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Using Google Design Sprint method to validate a startup product vision for Industry 4.0

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Abstract The growing competitiveness in the marketing sphere inevitably accentuates the demand for more efficient methods in the process of validating and developing new products and businesses. To support teams in testing and prototyping ideas and solutions in an agile way, Design Sprint was created at Google. The method helps to define critical product and business challenges, to think about different solutions, and to arrive at a validated prototype in less than five days. This study presents the application of Design Sprint to support a startup company with a solution for Industry 4.0, helping its entrepreneurs to validate their product and business hypotheses. The study shows the impact and the learning that the method is capable of bringing in a relatively short period, from user interviews and prototype tests. Although it was not possible to reach full validation of the product vision, this work shows the power and performance that Design Sprint has in helping test an idea quickly, without significant investments in terms of time and money, to support innovative processes and the development of products with better marketing appeals.

Keywords: Design Sprint; Industry 4.0, Startup company

1 Introduction

The dynamics of the business world has gone through significant changes in the last years, and most experts agree that every industry faces some kind of disruption in the coming years, leaving continuous business innovation as the only way to maintain any type of competitive advantage in the long run (Banfield et al, 2016). Companies from different segments are being forced to develop their solutions in a more agile and efficient way, given the growing competitiveness, especially with the changes brought by Industry 4.0 transformations.

In this sense, both traditional organizations, already consolidated in the market, and startups - the nascent technology-based companies - need to adopt continuous innovation processes and agile methods (Banfield et al, 2016). However, even when applying agile methods to reduce a project's risks and uncertainties, entrepreneurs only have real validation of their ideas when they put their solutions in the hands of their customers - and this can take a long time, due to the long time of developing their ideas (Knapp et al, 2017).

As a way to reduce the risks and time for an end customer to test a solution, innovation processes started to adopt design techniques, applying tools for solution concepts and problem-solving, useful in the development of innovations focused on the user (Bonini, Sbragia, 2011). This influenced the creation of methodologies based on the way a designer thinks and acts, such as the Design Thinking approach, making it easier even for non-designers to conduct innovation processes (Brown, 2010).

It is in this context that Design Sprint emerges, a user-centered, iterative, practical, and collaborative method, based on Design Thinking and agile methods, that helps teams create and prototype solutions very quickly (Silva, 2018). The method, developed at Google Ventures (GV), allows organizations to come out of an idea and, in five days, build a prototype and test it with real users (*GV Design Sprint page*, no date). Quickly and efficiently, entrepreneurs and organizations verify the acceptance of their solutions with real

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customers and answer critical business and product questions, without the need for significant investments of time and resources (Knapp et al, 2017).

The method became known worldwide after the publication of the book *Sprint: how to solve big problems and test new ideas in just five days* (Knapp et al, 2017), having already been adopted by companies in different sectors, helping creating and improving physical and digital products, services and strategies (*GV Design Sprint page*, no date). However, because these projects often involve strategic and confidential aspects, there are few cases published in the academic literature. Having said these considerations, the objective of this work is to present the application of Design Sprint as a support tool in the validation of the product vision of the startup IndustryCare, which aims to help industries reach the stage of Industry 4.0, helping them generating and managing the data of their machines and processes.

2 Literature review

2.1 Agile Methods and Design Thinking

The Agile Methods represented a milestone for management, allowing teams to systematically achieve both an execution discipline and continuous innovation, something that was impossible with a hierarchical bureaucracy (Denning, 2013). Agile methods are *incremental*, *cooperative*, *straightforward*, and *adaptive*. *Incremental* due to small versions and rapid development cycles; *cooperative* because of the close relationship and interaction between the client and the development team; *straightforward* because the method itself is simple to learn and has sufficient documentation; and *adaptive* due to the ability to make last-minute changes during the project (Abrahamsson et al, 2003).

Design Thinking is a creative framework for solving complex, unknown and challenging problems. It generates potential solutions to a problem, helping in the creation of better products and services (Gruber et al, 2015). It is a useful tool that applies creative and critical thinking to understand, visualize, and describe problems and then develop practical approaches to solving them (Brown, 2010). It aims, through user-centered design, to capture what is desirable for people, what is technically possible and feasible for business, and convert it into consumer benefit and commercial value (Brown, 2008).

2.2 Design Sprint

The Design Sprint is a five-day process designed to answer critical business questions through design, prototyping, and testing ideas with customers (*GV Design Sprint page*, no date). The process mixes notions typical of the design domain - such as drafts or storyboarding - with others that are closer to management - such as time-boxed tasks, productivity, and individual work - in one unique way (Alba, 2018). It quickly aligns teams under a shared vision, with clearly defined goals and deliverables, being a tool for developing hypotheses, prototyping an idea and testing it soon with the least possible investment in a more realistic scenario (*Design Sprint Kit page*, no date).

The method can be used in different situations, from early-stage to more mature projects (Banfield et al, 2016). In nascent projects, it helps to create the concept of a new solution and to explore several opportunities. In existing and more mature projects, Design Sprint can be a tool to update or improve a solution (Banfield et al, 2016). Best known for injecting speed and innovation in product development, the method can also be used to create new processes, create or update a brand, or even define a vision for the impact that an organization wants to bring to the world (*Design Sprint Kit page*, no date). Google Ventures (GV) has already applied Sprints to hundreds of companies, such as Nike, Flatiron Health, and Medium, helping them to enter new markets, design new products, develop new features, define marketing strategies, and much more (*GV Design Sprint page*, no date).

The process starts with a big challenge to be solved and goes through several activities (see Table 1). Each exercise builds upon each other, helping participants start by defining a specific problem to be solved, finishing the Design Sprint with a validated prototype (Knapp et al, 2017).

Table 1 Design Sprint major activities (Riedewald et al, 2018)

Day	Activities
Day 1: Monday	Establish a common understanding of the context. Identify the critical areas and choose the questions you will be able to tackle in this Sprint.
Day 2: Tuesday	Expand and explore the solution space for the selected question(s).
Day 3: Wednesday	Quickly decide on a solution. There may also be several alternatives. Create storyboards for the test. Specify the details according to the storyboard.
Day 4: Thursday	Implement the solution(s) as a testable mockup / prototype. Different aspects might also be tested with different mockups/prototypes.
Day 5: Friday	Run tests with real users. Observe and learn.

The systematic was detailed in the Sprint book (Knapp et al, 2017), helping to spread knowledge about the applicability of the method. It is divided into five stages: (i) understanding and defining the problem; (ii) divergence and proposition of different ideas; (iii) voting on the best idea; (iv) prototyping the solution; and (v) validating the prototype with real users, obtaining answers to critical business and product challenges (Knapp et al, 2017). The Sprint book is a practical guide for answering critical business questions, for teams of any size, from small startups to Fortune 100 companies, from teachers to nonprofits, serving everyone with a great opportunity, problem, or idea they need responses as quickly as possible (*GV Design Sprint page*, no date).

Design Sprint is relatively new, and the literature is not vast with publications. However the researches available give a glimpse of the variety of situations where the method can be applied: designing and testing new products (Martinez et al, 2018, Pinto et al, 2020, Ferreira et al, 2019, Bianchi et al, 2019), new learning tools (Ferreira, Canedo, 2020), services (Rontti, 2016), process improvement (Perpetuo, 2018) and even behavior change (Colusso et al, 2018). There are also publications of adaptations from the original 5-day Design Sprint (Riedewald et al, 2018, Petolta, 2017, Southhall, 2019), demonstrating that it is also possible to obtain learnings and evolving an idea/solution with these adaptations. We highlight the versions from companies such as McKinsey, with its adapted version called Concept Sprints (McKinsey, 2018) and AJ&Smart's Design Sprint 2.0, a 4-day version of the method (Courtney, 2018), endorsed by Design Sprint creator Jake Knapp (*The Sprint Book Masterclass page*, no date).

3 Methodological procedures

This study goal was to apply Design Sprint 2.0 to test the solution of a startup company, helping to quickly build a prototype, get answers to critical business questions. The action-research procedure was adopted since the author was a participant (facilitator) of the Design Sprint, being, therefore, an interventionist research (Vergara, 1997).

Concerning its goals, this work is exploratory and descriptive since it is carried out in an area in which there is little accumulated and systematized knowledge (Vergara, 1997). Perhaps, because the Design Sprint method is relatively new, with few academic works developed with the perspective of analyzing and implementing it, this work is also descriptive because it aims to describe the characteristics of a specific phenomenon, in this case, the application of the method to help in a startup company's validation process.

As for the approach, it is a qualitative research, in which, through observations to the organization, evidence is collected, having direct contact between the researcher and the researched environment [30]. One point of qualitative research is that the interest is to unveil the course of events that culminate in the results studied, not only the results themselves, but how they came to them, enabling the explanation of how and not just what (Fleury et al, 2012). This is in line with the proposal of this study, to show the application of Design Sprint in the specific case of a product vision validation, showing the paths taken and the reasons for reaching particular results.

By applying the method, it was possible to gather product and business insights, which converged to the creation of a prototype. With the presentation of the prototype in a user test, in an interview format, it

was possible to extract qualitative information and make inferences about the prototype and critical aspects of the business.

4 Results and discussion

4.1 Case study

The present case study is with IndustryCare (*IndustryCare page*, no date), a Brazilian startup company that was born to help industries in the generation and management of their factory floor data, assisting enterprises to reach the Industry 4.0 stage. The founding team applied the Design Sprint method to validate the product vision and test its desirability, helping to accelerate the learning and software development cycle.

The solution idealized by IndustryCare is to work with a Platform-as-a-Service (PaaS) model, integrating Hardware, Software, and Specialized Services:

Hardware: IndustryCare assumes all CAPEX of Internet of Things (IoT) sensors and meters - from partners such as ABB, Siemens, Schneider, and others - and installs those IoTs in as many points as necessary. All communication infrastructure is IndustryCare's responsibility, and the startup guarantees data consistency and security.

Software: With the data collected, IndustryCare delivers to the industry an analytics dashboard in which it is possible to monitor, in real-time, the behavior and performance of machines and processes; monitor production and consumption indicators - the WAGES: Water, Air, Gas, Electricity and Steam. Since IndustryCare installs IoT sensors and meters in dozens of points in the industry, it will be able to create an *Industrial Big Data* and deliver a global overview of a factory plant, a production line, and specific equipment. With this analytics panel, the startup will help industries to become more efficient through (1) *visibility* - understand what is happening, (2) *transparency* - understand why it is happening, and (3) *predictability* - understanding what will happen. All of this to achieve *adaptability* (Fig. 1), through *Industrial Cognition*, and help industries to reach the final stage of Industry 4.0.

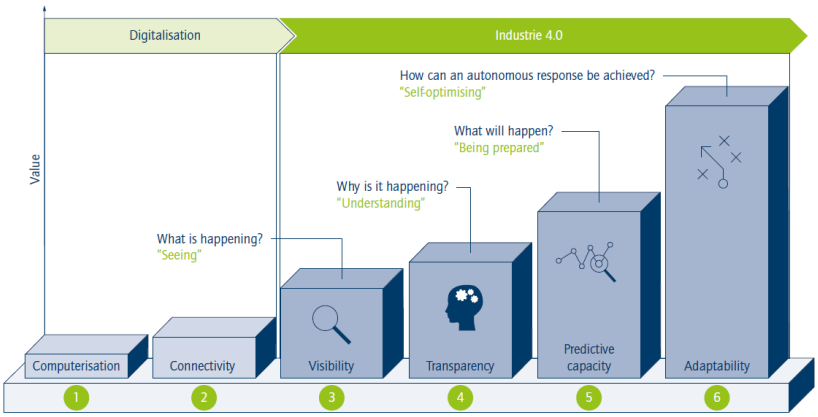

Fig. 1 Stages in the Industry 4.0 development path (Schuh et al, 2017)

Specialized Services: IndustryCare works with an end-to-end process, from the implementation to the execution of improvement projects.

The big challenge for the founding team was to validate the product vision, helping the entrepreneurs to reduce uncertainties in business and product development. With this goal and challenge, the 4-day Design Sprint 2.0 method was applied.

4.2 Design Sprint 2.0 process description and analysis

4.2.1 Day 1

The first Design Sprint exercise is to understand the challenges that the team faces. It starts with a specialist interview: each team member presents his point of view, for 10 minutes, regarding the challenges and problems that the organization faces. While one member speaks, the other takes notes, on post-its, rewriting the issues in the format "How Might We" (HMW). After each member presented their point of view about the challenges, they placed the HMW post-its on the wall, and each member received dot votes and chose the challenges they considered to be the most relevant to address during the Sprint.

Then, the team created a Two-year goal, from which each IndustryCare member wrote where he pictured the company would be in the future, from an extremely positive perspective. After aligning and defining the goal, the team raised the biggest obstacles that could prevent IndustryCare from reaching that goal. In this exercise, an analysis was made from an extremely negative perspective. The Two-year goal exercise idea is to reformulate the main obstacles in the form of a critical question for the business and product. At the end of Sprint, with the prototype tested with real users, these questions were reviewed and answered objectively (Yes / No).

Having defined the Sprint Challenges, Two-year goal, and Sprint Questions, the team went on to the exercise of drawing the Sprint Map. The map (Fig. 2) provides a view of how the end-user (industry client) interacts with IndustryCare's platform - how he discovers, learns, uses, and what he wants to accomplish by using the solution.

With the map drawn, the participants put the Sprint Challenges post-its in their respective user interactions on the map, which helped the team visualize where the business/product problems were concentrated, helping to create solutions focused on solving those specific challenges of that region/interaction. The area chosen was the one related to the visualization of data in real-time on the dashboard, monitoring the performance and behavior of the industry's machines and processes.

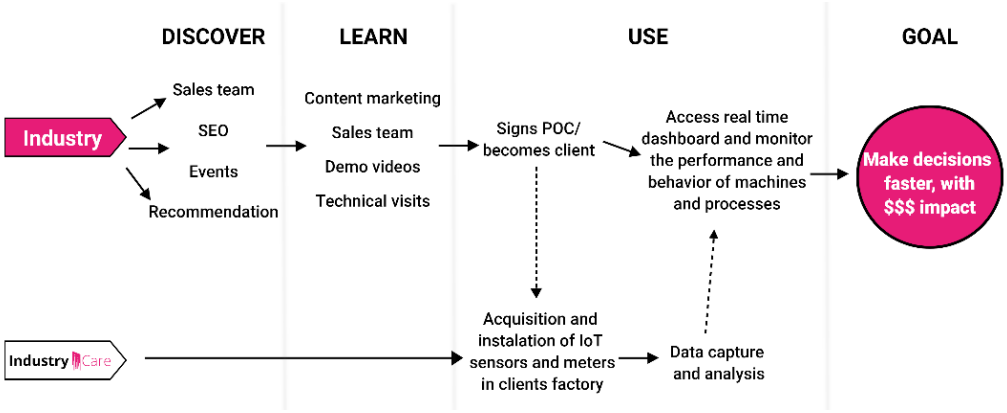

Fig. 2 IndustryCare Sprint Map

The following exercise was Lightning Demo, in which members sought inspirations for solving the challenges of the targeted region of the map. Then, the team started the activity 4-step Sketch: with a note-taking, doodling, trying rapid variations, and finally sketching a solution concept with more details.

4.2.2 Day 2

The solution concepts made on the first day were exposed and presented, creating a heat map with dot votes on the solutions, showing dashboard ideas that could be helpful for industries to monitor in real-time their processes and machines performance and behavior. The heat map exercise helped to show which features ideas were most attractive to the team members.

After creating a heat map, the team chose the best solution to prototype and created its storyboard, with a script to detail the interactions that the prototype would address with the user to answer the Sprint Questions.

4.2.3 Day 3

On the third day, the participants created the prototype's screens and interactions, based on the definitions and specifications raised in the storyboard. The team used Adobe XD (*Adobe XD page*, no date) software to create a high-fidelity prototype (Fig. 3), which simulated the navigation experience of IndustryCare's dashboard, with key indicators of a factory: energy consumption, total savings, energy baseline, productive time, OEE, efficiency and operation rates, among others.

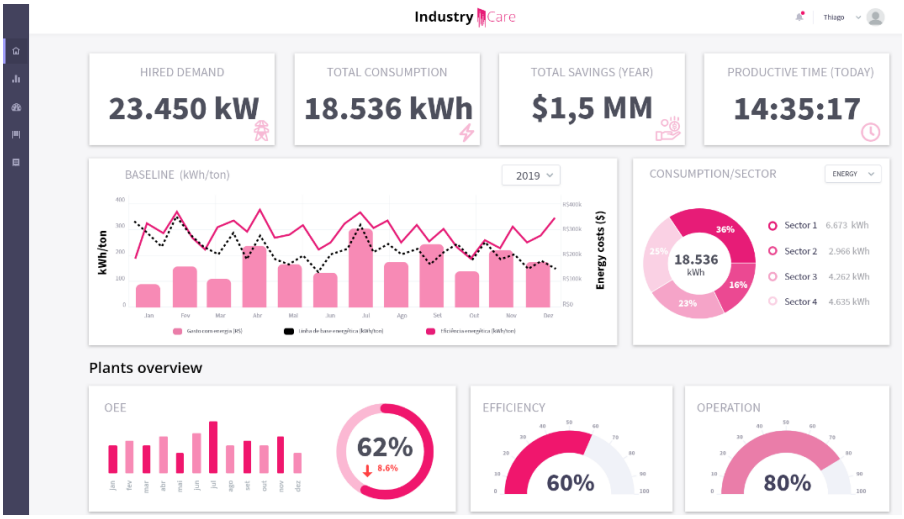

Fig. 3 One of the prototype's screens

IndustryCare entrepreneurs' network was accessed to recruit users for the prototype test, bringing professionals with extensive experience in the industry to evaluate and give feedback on the conceptual prototype. Five people were recruited, as recommended in the Sprint book (Knapp et al, 2017), based on the study that it is possible to raise 84.3% of usability problems with this number of users (Nielsen, 2000). The recruited interviewees represented some of IndustryCare's user personas: industrial, maintenance and utilities managers and energy efficiency experts.

4.2.4 Day 4

On the last day of the Sprint, the team ran five interviews with users to test the developed prototype. The interviews were online, via videoconference, and lasted, on average, 1 hour. Each interviewee received a link to access the prototype, and through screen sharing, it was possible to follow his navigation of the prototype, performing previously defined tasks.

With the interviews and user testing, the team detected some issues and opportunities for improvement, including the best way to navigate and analyze data from a global perspective (i.e., plant view) to a granular perspective (i.e., production line or equipment view). The team learned during the prototype test that different personas have a specific interest in some metrics. They discovered that it would be interesting if the platform had some sort of personalization to highlight some metrics depending on who's accessing it (i.e., industrial manager, maintenance).

Based on the lessons learned from the interviews, the team returned to the Sprint Questions, which took into account the main obstacles that could prevent IndustryCare from reaching its two-year goal and evaluated if their solution was on the right track, as they previously thought.

4.3 Process analysis

By using AJ&Smart Design Sprint 2.0, which runs in 4 days instead of the original 5-day, the researcher and the other entrepreneurs from IndustryCare were able to accelerate their learning and validation of the startup's product vision. The main benefit of this shorter Design Sprint version is that it made it easier to gather the startup's stakeholders (CEO, Sales, Developers), demanding less time to reach the goal of learning. That is possibly one of the reasons that helped AJ&Smart successfully applied its adapted version in large organizations around the world – such as LEGO, Lufthansa, UN, Adidas, among others (*AJ&Smart page*, no date).

With an agile ideation cycle of ideation, prototyping, and testing with real users, the desirability of the solution could be verified with interviewees, giving greater security in the development of the product and business.

Despite the many learnings and positive general feedbacks, with demonstration of acceptance of the application, only one iteration of Design Sprint was not enough to answer all critical business questions raised. To obtain the answers and learnings that the Sprint was not able to bring, it is recommended as a next step to execute a second cycle of the process (iteration Sprint), using the learnings and insights from these interviews to refine the ideas and prototype and test again with five other users. With an iteration Sprint, IndustryCare entrepreneurs could gather more information that will help them answer critical business and product questions, reducing considerably the risks and uncertainty that are very common with startup companies building innovative business models and products.

4 Final considerations

The application of Design Sprint at IndustryCare reinforced the great utility of the method as a support tool in the validation of a business idea, helping entrepreneurs to obtain learning and progress quickly. With the series of activities that the process brings, it was possible to test the application's proposal and raise the most attractive points in the eyes of industry stakeholders, in addition to mapping interactions and features that still need improvement.

Design Sprint's success can be measured in different ways, which are: 1) Preventing failure, 2) Getting validation, 3) Getting some validation, some things to fix, and 4) Getting invalidation (Banfield et al, 2016). In this context, IndustryCare's Sprint was a success, getting some validation and finding out quickly what the entrepreneurs had to work in terms of product development.

Even though the team did not get a complete validation of their product vision, this research showed the power that the Design Sprint process has in helping to quickly test an idea, without significant investments of time and money, supporting innovation and the creation of better products.

The application of the adapted 4-day version of the method, created by Berlin's design agency AJ&Smart, brought good results in terms of the team's engagement and alignment with the challenges and goals of the business. It was possible to develop a high fidelity prototype and test it with users, gathering insights and feedback that helped the entrepreneurs see where improvements were needed.

This paper contributes to the literature bringing another successful case of Design Sprint application, especially in the development of new Industry 4.0 business solutions and technologies. Since Design Sprint results and impact have a subject and qualitative analysis, we recommend for future researches to find an objective and quantitative way to measure the efficiency and impact of the method on the company it was applied.

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