents limitations and opportunities for prototyping efficiently. He develops his vision about fast prototyping. One key for the success of a project is the prototyping fastness, in order to test it and improve very quickly.

Jacobsson (2013) presents two variables to consider for each prototype iteration:

- How many lessons will we learn from this prototype?
- How much money will we invest in this prototype?

The goal is to maximize the first variable and reduce the second as much as possible. The target of prototyping is the feedback. An efficient prototype does not contain a lot of functions, colors and designs, but only some essential features on which it is easy to ask a clear question and collect feedback about (Jacobsson 2013). For example, in the case of software products, it is not necessary to have a code and a functional prototype to ask feedback to users. Gruber & al. (2008) presents an example in which software conception team is testing interfaces only thanks to paper and drawings.

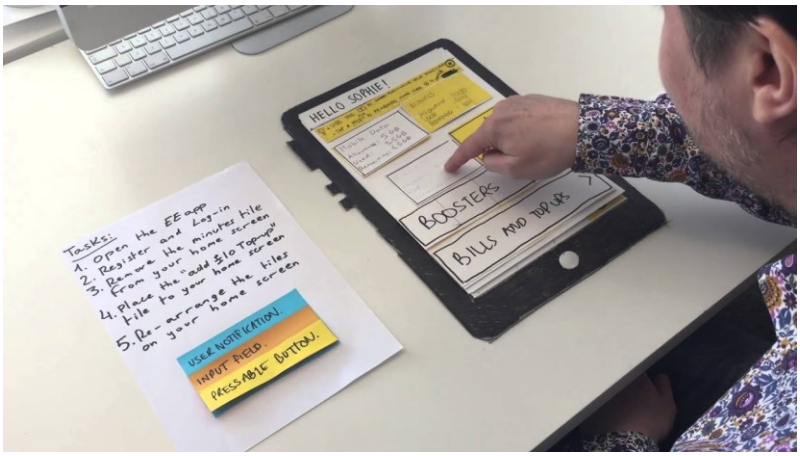


Fig.1: Software prototype testing with paper and drawings.

Huet (2019) presents three main requirements for an efficient prototype:

- The prototype must not be complete
- The prototype must be easy to modify
- The next prototype will make the current one obsolete

“The best way to have a good idea is to have a lot of ideas” (Linus Pauling). This sentence summarizes how prototyping works. By producing several iterations, the conception team narrows the possibilities. At the beginning of the project, the gap between two prototypes is huge. And after several iterations, variations are less and less important. The project gets closer to perfection thanks to feedback collected on each prototype (Huet 2019).

Anant (2019) explains that fast prototyping has no limit. It can be an infinite cycle during which the conception team realizes experiments, collect feedback and improve prototypes until it reaches 100% of customer expectations. Every feedback collection is an opportunity for reviewing and refining the prototype, and then repeat.

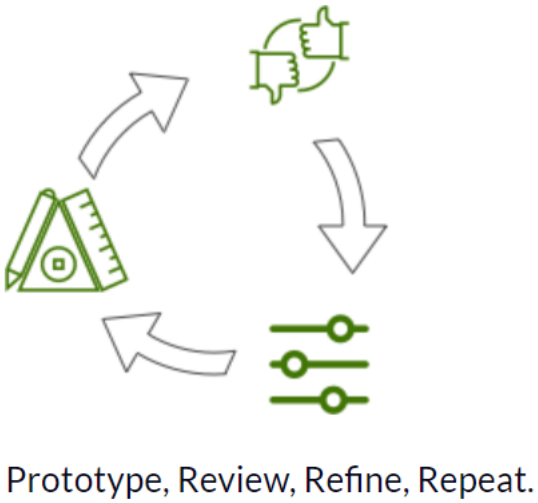


Fig.2: Fast prototyping experiment cycle (Anant, 2018)

The next part of this study will concern the product project in Decathlon especially. By detailing all the important steps for developing a product in this big company, conception team will make a list of the potential wastages and will try to improve it in a serie of experiments. The goal of the following steps is also to evaluate the success of these experiments (Anant 2019).

3. Potential improvements on camping good development

a. Current product development project

It is possible to make a comparison between Decathlon product development and theoretical frame from Ulrich & Eppinger (2015).

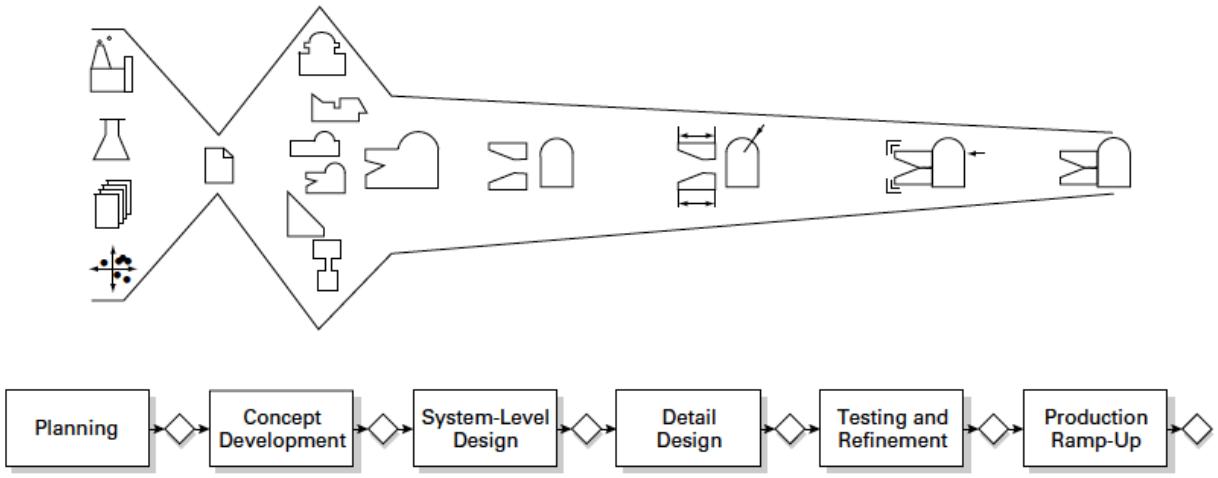


Fig.3: Ulrich & Eppinger product development framework

The product lifecycle in Decathlon can be split in two well defined steps, the conception and the commercialization. The conception step follows the Ulrich & Eppinger frame. At the beginning of the conception step, the product manager expresses the user needs and requirements to the product engineer **(Planning)**. The role of the product engineer is to find and select the technical solutions for fulfilling all the needs and requirements. He is also guaranteeing the feasibility of the project in accordance with the criteria of cost, quality and time **(Concept development)**. The designer is responsible for the aesthetics of the product, and its visual coherence in the wide range of products proposed by the passion brand **(Design & testing)**. Designer and engineer are working together from Concept to Production ramp-up. After conception, other collaborators are taking care of the commercialization. For the commercialization step, the merchandiser is fixing the layout of the products in the Decathlon stores. All the supply chain, from the factory to the stores, is managed by a retail supplier (Decathlon).

Decathlon products are all based on the same development framework. The product project is standardized for all the passion brands. It is split into different time-markers for which specific deliverable are expected. The figure 4 (Product project in Decathlon - time-markers) presents the typical path to follow during the product development. Each time marker is followed by the mention OK only if all the deliverables are provided (Decathlon).

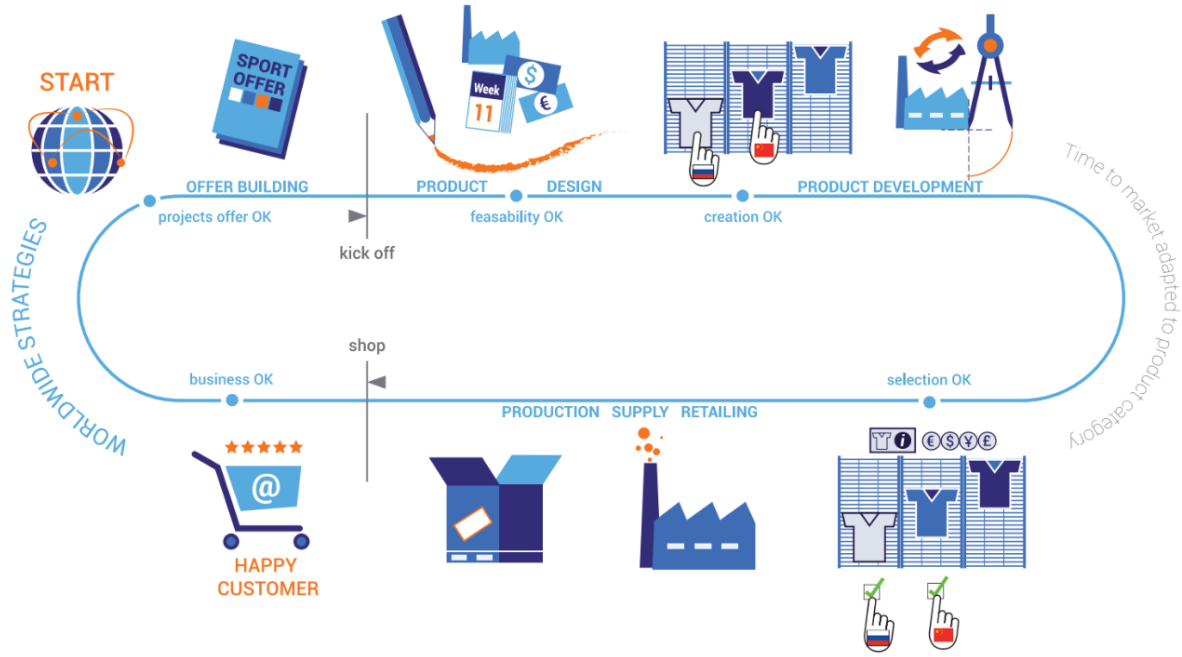


Fig.4: Product project in Decathlon - time-markers

The typical product development lasts between 18 and 24 months, from the offer strategy building to the commercialization of the final product. The conception team must write a product brief for the kickoff. This brief summarizes all the details concerning the offer and the purpose of the future product. At this moment, the conception team must not think about the technical solution but only about the customer needs (Decathlon).

The following example of a sorting trash brief has been realized by a product manager from Quechua team. In this simplified example (figure 5), product manager gives all the functions to prioritize on the future camping sorting trash. It also shows concurrent products and their associated prices. This information will be used by engineers and designers, in order to create a product that can fit with market expectations.

Fig.5: Example of a Quechua brief poster for camping sorting trash

Before to reach the selection OK, the product must pass the feasibility OK and the creation OK. These steps determine if the product is commercializable or not because the key information to collect in order to pass these time-markers concern the costs, the materials and the ability of the supplier to provide the right product in the right quantities. Usually, it takes between 12 and 18 months to elaborate a brief and reach the selection with all the deliverable associated with (Decathlon).

From the kickoff and the product brief, the role of the conception team is to realize a commercializable prototype for the selection OK. The selection meeting is one of the most important time-markers. During this meeting, representatives from different countries evaluate the commercializable prototypes and decide on the future offer for the following year (Decathlon).

The conception team in Decathlon is mainly involved the design and development. These steps usually last 12 months and regroup several deliverables for each time-marker. By applying the lean approach to the product development, it is possible to distinguish

different steps with a very bad ratio between added-value activities and wasted time. The figure 6 (Deliverable expected from the conception team) presents all the documents and study that must be provided by the engineers and designers.

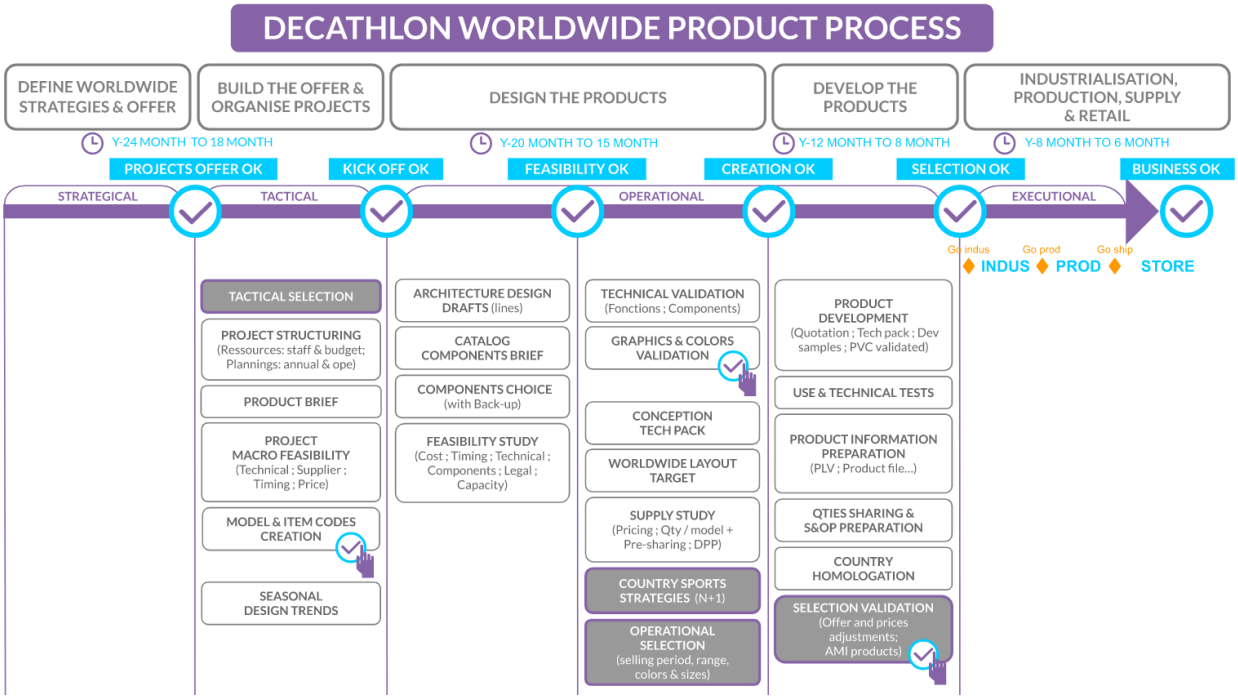


Fig.6: Deliverable expected from the conception team

By taking a look at the deliverable expected for the kick off, feasibility OK, creation Ok and selection OK, the purpose of the next part of this section is to determine the key steps to optimize in order to reduce the 18 to12 month lead time of the product development process.

b. Improvements in product development process

The product brief elaboration expected for the kickoff of the project can last 4 to 6 months. The first aim of this study is to accelerate the ideation process by involving users in the brief elaboration (Decathlon).

Fig.4a: Product project in Decathlon - time-markers (from start to kick off)

The architecture design and component selection define the main features, characteristics and technical viability of the final product. The conception team usually spends 8 months before to fix a final design and technology. The second aim of this study is to accelerate this step by a smaller, new project organization and fast prototyping with user involvement.

Fig.4b: Product project in Decathlon - time-markers (from kick off to conception)

There is no precise timescale for selecting the different features, functions, dimensions of a product, but most of the time this 8-month period is organized as following:

- 4 months for selecting global dimensions and shape.
- 2 months for technology validations
- 2 months for colors and additional feature selections

(Decathlon).

II. Experimental method

Research questions (RQ)

RQ1 – How to involve users for accelerating the ideation step?

RQ2 – How to accelerate product development process by prototyping and involving users: evaluation of the gain of time compared with coherence of conception choices?

0. Roles & organization

The project group in charge of this project is composed of one trainee engineer (author) and one trainee designer. As co-creation has been used for ideation, there was no product manager involved at the beginning of the project. This was the main particularity of the team dedicated to this development.

Team designer realized all the artworks and deliverables linked to visual aspects of the product. He was also a great support during prototyping experiments. As product engineer, author's role during the conception step was to provide technical solutions. It includes a lot of tasks such as material selection, architecture and functions development.

Author also decided to play a role of coordinator. As mentioned previously, organization is one specificity of the product development. As a coordinator, author fixed the numerical tools and communication methods at the very beginning of the project.

- Data sharing via Google Drive
- Online communication via Hangout and Gmail
- Agenda coordination via Google Agenda
- Weekly meeting every Monday from 16 to 18.

These tools are very common, but it is important to fix it before to start, in order to keep a certain coherence all along the project.

1. Co-creation for ideation

a. Ideation made by users

The Oui Are Makers challenge is a co-creation challenge that have been launched at the beginning of November 2018. The name of this challenge was “Reinvent camping”. For reinventing camping, three subjects were proposed: hygiene, waste management or space optimization on the camp. These three subjects have been chosen in accordance with the field of expertise of the Nature Hiking team. Any person could participate. The expected deliverables were:

- A very rough prototype
- A small brief summarizing the main strengths of the product
- The problem solved by the prototype

In a usual product development, customer observation reports from product managers are the only expected deliverables. This report summarizes problem observations or potential needs observed in camping.

A jury composed of experimented members of Quechua conception team evaluated all these projects and selected the 10 best ideas. The 10 challengers at the origin of these ideas received a 1000€ cash price and the opportunity to prototype their ideas in Quechua offices. Most of the challengers are students, campers, sellers for Decathlon or tinkers.

2. Prototyping experiments

a. Feedback collection

During this study, feedback have been collected from three different populations. Both have a different field of expertise and are connected to the product by different ways. The

following section explains how and why both categories are important for a rich feedback collection.

- **Expert community:** This community has a big experience about camping products and technical solutions. They are colleagues from other conception teams of Quechua (40 persons), or Decathlon Quechua monitors (23 persons). They have notions on the concurrent market and costs of existing technologies. Their advice directly concerns the conception choices, for example design and materials. They are also a good reference in terms of cost positioning.

- **Maker community:** After Oui Are Makers challenge, most of the maker community wanted to stay involved in the future product developments. A Facebook community “Co-creation Nature Hiking by Decathlon” has been created in order to keep in touch with them. These makers are completely detached from the realities of the product development. Their opinion matters because they are not distorted by some concrete notions from the inner company, like costs or feasibility. They are tinkers, volunteers and propose a lot of ideas.

- **Nature Hiking personae:** This community has been identified as the most coherent customers. Communication teams from Decathlon analyze typical populations of customers who mostly buy camp products. Collecting feedback from the most coherent customers is important for the evolution of the prototypes. Communication teams identified three personaes who buy Quechua camp products:
    - Young couple between 25 and 30 years old
    - Couple from 40 to 50 years old with 2 children
    - Old (retired) couple from 60 to 70 years old

  All the three personae have different budget and different expectations from the product. It is important to involve both of them in order to collect complete and various feedback.

b. User observation

To observe user behavior, two usage tests have been organized. Prototypes with different features have been proposed during these tests. The three Nature Hiking personae categories (see previous chapter) have been recruited to participate to these tests.

They used the prototypes during one week in real conditions in camping (May and June 2019). The conception team observed their ability to understand and use the main functions of the prototypes, but also their limitations and troubles. The goal of this prototype testing was to be as close as possible to the real conditions of a lambda customer using the product in everyday life.

c. Other feedback collection methods

- **Direct information sharing with expert communities:** By using information sharing tools and interactive agendas, such as Google documents and agendas, of the team members, and members from other conception teams, the team succeeded to organize several group-work sessions. Every user of these online agendas can see when other users are available in order to organize meetings easily. These group-work sessions are well adapted for collecting feedback from the expert community who share the same vision of the product development and have a quasi-equivalent technical background to discuss and understand very precise concepts.

  A meeting session with all the Quechua monitors has been organized in the south of France in April 2019. The 23 Quechua monitors are sellers and ambassadors for Decathlon Nature Hiking brands. They are volunteers and specialists in camping. Their opinion mostly concerns the validation of the different functions associated with the product. A direct discussion and feedback collection have also been realized with the monitors. The team shares the same target with the expert community (use the adapted technology for proposing the desired functions). This

makes direct questions/discussions possible in order to validate or improve team ideas.

- **Oriented feedback collection with online communities:** Direct discussion with the Facebook maker community is impossible because of the big number of members (90 persons). The real added value of this community is its capacity to think outside the box and propose a huge quantity of ideas. They do not have notions on the techniques and feasibility. It is necessary to orientate the questions and set clearly the entities on which team want them to give feedback.

  Conception team used modelization tools for this step (Blender 3D modelization software), in order to create visual supports on which the community can project ideas. It is a good way to orientate a problematic or question.
  For example, to collect ideas and feedback on the potential accessories of the product, conception team realized a 3D model of the inflatable shelves' architecture. Team asked the community to imagine the accessories to add on this empty architecture and collected new suggestions and feedback they would not have imagined.

d. Prototyping methods

Prototyping experiments aimed at specifying several features and functions of the inflatable shelves:

i. Architecture and dimensions of the final product
ii. Plate sizes and positions
iii. Compactness, Inflation and deflation fastness & Transportability
iv. Accessories

i.Target of the first prototyping experiment was to select architecture and dimensions of the final product, in order to fit with all Decathlon tents and living rooms. Several cardboard structures have been realized in order to represent the potential dimensions and shape of the final product. These structures have been put in all the tents

and living rooms. Best fitting structure was chosen. This best structure must be as high as possible (for a maximum storage area) and must not touch the walls of tents and living rooms, because it would reduce waterproof properties of the structures.

ii. Positions and sizes of the hard plates inside the furniture depend on the target storage capacity. The brief of this product set that the inflatable shelves must be able to store all the clothes and stuff of the three different Nature Hiking personae. The experiment realized for fixing the dimensions and positions of the plates consisted in spreading different quantities of clothes and stuff on the ground, in order to measure the occupied volume. These quantities of clothes have been determined in order to correspond to the three typical personae. Three different camping bags have been created according to information from Decathlon communication team.

iii. Compactness, inflation and deflation fastness and transportability are inflatable technology added values. They are identified as a real need for customers because tents and other furniture are difficult to transport, not compact and sometimes very long and difficult to install. For observing the added value of this technology, a rough inflatable prototype has been realized by the team. It is made of an inflatable thermo polyurethane (TPU) tube surrounded by polyester (PES). Polyester stitched properly constraints the TPU tube in order to make a structure with the same shape as the final product. This structure has been tested by users in order to observe the inflatable technology added value.

iv. Accessories of the final product have been proposed by the Facebook maker community, stitched on the existing structure and selected in accordance with customer expectations.

The following table summarizes all the prototyping experiments and methods for reaching the expected outcomes.

Prototype	Experimented property	Method used	Feedback collection	Outcome
i	Architecture & dimensions	Cardboard structures	Own tests	An architecture fitting with all tents & living rooms
ii	Plate sizes & positions	Typical customer bags	Own tests	Plate sizes and positions fitting with the 3 bag contents
iii	Compactness, inflation and deflation fastness & transportability	Rough inflatable structure	Customer observation	Validation of the inflatable technology added value
iv	Accessories	Multiple accessory testing on existing structure	Customer observation	Selection of several accessories

Table 1: Prototyping experiments and methods for reaching expected outcomes

3. Indicators for performance evaluation

a. Cost, quality, time consumption, human

Decathlon evaluates the quality of a project according to four criteria (cost, quality, time consumption and human). These criteria are assessed all along the project and for each deliverable. They are interdependent and conception teams must take care about both.

- **Quality:** The term quality can take many significations. From a very large point of view, the quality of the project is defined by the four criteria (cost, quality, time consumption and human). But at a lower scale, the quality of the product is its ability to fill 100% of the brief and usage requirements. The best qualitative product has a technical and design solution in front of all the customer expectations. For example, if the capacity of a bag is reduced from 30L to 20L, because of the costs or time consumption, its quality has been reduced. Quality of the product is evaluated by the conception team, who set the minimum level of acceptable quality, and try to do better.

- **Time consumption:** Inflatable shelves project is mainly focused on these criteria. The time consumption in Decathlon is fixed, as it depends on the different time-markers presented in the first section of this study. In order to respect the time consumption, the conception team must realize different deliverables for given periods. The purpose of this study is to evaluate the success of co-creation, fast prototyping and efficient feedback collection, to accelerate the product development project.

Cost evaluation and health and safety considerations are not included in present study.

b. Inflatable shelves project performance indicators

Time consumption is measured in terms of full workload weeks. One engineer is working 35h/week in France. The very short development time has a very big influence on the cost, quality and time consumption balance. These criteria can be considered as performance indicators in this project. However, the team will consider the time consumption OK if the methods used for accelerating the process can effectively reduce the initial retard.

For each method presented in the previous part, it is possible to evaluate the success by comparing the results to the initial target. The performance of methods is mainly shown by their ability to reduce global retard **(time consumption)**. However, each prototyping experiment has a purpose. The success of these experiments is shown by their ability to fill this purpose. A successful experiment is due to a coherent associated feedback collection, in order to make a choice or decide on improvements **(quality)**. This coherence is translated by the number of feedbacks received from different communities.

The main limitation of this development is the lack of consideration about costs. This criterion mainly depends from suppliers. After each prototype experiment, engineers must realize a parallel study with suppliers in order to evaluate the costs of the future product. This study has been realized at the very end of the prototyping step. The criteria cost will not be part of the success evaluation but must be taken into account as the biggest risk of this project development.

The following tables summarize the different methods used and performance indicators associated with them.

Table a: Co-creation		**Co-creation for ideation**
Perf. indicator 1	Quality	• Number of challengers • Percentage of challengers dealing with the same topic
Perf. indicator 2	Time consumption	Comparison to traditional product development brief elaboration (4 months)

Table b: Prototyping		**Compatibility with all Decathlon tents and living rooms**
Perf. indicator 1	Quality	• Architecture and dimensions which do not touch tent and living room walls • Feasible inflatable structure
Perf. indicator 2	Time consumption	Selecting the architecture and dimensions in less than 2 months (traditional shape and dimension selections last 4 months)

Table c: Prototyping		**Plate sizes and positions**
Perf. indicator 1	Quality	Plate sizes and positions fitting with the 3 user bag contents
Perf. indicator 2	Time consumption	Selecting the architecture and dimensions in less than 2 months (traditional shape and dimension selections last 4 months)

Table d: Prototyping		**Inflatable technology added value**
Perf. indicator 1	Quality	• The inflatable structure is enough compact for fitting in all the car trunks of the customers during tests • The inflatable structure can be inflated and deflated in less than 30 seconds by all the customers during tests • The inflatable structure can be transported easily on 10 meters by all the customers during tests
Perf. indicator 2	Time consumption	Comparison to traditional product development technology validation (2 months)

Table e: Prototyping		**Accessorization**
Perf. indicator 1	Quality	Number of customers using accessories during tests
Perf. indicator 2	Time consumption	Selecting accessories in less than 1 month (Traditional color and additional features is 2 months)

III. Results & Discussions

1. Co-creation for involving users and accelerating ideation

a. Oui Are Makers challenge results

At the end of Oui Are Makers challenge, 50 prototypes have been proposed. Inflatable shelves prototype was associated with space optimization topic. The jury evaluated the projects according to two criteria:

- The ability to understand quickly the main functions by looking at the prototype
- The ability of the project to solve a customer problem

The prototype presented by the Maker who invented the inflatable shelves was very rough. It had a very small size and was made of cardboard and pieces of rubber wheels. However, it represented perfectly the desired functions.

Fig.7: Inflatable shelves monster prototype

By folding the cardboard structure, the maker communicated the instantaneity and compactness of the potential product. The feasibility of the project has been quickly evaluated by looking at the rubber surrounding, representing the inflatable parts. Quechua team realized several products, especially tents with a similar technology. The rough prototype was able to show all the value and technical aspects of the product, as expected by the jury.

According to jury this project is potentially able to solve one user problem. Until now, campers used to store their clothes in bags on the ground. Several storage furniture exist on the market, but their height and compactness are very limited. The inflatable shelves is the first vertical, easy and fast to use storage furniture.

b. Quality of brief elaboration

On the 50 projects proposed during this challenge, 37 were focused on the space optimization topic. This means 74% of the projects identified space optimization as a priority. This percentage shows the importance of space optimization for users.

Usually, product managers process a long series of interviews and observations in order to gather many points of view. Experts and customers are asked during these observations. The target is to identify trends and common points in order to determine which topics are at the heart of expert and customer concerns.

The coherence of co-creation for ideation can be shown by comparing it to the usual way to create the brief:

- The number of feedbacks collected by product managers can vary, but usually it is close to 50. Oui Are Makers challenge has been considered as a real success because this level of participation was not expected at all. The number of projects makes it very relevant.
- The interest for the space optimization topic is very high. The target for product managers is to observe trends as evident as possible. The more experts and customers are concerned by a given topic, the more it shows a problem to solve. In this case 74% of a population composed of makers with different backgrounds (experts, campers, potential customers etc…) worked on the same topic, which makes it very coherent.

c. Gain of time

Product managers usually elaborate a brief in 4 to 6 months (full workload). This elaboration includes interview and observation steps. It is one of the key steps that can be accelerated to improve the whole product development. Oui Are Makers challenge was launched in November 2018. Projects have been proposed until December 31st,

2018. A jury evaluated these projects during the month of January 2019. The project kickoff has been launched in February 2019.

As it is necessary to give at least 2 months to the makers for prototyping their ideas, and 1 month for the jury to evaluate the projects, the process has not been accelerated in this case. However, the coherence and feasibility of the idea do not make any doubt.

Co-creation cannot accelerate the ideation step but is an alternative to product manager observations. Information about customer problems and trends are very similar to traditional observation. Furthermore, several technical solutions associated with a given customer problem emerged, whereas only one solution is mostly investigated by conception teams during traditional development. Figure 8 presents a comparison between co-creation and traditional brief elaboration, with inputs (efforts) and outputs (results) associated.

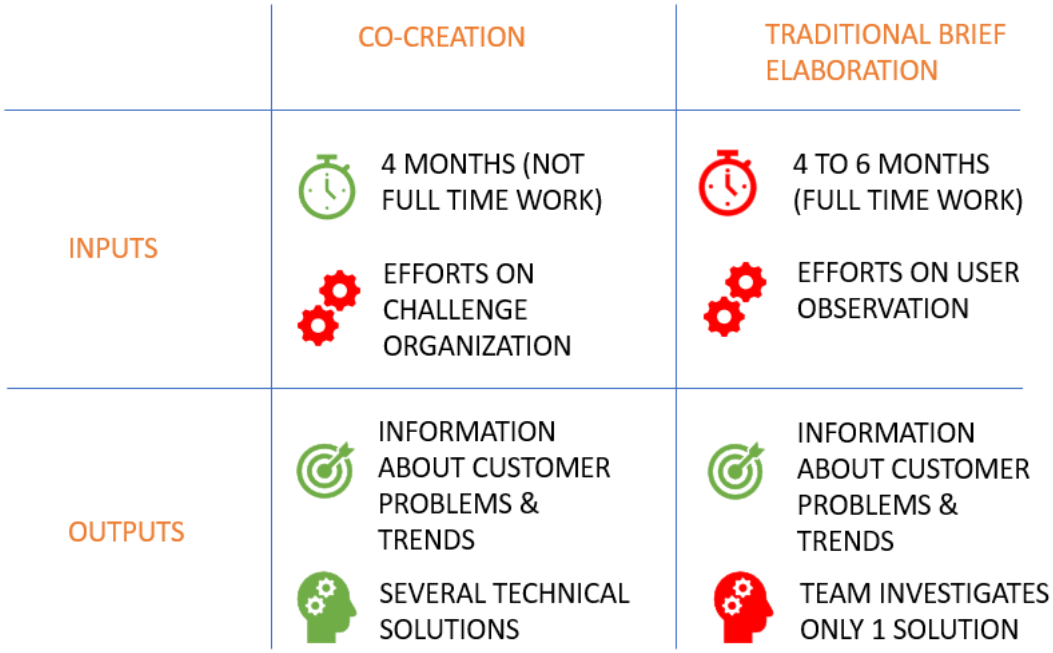


Fig.8: Comparison between co-creation and traditional brief elaboration

2. Fast prototyping for accelerating the product development project

a. Architecture & dimensions

Decathlon engineering teams are used to realize advanced prototypes to test. Realizing a prototype with the inflatable structure surrounded by polyester costs a lot of money and time. By using very easy methods for prototyping these structures with cardboard and glue, conception team proposed four different shapes very quickly and for zero cost.

Fig.9: Cardboard structures for shape prototyping

By testing all the cardboard structures in tents and living rooms from Decathlon, the shape and dimensions of the future product have been fixed. The technical feasibility of these structures has been evaluated by others conception teams. The inflatable technology is still difficult to put in shape because of all the constraints applied by the polyester surrounding. It has a very particular behavior and possible twisting effects can appear. Engineers working on inflatable tents since several years have relevant experience on this technology and know the risk associated with the shape of the beam. Their experience was a key feedback in order to determine which structures are possible or not.

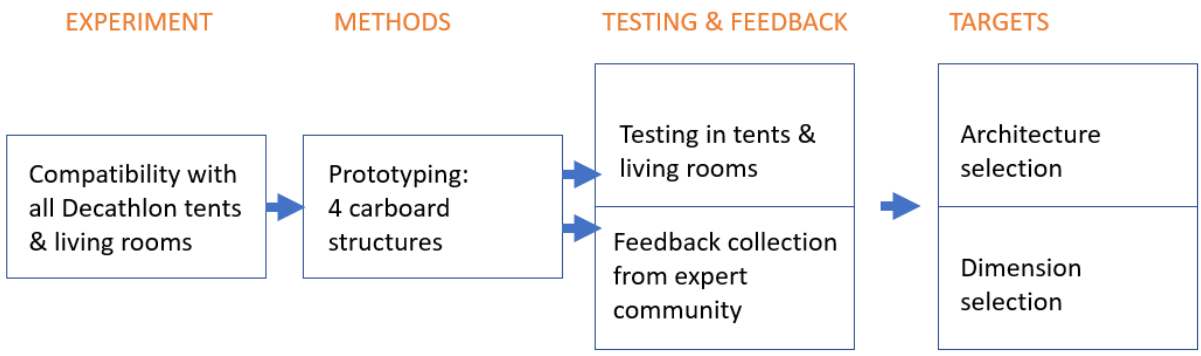


Fig.10: Prototype expectations - Compatibility with all Decathlon tents & living rooms

Architecture and dimensions have been fixed in less than one day. The 4 cardboard structures have been placed in all tents and living rooms made by Nature Hiking team (5 products in total). Results obtained have been correlated with expert interviews about feasibility of these structures and tabulated in figure 11. Three architectures fitted with all tents and living rooms. Their shapes and dimensions were optimal in order to be placed in different positions, in all the models of the Decathlon range. However, only one structure was feasible. The two others have been abandoned because of their sophisticated architectures. Potential constraints would have distorted the inflatable beam. These information about feasibility came from another conception team specialized in inflatable tents. When inflatable beams are constrained by a weak angle (more than 110°), the structure cannot stay straight. Inflatable shelves team decided to trust their experience, as experts in this domain.

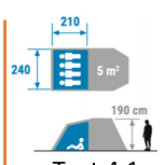
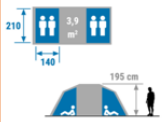
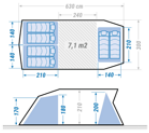
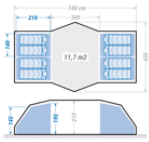
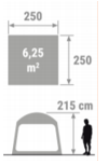
	 Tent 4.1	 Tent 4.2	 Tent 6.3	 Tent 8.4	 Living room	FEASIBILITY
 Cardboard structure 1	OK	OK	OK	OK	OK	OK
 Cardboard structure 2	NOK	OK	OK	OK	OK	NOK
 Cardboard structure 3	OK	OK	OK	OK	OK	NOK
 Cardboard structure 4	OK	OK	OK	OK	OK	NOK

Fig.11: Fitting and feasibility of the 4 carboard structures in Decathlon tents and living rooms

When working on a real inflatable prototype, it takes 12 hours of work. Realizing the four structures with cardboard took only 3 hours. The decisions about architecture and dimensions took 5 hours in total. This represents a real gain of time and shows the success of this prototyping experiment. By realizing very simple monster prototypes, it is possible to take decisions very quickly.

Target of this experiment was to select architecture and dimensions quicker than traditional development. This selection took 1 day instead of 2 months.

b. Plate sizes and positions

Plate sizes and positions have been determined by measuring the occupied space of customer stuff. Three bags with typical personae stuffs have been elaborated.

Fig.12: Example of typical camping bag - Young couple between 25 and 30 years old

Measurements of the occupied volume and biggest stuff are correlated with dimensions of the global structure in order to fix the size of each plate and the gap in between.
Bags and water bottles are the biggest stuffs carried by Quechua personae.

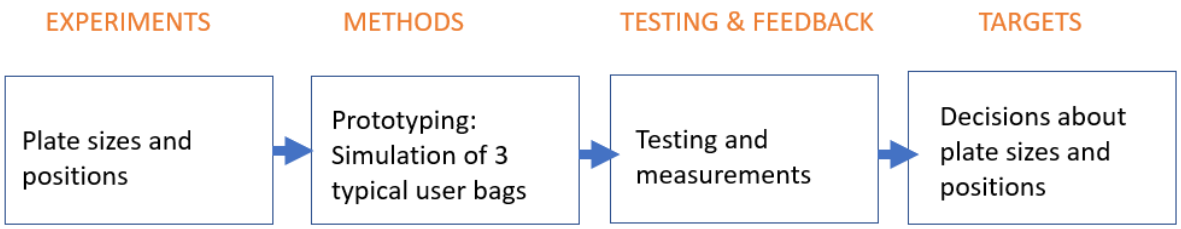


Fig.13: Prototype expectations – Plate sizes and positions

Traveling and hiking bags made by Decathlon are 33cm high. Bag is the biggest stuff carried by personae. The first plate has been placed 35cm high from the ground, in order to put all the big stuff in the lowest compartment. The rest of the spacing and dimensions

have been measured by splitting the rest of the stuff in 3 (because team wanted the furniture to have 3 shelves).

Team ability to take decisions very quickly (less than 2 hours) shows the coherence of fast prototyping for accelerating the development process. These choices have been validated by customers during usage tests (see chapter II.2.c). Programming tests with users is long and must be planned at least 3 weeks before. That is why the plate dimensions have been validated in one month (2h for having a result and one month to verify it with users). Target of this experiment was to fix these dimensions in less than 2 months, in order to be faster than traditional development. This target has been reached, as it has been 50% shorter.

c. Inflatable technology

The choice of the inflatable technology is coherent with several brief requirements. Prototyping this technology is long and expansive. As it is necessary to validate all the functions associated with this technology, conception team realized a very simple prototype with inflatable tubes. This prototype has been evaluated by Quechua monitors in April 2019, implemented, and reevaluated by typical users in May and June 2019 (see chapter II.2.c).

- **Compactness** is a real strength of inflatable technology. This function must be one of the most important added value. Typical user personae already have a lot of camping equipment. Tents and other furniture are not compact. They are difficult to transport and take a lot of space in the car.

- **Inflation and deflation fastness** have been identified as a real need for customers. Assembling and disassembling the tent, table and chairs is very long and is still a pain for users. Inflatable structures can be a great solution for this problem.

- **Transportability** when inflated must be easy and can be a strength because some personae include children. Inflatable technology is very light compared with metal structures. There is an opportunity to involve children in the camp set up phase, by proposing lightweight products.

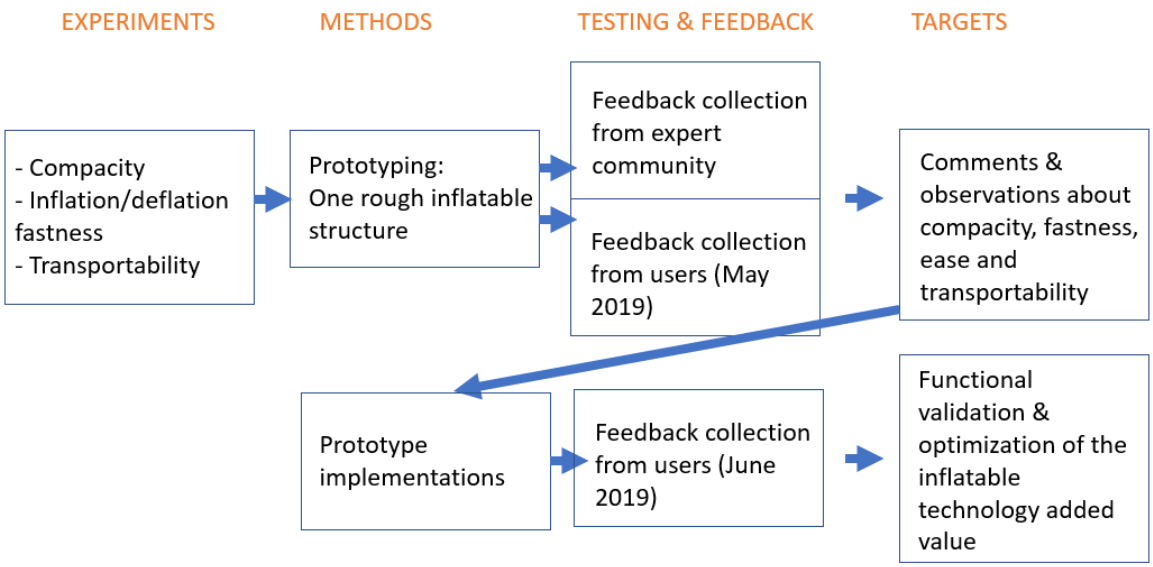


Fig.14: Prototype expectations – Compactness, inflation/deflation fastness, transportability

A very simple prototype made of inflatable tubes (**prototype A in figure 15**) has been evaluated by experts and customers. A first community of experts (monitors) evaluated the technical aspects of the prototype during the monitoring meeting. Team asked for feedback about compactness, ease and transportability. They suggested to implement the stability by modifying the shape of the feet. Stability has been implemented by following their advice, but any information has been collected about compactness, ease and transportability. The team did not address the right community for collecting the right information.

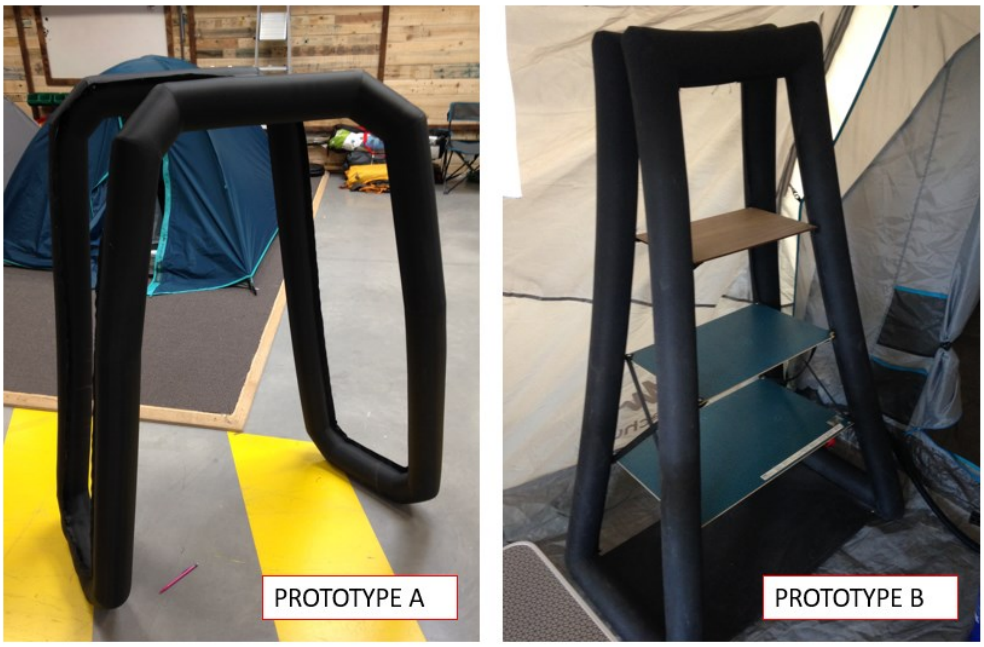


Fig.15: First rough prototype A and its implemented version B

These functions have been validated by proposing this prototype **A** to user personae. Six families corresponding the three target personae had the opportunity to use this prototype in May 2019. One month later, six new families tested an improved version (**prototype B**) in June 2019. The team observed their behavior and collected the following results, tabulated in figure 16:

- In May, only 17% of the users are able to compact the product properly. Paper instructions and a carry bag have been added in order to make this compaction easier.

  In June, 100% are able to compact it and the prototype fits in 100% of the user car trunks. All of them were able to put the prototype in their car, even if it was full of camping stuff. Without asking any questions about it, three families said they are impressed by the compactness of the product when it is deflated.

- In May, all the families underlined a problem linked to the position of the valve. This position made the inflation step non-intuitive. The valve was at the top.

However, the length of the pump tube was not long enough. Prototype has been modified; the valve has been put closer to the ground.
In June, 88% are able to inflate and deflate the prototype in less than 2 minutes.

- In May, plates were made of wood and surrounded by metal pieces. Users must add it to the structure thanks to webbings with buckles. According to users, the whole structure was too heavy. A lighter component has been selected, medium density fiberboard (MDF).
  In June, all the children (from 6 to 14 years old) were able to inflate, deflate and transport the prototype from their car to the tent, without any difficulty.

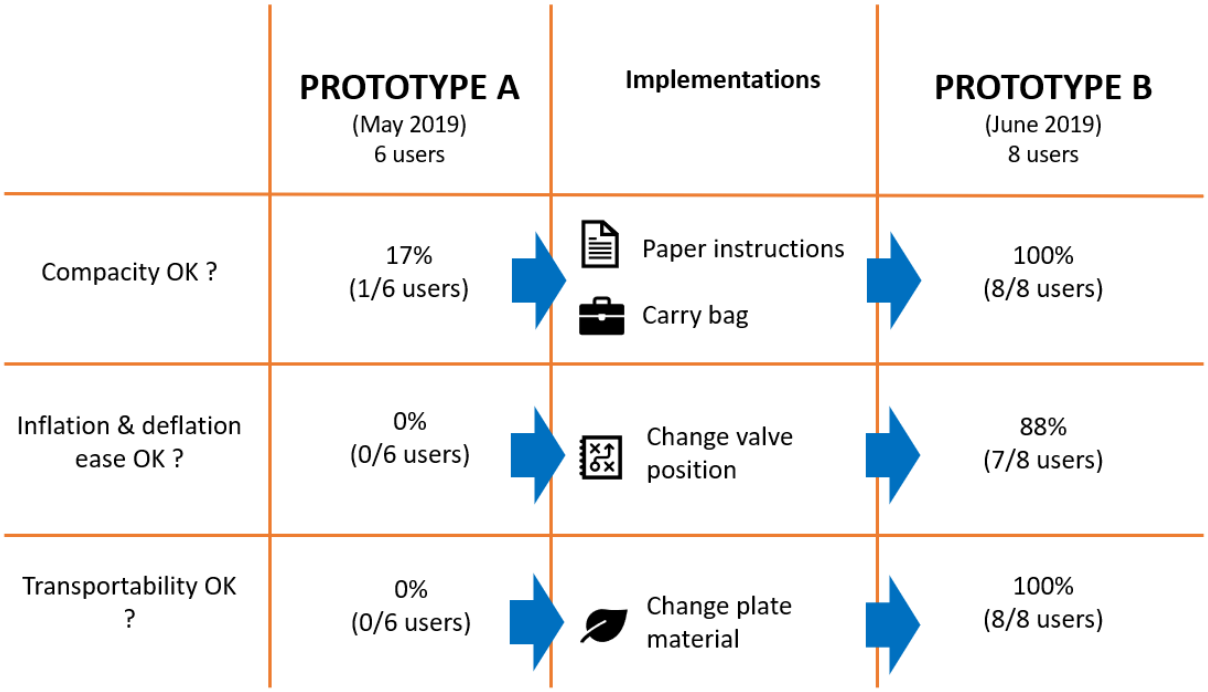


Fig.16: Results of usage tests before and after prototype implementation

By observing real users manipulating this very simple prototype, conception team validated the three functions showing the real added value of inflatable technology. Gathering users for doing tests takes a lot of time. It necessitates a very precise

organization. However, it is a perfect way to make choices by being 100% sure of their coherence.

Elaborating the prototype took 12 hours of work. Development process has not been accelerated by realizing this first prototype, but during the implementation phases. Every collected feedback allowed to make a better prototype very quickly, because it only consisted of small modifications. This prototype was a real success because it was very simple and easy to implement and to modify very quickly.
Target of this experiment was to validate the technology choice in less than 2 months. All the test and modification iterations took only 1 month.

d. Accessorization

For choosing types and dimensions for supplementary accessories, such as lateral pockets, the Facebook Nature Hiking maker community has been involved. The team proposed a 3D model of the product to the community and asked for ideas. The open question and text posted with the model was “According to you, what would be the smart accessories to integrate to the inflatable shelves’ structure?”. More than 30 people commented the Facebook post.

- 20 comments proposed pockets on lateral faces of the structure.
- 16 comments proposed shoe boxes.
- 7 comments proposed hooks for fixing the structure to the tent.
- 7 comments proposed towel holders.
- 1 comment proposed a webbing with loops in order to attach carabiners.

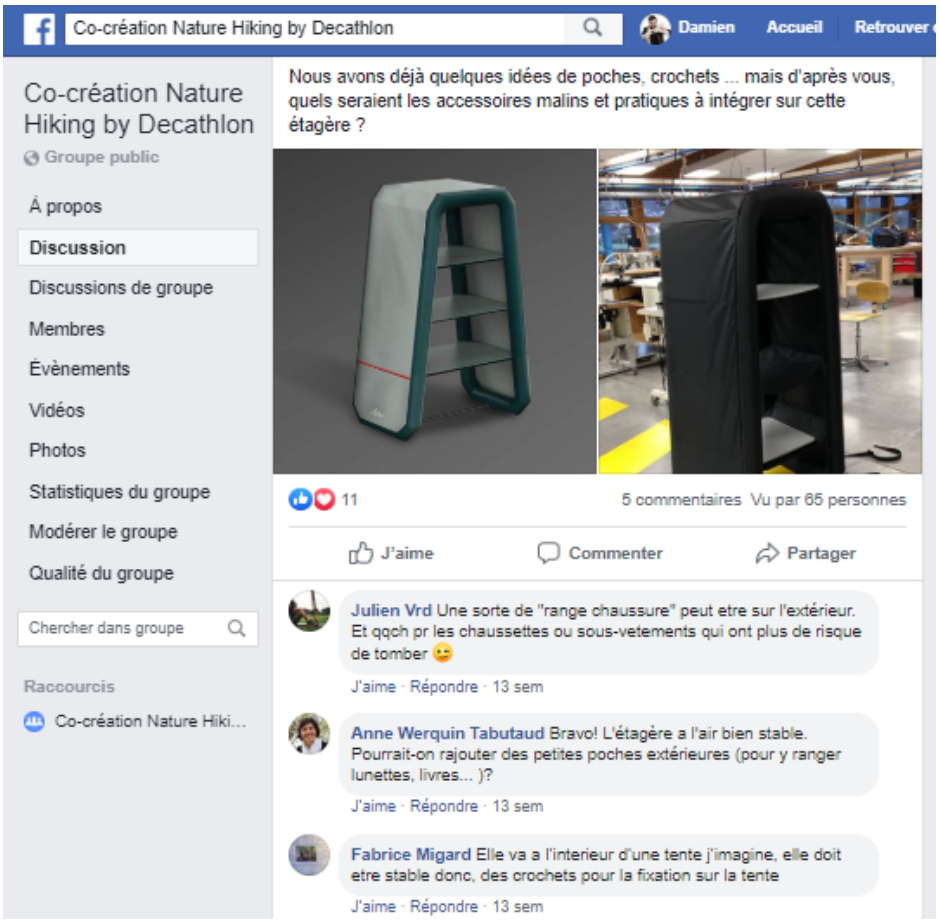


Fig.17: Facebook maker community - Accessorization ideas

Prototyping these accessories on the existing inflatable shelves prototype was fast (less than one hour). Components, such as webbing or mesh textile, can be recycled from old tents or other products and modified to fit with the prototyping purpose. Five different accessories have been prototyped on the existing structure (**prototype B on figure 15**) and tested by customers during the second usage test in June 2019.

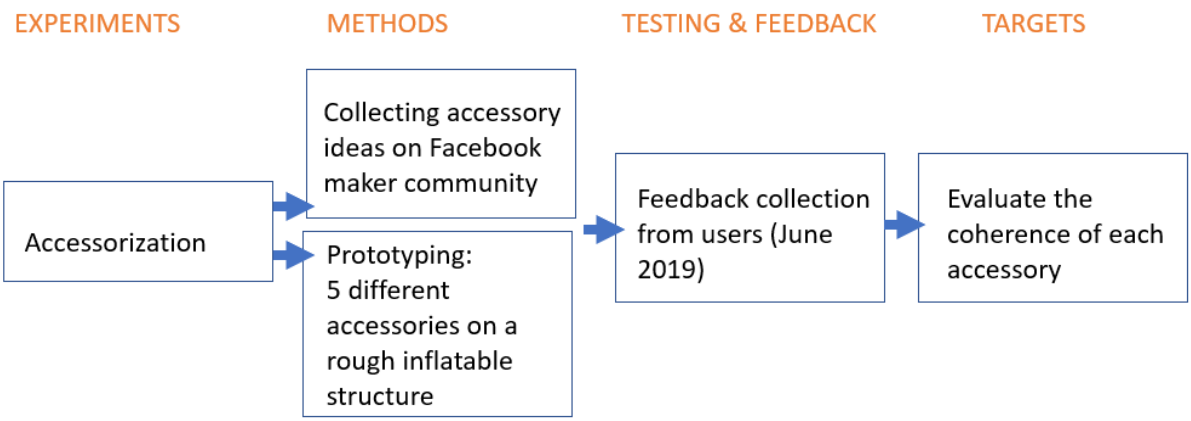


Fig.18: Prototype expectations - Accessorization

Because of the difficulty to understand the purpose of accessories, some of them have not been used by any user. These accessories must be an added value for the product. If customers do not use it, because their value is not well understood, it is not necessary to keep them. Among the five proposed accessories, only mesh pockets and webbings with hooks (for fixing the prototype to the tent) have been used.

For pockets, 100% of the customers used it for storing small stuff for hygiene, or more personal tools (wallets, jewelry etc..) in the pocket located inside the prototype.

Fig.19: Results of accessory usage test

This experiment is a real success. The success was directly linked to communication with users. Thanks to the Facebook community, the team proposed and prototyped five ideas very quickly. It would have lasted one whole week thinking about accessories to prototype, if the right community would not have been asked. User tests allowed to make choices by knowing exactly what is interesting or not for real customers. Having the certitude that these accessories do not please to customers is a success. Accessory selection took 1 month in total, whereas target of this experiment was to do it in 2 months.

3. Impacts of co-creation and fast prototyping on product development project

a. Co-creation and fast prototyping added values for inflatable shelves project

The use of co-creation for ideation step did not accelerate the product development project consequently. Organization of the challenge took 1 month, time consumption for participants to prototype their ideas took 2 months and jury evaluations took 1 month. Traditional user observation is about 4 to 6 months. There is only a small gain in time using co-creation. Figure 20 presents a time and outputs (results) comparison of traditional product manager user research and co-creation for ideation.

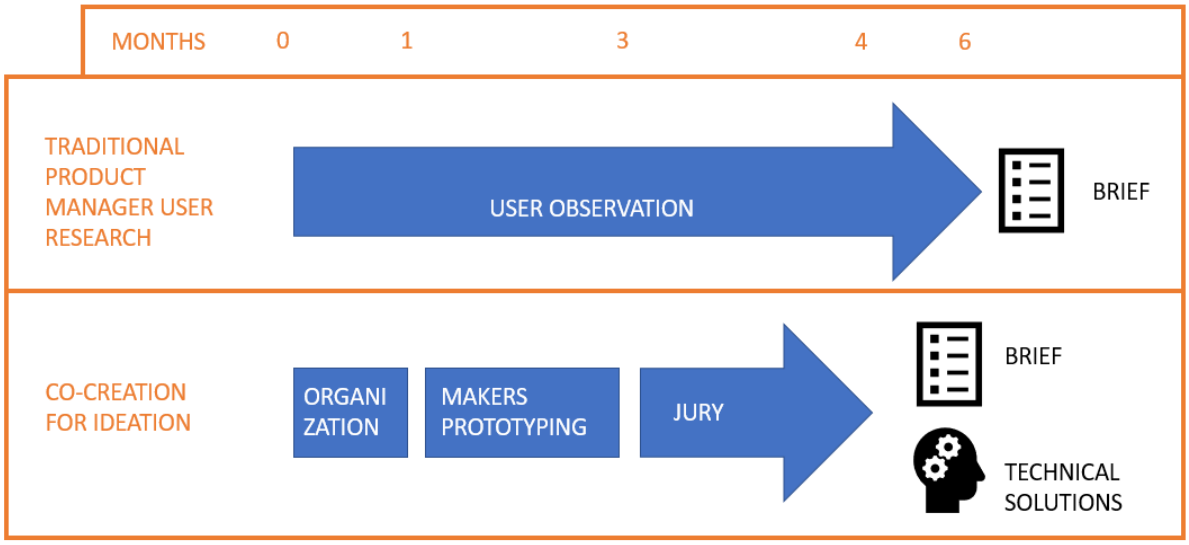


Fig.20: Timeline comparison between co-creation and traditional user research

However, quality of the product development is improved by co-creation. As explained in the first part of this study, most development failures are due to a lack of user centeredness. Thanks to co-creation challenge, customer problems and trends are identified “quasi automatically”. The coherence of the identified user needs is equal to the coherence of a traditional user research. Organization of the challenge is not a full

workload, compared with traditional user research. Ideas are generated by makers, while conception team can work on other projects. Another gain with co-creation is the association of technical solutions to the identified problem.

Fixing the technical solution and design usually takes 8 months. In order to accelerate these parts of the product development process, conception team realized fast prototyping experiments. By realizing very precise tests, important decisions have been taken in very short times. From the end of the jury evaluation (brief) to the selection meeting, technical solution and design have been fixed in 4 months. Cardboard structure experiments took only one day for choosing the shape and global dimensions. Plate sizes and positions have been determined in 1 month. The choice of inflatable technology has been validated in 1 month. Accessories have been selected in one month. Fast prototyping experiments have been a real success and accelerated the conception step consequently. Figure 21 presents a time and outputs (results) comparison of traditional conception and inflatable shelves conception using fast prototyping.

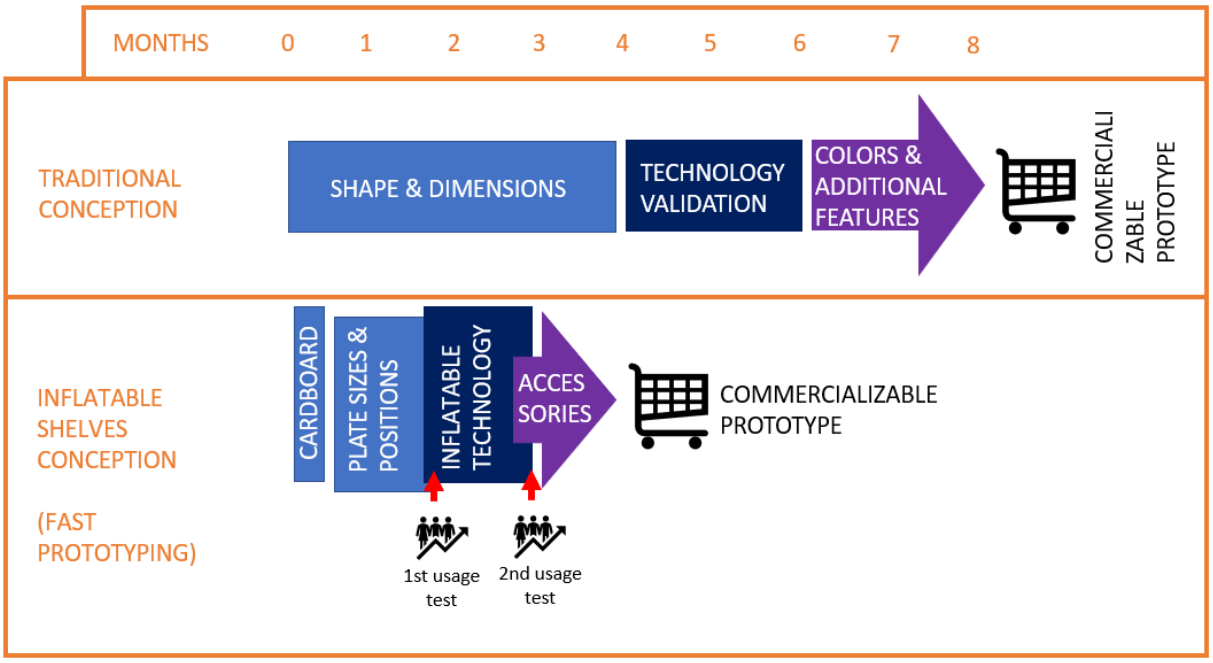


Fig.21: Timeline comparison between traditional conception and fast prototyping conception

Quality of the decisions taken after these experiments has been ensured by efficient feedback collection. Every experiment has been addressed to a given community in order to collect precise feedback. Technical feedbacks have been collected with expert communities in order to validate the feasibility and durability of the product. Function validation and coherence have been tested with real customers, in order to create a user centered product, synonym of success. Every feedback has been a clue for implementing prototypes and test it again in order to reach the most qualitative product.

b. Discussions

Following planning shows a comparison between classic product development and accelerated development. Co-creation did not accelerate the ideation phase but made it very coherent because of user involvement. Unexpected result of co-creation is the appearance of several technical solutions to problematics, such as inflatable beams for storage. Team did not imagine this result, because usually, only one solution is dedicated to one problem. Target fixed during prototyping experiments has been under-estimated. Team expected to accelerate the product development by reducing traditional conception time of one or two months. Fast prototyping experiments divided conception time by two, from 8 to 4 months. The unexpected success of these methods must be considered as a clue for improving next developments. Figure 22 presents a comparison of classic development and inflatable shelves development timescales. Benefits (in green) and limitations (in red) of the techniques used during this accelerated development are presented, as mentioned in this chapter.

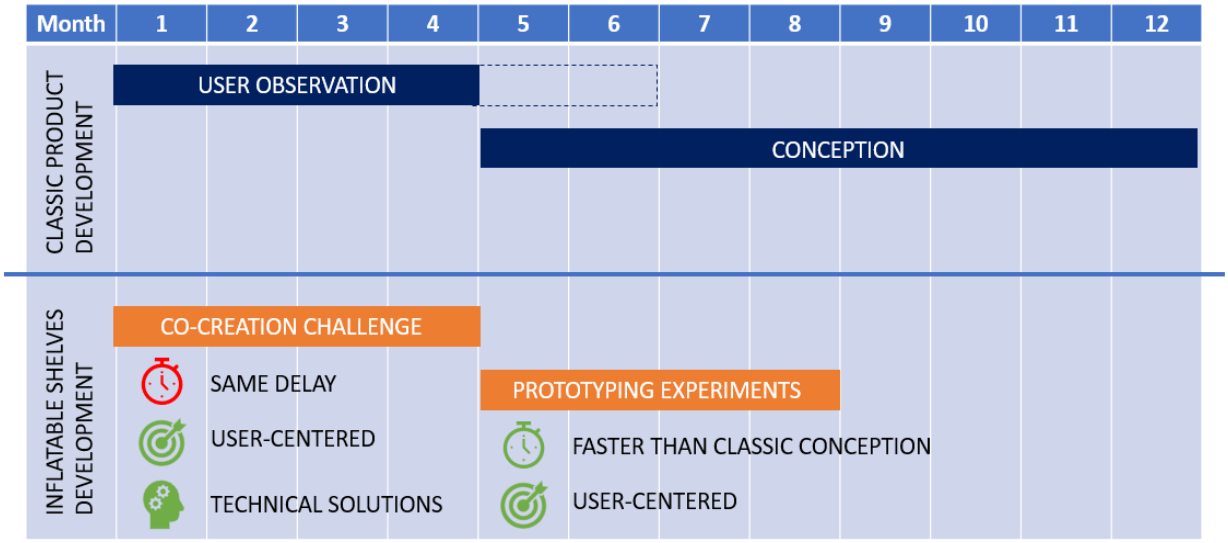


Fig.22: Timescale comparison of classic development and accelerated development

The cost has been neglected during this study. It represents the main risk of the product development of the inflatable shelves. The team did not measure the impact of conception choices (results of experiments) on the final cost of the product. The first cost analysis has been realized after the last usage test (June 2019). At this moment, it was too late to optimize the costs. The objective for the selling cost was 40€. After the cost analysis in collaboration with a Chinese supplier, cost has been estimated around 60€. This could have been avoided by analyzing the cost while making conception choices.

The main purpose of this study was to make proofs of concept for co-creation and fast prototyping applied to Decathlon product development. Some aspects of these methods can be considered as failures. Costs of finished product have been neglected and co-creation did not accelerate the process. Base on the present study, team decided to propose a new methodology based on the previous experiments, in order to accelerate the product development project without reducing the quality (see chapter II.3).

c. Recommendations

Another co-creation challenge will be organized in September 2019. The topic of this challenge is about accessories for camping chairs. According to present study, following recommendations are made.

Co-creation for setting rules – This study has shown that real added value of co-creation for ideation is not process acceleration but brief coherence (chapter II.1.b). It indicates what customers really need and problems they want Decathlon to solve. Organizing the challenge took some efforts. Community animation and rule settings take a lot of time but are necessary in order to communicate all the information to challengers. New methodology proposes to involve the maker community at the very beginning of the challenge, for fixing the rules. Figure 23 presents team expectations for next co-creation challenge in terms of inputs (efforts = in red) and outputs (results = in green).

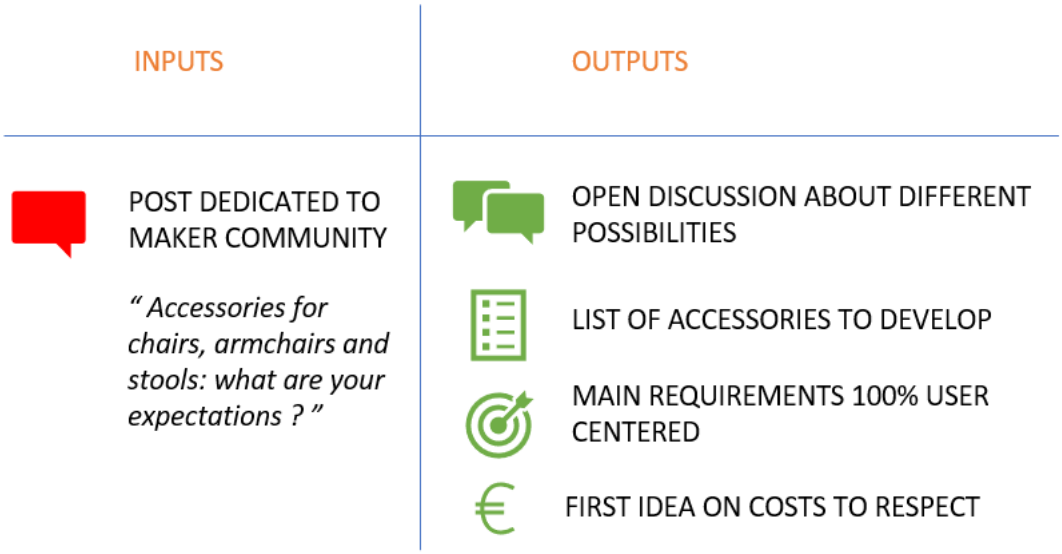


Fig.23: Involving makers for fixing challenge rules

By involving customers and makers before to begin the challenge, it is possible to write user centered rules. This step will be two weeks long. It begins with a post on social networks, dedicated to maker community, introducing an open discussion about

accessories for chairs, armchairs and stools. It will result in a list of accessories to develop, with requirements associated with and a global idea on the costs customers would be willing to pay for it. This first feedback collection wave is a way to co-create the future rules of next challenge. It makes these rules more coherent and user centered. Potential costs must be discussed at this very first step, in order to do not reproduce the mistake made during inflatable shelves development. The costs defined during discussion with customers will be considered as a key performance indicator.
Two more weeks will be necessary to collect all the feedback and write rules properly. This means that organization step still lasts one month but is further user centric. Time consumption is not improved yet, but quality is, as challenge rules become closer to customer expectations.

Design to cost oriented challenge - Co-creation challenge will begin right after rule elaboration. Makers will be allowed to prototype during two months. Two months were enough for Makers to propose advanced technical solutions and easy to understand prototypes. This timescale suited perfectly during the previous challenge. Main failure during last challenge was the lack of consideration about costs. For next challenge, cost will be an evaluation criterion for proposed prototypes. As the jury is composed of experts and engineers, they are able to make a design to cost evaluation very quickly. Design to cost is defined by Spacey (2019) as a simultaneous analysis of conception choices and finished product cost. In industry, every decision on designs and technical solutions has an impact on costs. Gille & Kolkmeier (1990) explain that design to cost analysis necessitates advanced knowledge on processes and manufacturing techniques. Engineers in Decathlon are experts in given processes. They are used to work with very few suppliers and know the costs of materials and techniques used for these processes. What is expected from this expert community is to realize a very rough design to cost analysis on the prototypes proposed by Makers. If they can predict the costs at +/- 20% roughly, this analysis could be a very important clue for the prototype selection and next steps of the project. Michaels & Wood (1989) introduced Design to cost as a way to reach target cost by modifying an existing product. This older way to process a Design to cost analysis, not before but after prototype creation, could be possible in this case. If experts observe a very coherent but expensive technical solution, next steps of the project will be

focused on reducing the costs for pushing the idea on the market. Figure 24 presents a time and outputs (results) comparison between last co-creation challenge (inflatable shelves project) and next co-creation project.

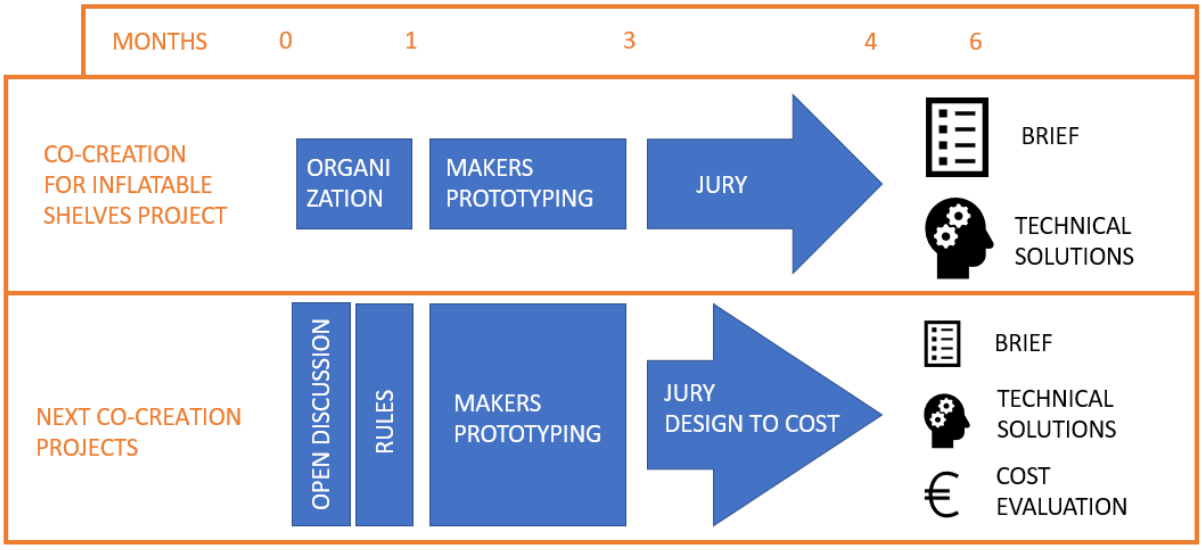


Fig.24: Comparison of co-creation for inflatable shelves project and next co-creation projects

Timescales of co-creation challenges for inflatable shelves project and next projects are very similar. A new variable has been introduced in order to take costs in consideration. Qualities of brief elaboration and technical solutions are conserved. Co-creation process for ideation still lasts 4 to 6 months.

Fast prototyping & feedback collection - Techniques used during inflatable shelves development have been very efficient for decision taking. Right communities have been consulted in order to improve and collect feedback about prototypes. What made feedback collection efficient was to involve the right community at the right moment.

- Expert communities for technical decisions
- Nature Hiking Maker Facebook community for proposing a lot of ideas
- Quechua Personae for function or feature validations

Fast prototyping experiments have been efficient. Team will continue using cheap and easy to make prototypes such as carboard structure for shapes, recycled tent materials for accessories or personae bags for choosing dimensions.

This efficiency transformed the classic conception phase of 8 months, in a continuous prototype evolution of 4 months. On this 4-month period, two usage tests have been performed. These tests have been key moments for choosing the functions of the inflatable shelves, in accordance with customer needs. The following methodology proposes to organize 4 usage tests in this 4-month period. Testing prototypes with users more often could lead to a more and more user-centric conception. It is difficult to organize usage tests for camping products, because their use mostly depends on weather. A solution is to test products in Southern countries, where seasons are shifted with Europe. For example, co-creation challenge will finish in January 2020. First usage test can be performed in South-Africa, because the weather is already around 25°C in January. It is a good way to be closer to real conditions and organize tests more often.

This calendar in figure 25 proposes a planning for performing 4 usage tests (of 1 week) in the 4-month conception period. It consists in organizing one usage test with customers at the beginning of each month (red squares). During these tests, conception team collect feedback from real users in real conditions. Next step (2 week long) is to couple these data with:

- Expert feedback (green squares), in order to keep considering the costs and feasibility of the product.
- Makers feedback (blue squares), in order to collect ideas and comments for prototype evolution.

All this information must lead to a “design to cost” and “user-centric” oriented prototype evolution (violet squares). Four iterations of this continuous improvement will be processed. The expected result is a product ready to industrialize, fitting with customer expectations and respecting the target cost fixed before the challenge.

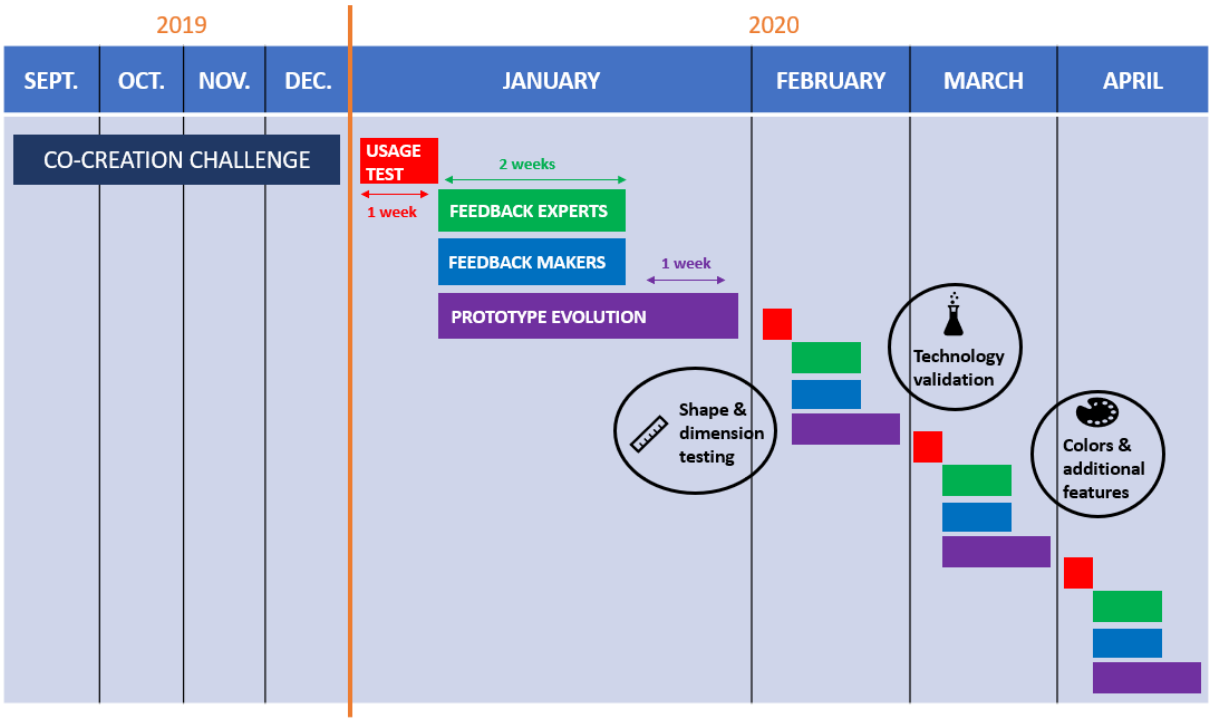


Fig.25: Calendar proposition for iterating tests, feedback collection and prototype evolution

The success of co-creation and fast prototyping experiments has been evaluated by considering only quality and time consumption. Quality has been determined in accordance with the objectives fixed before to realize the experiments. The main target was to accelerate the development process. However, only few experiments have been realized in this study. These experiments were directly applied to the product development of the inflatable shelves. In order to validate the coherence of each method, it would be necessary to realize more experiments on other product developments.

Conclusion

By analyzing the product development process, it is possible to identify several steps that can be accelerated. The ideation and prototyping phases are usually long, and methods have been proposed in the literature in order to optimize it. This study proposed to investigate co-creation and fast prototyping coupled to feedback collection in order to accelerate these steps. Efficiencies of these methods and experiments have been analyzed according to two criteria. The first criterion is the ability to lead to conception choices with as little uncertainty as possible. The second is the time saved by using these methods, compared with usual product developments.

The uncertainty associated with conception choices and decision taking is mostly linked to customer expectations. A decision is coherent if it is guided by customer feedback or observation. The rest of the uncertainty associated with conception choices is due to technical feasibility. Feedback collection from expert communities can help on this side.

Co-creation may not seem like a good solution for accelerating the ideation step. The organization and result analysis take at least four months. This time is almost equivalent to the usual time needed for product managers to elaborate a product brief. Quality of ideation is good thanks to user involvement. If the number of projects proposed during the challenge is enough, it is possible to observe some trends. In this case, 50 projects were proposed and 74% of the projects underlined the same customer need: space optimization. This reveals a potential user problem, with a lot of solutions associated with. Makers proposing ideas are also users. Co-creation is a good solution to involve potential customers in the ideation phase.

Fast prototyping experiments realized during this study have been tested by collecting customer feedback. It has been a very efficient method for accelerating the product development of the inflatable shelves. The quality of conception choices realized after these experiments is ensured by collecting feedback from real customers. Fast prototyping is successful when the experiment is focused on few features. Prototypes must be very simple and easy to implement. Making rough prototypes, collecting feedback and implementing the prototypes gave very successful results. It allowed to

choose the architecture and dimensions of the inflatable shelves. It also provided solutions for showing the real added value of the product. Dimensions, shape, storage spaces and accessories have been chosen during these experiments, in accordance with user expectations.

A co-creation challenge will be organized in September 2019. This challenge will be a perfect occasion for validating the advantages of co-creation and fast prototyping to accelerate the product development process without reducing the quality. A methodology based on the present study has been proposed. It proposes to use co-creation not for accelerating, but for increasing user involvement in ideation phase. Fast prototyping experiments are a good solution for accelerating the whole process. These experiments must be coupled with several user tests and targeted feedback collection. Costs must be considered all along the process. A design to cost oriented prototype evolution can be performed, thanks to expert communities.

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