Project info

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Deliverable info

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Contents

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Executive summary

Between February and March 2021, 60 SMEs based in 7 different EU countries (i.e. Italy, Germany, Finland, Lithuania, Spain, Estonia and Denmark) took part in an online User Experience Challenge (UX Challenge) pivoted on the Design Sprint methodology. To establish if taking part in the UX Challenge increased companies' digital design readiness and awareness, the access to the UX Challenge was strictly dependent on randomization. This evaluation design allowed comparing a set of indicators of digital design readiness and awareness in the 60 participating companies (i.e., the treatment group) with the same indicators measured in a set of 130 equivalent companies, which served as a "control group".

The results of this Randomised Controlled Trial (RCT) suggest that the UX Challenge is a promising way to improve participants' objective and practical knowledge about design sprint and digital design. Positive, even if not statistically significant, impacts were also found on participants' positive attitudes towards digital design. However, participants did not show any higher intention to adopt digital design in their companies as compared to the control group. Some organizational and financial constraints may be the reason behind this discrepancy between the largely positive impacts on knowledge (and the tentative positive impacts on attitudes) and the zero impacts on intention to adopt design sprint. More research is needed to investigate these aspects further and to understand whether--and under which circumstances--the increased knowledge about digital design leads to concrete, tangible changes in companies' approaches to digital design.

To the best of our knowledge, this is the first and only experimental study on the impact of an innovation contest on user-centered design offered as-a-service to digital companies with the aim of increasing digital design readiness and awareness. Future studies are needed to consolidate these findings. Particularly, this study suffered from small sample size, which limits the statistical power of the experiment, and from a very high differential attrition, due to the much lower response rate in the Follow Up survey obtained in the control group. A number of statistical checks and a range of different impact estimation approaches have been performed, and these are to some extent reassuring that attrition was not systematically linked to some relevant company or participant characteristic. However, future studies in this field should assign highest priority to experiment designs or incentives mechanism aimed at reducing attrition.

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1. Introduction

1.1 Rationale of the intervention

Pursuing optimal design and user experience of digital products is key for companies that seek to stay competitive in the market. User-centered design methodologies inspired by design thinking, such as the Design Sprint, have the potential of substantially improving the quality of digital products design. Yet, many SMEs are not aware of the added value of these techniques and are not equipped to adopt them.

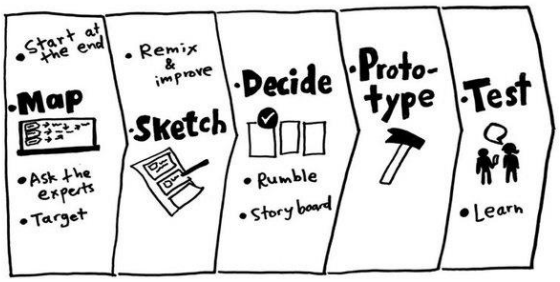
Private and public design and innovation agencies and intermediaries are activating services and support programs aiming at supporting companies and other innovation players in adopting user-centered design and design thinking methodologies for boosting companies' innovation capacity. The European Commission has been launching calls for projects specifically aiming at building capacity in innovation agencies for activating new SME innovation support programs (e.g. H2020 program INNOSUP).

Following SME innovation policy design recommendations from the European Commission, Hub Innovazione Trentino (an innovation agency located in northern Italy) in 2017 created a new SME innovation program aiming at raising the awareness of companies about the benefits of user centric design, as well as boosting their capacity to engage in open innovation processes. The program, which came in the form of an innovation contest, is the UX Challenge.

The **UX Challenge** (User Experience Challenge) is a 2-day Design Sprint hackathon that makes it possible for companies, especially SMEs - small and medium enterprises developing digital products and services (e.g. software, apps, etc.), to expericen the benefits of user-centered design methodologies, especially, the Design Sprint. The Challenge awards the best solution to User Experience (UX) problems launched by a set of selected SMEs. Solutions are developed by teams of students and professionals during a 2-day event pivoted from the Design Sprint methodology. Notably, differently from traditional prize initiatives, the UX Challenge allows delivering prototype solutions to a number of products and companies concurrently, since the activities of teams of Solvers are divided in parallel tracks (one per served companies). A short promotional video of the initiative is available here. Recent research has shown how the UX Challenge can accommodate new variants of the Design Sprint[1].

[1] Magistretti, S., Dell'Era, C., & Doppio, N. (2020). Design sprint for SMEs: an organizational taxonomy based on configuration theory. Management Decision.

The **Design Sprint**[2] is a five-day process for applying design thinking approaches to find solutions to business and product development problems through design, prototyping, and testing ideas with customers. The Design Sprint was developed at GV - Former Google ventures, startup incubator and accelerator from Alphabet, with the purpose of effectively fostering product development and innovation in startups.



Innovation Challenges[3] are Open Innovation initiatives similar to innovation prizes, that offer incentives for advancing research, technology, and generally addressing unsolved innovation problems that often impact society as a whole. Innovation Challenges can be utilized to accelerate Open Innovation in companies, especially in SMEs. In Innovation Challenges, SMEs work hands-on with students, researchers, or startups, who act as "solvers", and compete to provide the best solution to a product development or innovation problem. The solutions are intended to be very practical and in the form of new technology or business ideas, prototypes, or insights from field testing. Their success in supporting innovation in companies led to prizes and contests being recognized and studied as effective innovation policy instruments. Early guidelines for innovation intermediaries (including non-profit or public-funded agencies) were developed on how to successfully design innovation prizes for other purposes, not necessarily regarding major social or technological challenges. Recent research with major implications for practitioners has shown what are the parameters that need to be considered for designing and running Innovation Challenges specifically aiming at impacting on SMEs innovation capacity[4].

1.2 Description of the UX Challenge

The **UX Challenge format is an adapted, more condensed version of the Design Sprint**, encapsulated into a hackathon event. This format is intended to reach its awareness raising aims, also in the light of constraints experienced by innovation agencies such as lack of budget and strict time frames. In particular, an adapted version of the Design Sprint differs from the original as follows.

- **The duration:** The Design Sprint lasts five days while the UX Challenge covers all the phases of a Sprint within a 2-day time frame. SMEs (especially small companies) do not have much time to invest in innovation initiatives often because they do not have a proper R&D structure. Similarly, the 2-day

[2] Knapp, J., Zeratsky, J. and Kowitz, B. (2016), Sprint: How to Solve Big Problems and Test New Ideas in Just Five Days, Simon and Schuster, New York.

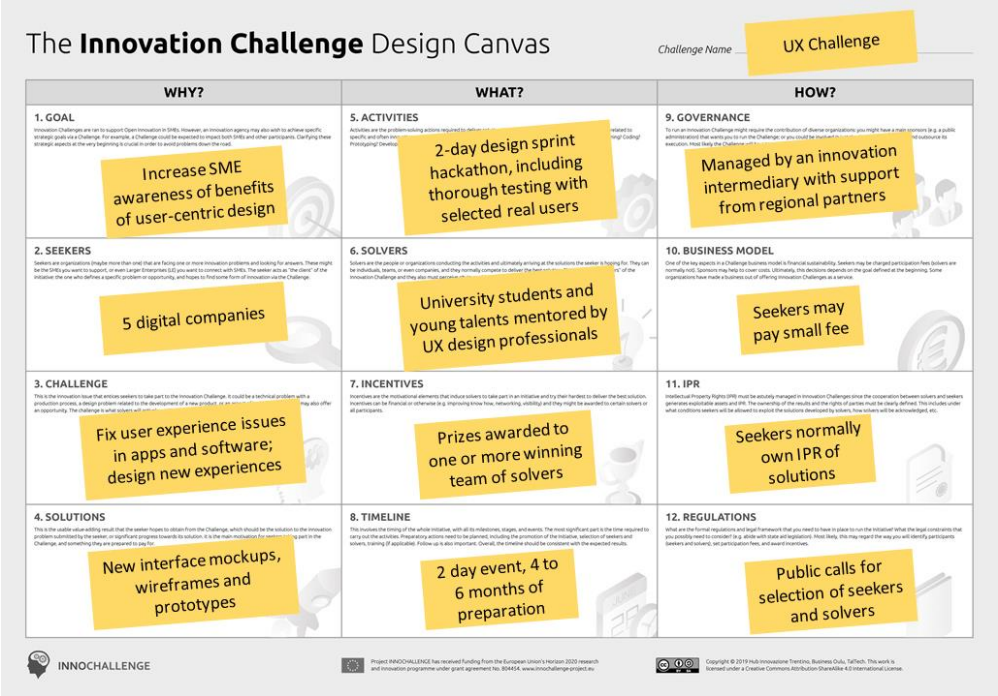
[3] Doppio, N., Mion, L., Latilla, V. M., Franzò, S., & Frattini, F. (2019). Innovation Prizes to Implement Regional Open Innovation policies for Small and Medium-sized Enterprises: a Case Study from an Italian Intermediary. XXX ISPIM Innovation Conference 16-19 June 2019, 1–17.

[4] Doppio, N., Väinämö, S., Haukipuro, L., (2020), Design elements of innovation contests supporting Open Innovation in SMEs – An action research study, Journal of Innovation Management, www.open-jim.org, 8(4), 26-56.

time frame is enough to deliver demonstrative results and still impact SME awareness on the benefits of the Sprint.

- **The team mix:** The Design Sprint is executed by members from the beneficiary company (many of whom are normally chosen from the product development team) plus one or more facilitators from a design firm. Instead, within the UX Challenge the Sprint is executed "as-a-service" to companies by teams of university students (Solvers) and professionals (Mentors) with a background in service, UX/UI design and/or HCI (human-computer interaction). The beneficiary company participates in all crucial steps of the Sprint. This way the execution of the Sprint has very small costs for the organizing innovation agency since students are strongly motivated by learning-in-practice and career development reasons, and professional mentors are interested in showing their abilities to potential future customers.

The working model of the UX Challenge is described hereafter following the overall framework of all design dimensions featuring an innovation contest. It's crucial to identify these dimensions as by acting on them one innovation agency can design a brand-new Innovation Challenge or adapt an existing one to specific contexts (e.g. type of targeted SMEs or industries).

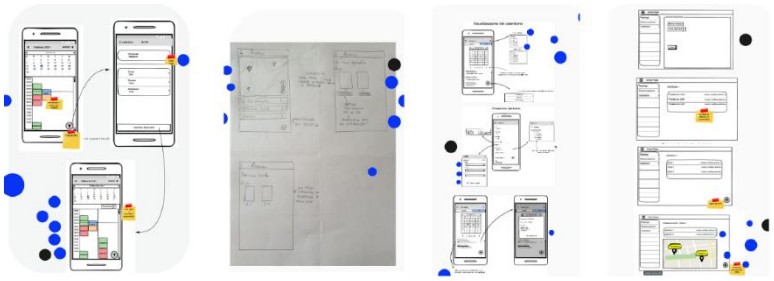


1. Goal. Strategic goal of the UX Challenge is to accelerate the adoption of user-centric design methods and practices by small and medium enterprises. This is done by means of involving students and young design talents in the execution of shorter versions of a Design Sprint aimed at designing or innovating products and services.

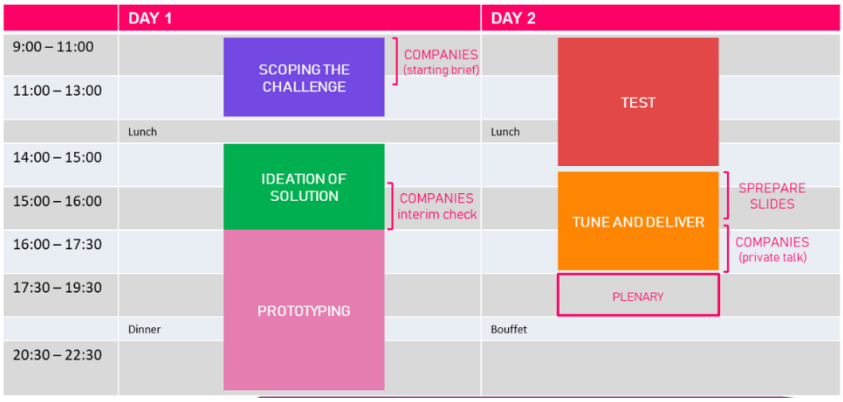
2. Seekers. These are the beneficiary companies – SMEs – mainly developing digital products and related services, but they can also belong to the manufacturing industry, or beyond. Companies apply to the Challenge with their products from among which the Challenge "activities" are selected (not companies). Products are such as mobile app, web app, software, or other digital interfaces utilized to operate production machineries and lines.

3. Challenge. Companies bring to the UX Challenge digital products (mobile apps, web apps, software) affected by UX-related problems and/or opportunities. Along with problems, companies bring innovation-related objectives (e.g. improving usability, designing new features, redesigning certain functionalities, etc.), hypotheses, or research questions. Altogether, these make up the so-called Challenge Brief. Products may come with very different degrees of maturation: from products already on the market to product concepts.

4. Solutions. Actionable design components and insights allowing companies to implement and industrialize an improved version of the selected product: these could be interactive prototypes developed with specific softwares, interface mock-ups, videos from user testing, user journeys, documents including guidelines for UX redesign etc.



5. Activities. Within the UX Challenge the condensed 2-day Sprint.is adapted in order to apply not only to strict design problems (aiming at developing and testing product prototypes starting from ideas and concepts), but also to re-design products and services (applying to existing products). By the end of the two days the teams present the results of their Sprint and the related outputs to the companies during a 1-hour meeting. The 2-day Challenge finally culminates with a 1,5 - 2 hours long Plenary Session organized as an event open to the public, at which the teams pitch their solutions to all participants. This may involve more than 100 people in the audience.



In order to execute those activities, some resources are needed. The Sprint involves **a testing phase which requires the involvement of real end users**. 40 citizens are invited to test the products and prototypes (4 per each team). The test consists of a 1-hour test-based interview executed by Solvers. Testers must be accurately outreached and selected, according to the profile of the selected products and companies. This can be quite challenging, especially in the case of B2B products. Incentives for Testers are normally some relevant vouchers (at a value of about 30€). For the easier outreach and selection of the Testers a dedicated database or platform can be used. The organizer can also ask for support from the selected companies in order to get in touch with their potential customers. Overall, organizers have to have in place a selection process which ends up in identifying and bringing to the UX Challenge the needed 40 testers in the morning of the 2nd day. Notice that day 2 could be a working day, making this rather hard to accomplish.

6. Solvers. Solvers are university students (including Ph.D. students) and young professionals (recently graduated students, junior designers already working) mainly with a background in UX design, interaction design and human-computer interaction (computer scientists, designers, sociologists, psychologists, economists). Solvers are organized into teams and each team is mentored by at least one Mentor (a UX design professional or researcher). Mentors take part in the two days free of charge. Team formation is driven

by the organizers. Each team normally counts 4 to 5 solvers. Each team is associated with one product / company. In total one UX Challenge involves about 50 solvers.

7. Incentives. Teams' results are evaluated by a jury, possibly involving all beneficiary companies (10), Mentors (10), and normally 2 external experts. Usually only one winning team is awarded. A reward is provided to all Solvers from the winning team (could be free participation to a conference, or free access to a training or MOOCs). However, following current literature on incentives at prize-driven events, the UX Challenge leverages on intrinsic motivations of Solvers (professional learning experience and connection with companies).

8. Timeline. Execution of the UX Challenge sprint endures 2 days plus a half-day of training for Solvers upfront (5-10 days before the Sprint itself). Overall, the process for outreaching and selecting all participants needs to start at least four months in advance (launch of the public call for selection of SMEs and students, and management of the actual selection process). Prior to that, capacity building activities (creation of partnerships, legal, marketing and communication aspects) may require further 2 to 4 months.

9. Governance. The UX Challenge is organized by an innovation support intermediary (e.g. Hub Innovazione Trentino - www.trentinoinnovation.eu) that is responsible and accountable for the realization of the initiative and can leverage on local partners in the ecosystem that can support it in executing certain tasks (e.g. reaching out to companies or Solvers). Although the Challenge may be executed as a result of a distributed consortium-based effort, it's very important that all partners are aware that the accountability is upon one party only.

10. Business Model. Participating companies are normally required to pay a small fee to take part in the UX Challenge. Solvers or Mentors do not pay, in fact, Solvers are provided incentives or rewards, and the same goes for Testers. Mentors are also provided with some gifts. All costs needed to execute a UX Challenge (we estimate them as between 7 to 10 K€ in direct costs, plus 4 months of personnel costs) are covered by the organizer who normally runs the Challenge for ecosystem and SME capacity building purposes (not for generating revenues). However, one organizer might consider charging companies as much as needed to cover all the costs, and possibly generating profit. It must be noted that, however, this is likely to be feasible only in case internal operations and networks with all participants (Solvers, Mentors, and companies) are well established.

11. IPR. In order to make the full exploitation capacity from companies possible, IPR - Intellectual Property Rights - of results are owned by the participating companies. NDAs - Non-Disclosure Agreements - are signed by Solvers and Mentors with regards to both solutions and submitted challenges.

12. Regulations. The outreach and selection of Seekers (companies) and Solvers (young talents) is managed via two separate public calls for notice published by the organizer. Each call includes full regulations of the initiative, and the criteria and process for evaluation of applications such as (for Seekers): 1) relevance of the product and challenge to the user experience domain; 2) feasibility (e.g. learnability of the product); 3)

potential business impact of the Sprint application; 4) clarity of the submitted challenge; 5) soundness of the motivations brought by the applying company. A third open call is normally managed to identify the Testers.

1.3 Concept and implementation of the RCT

The 200SMEchallenge project aimed at providing evidence about the feasibility for innovation agencies of activating and making available to a set of European SMEs a Design Sprint initiative coming in the format of an innovation contest. The initiative is intended to impact companies' awareness about the benefits of user-centered design. This initiative is called "UX Challenge" (User Experience Challenge).

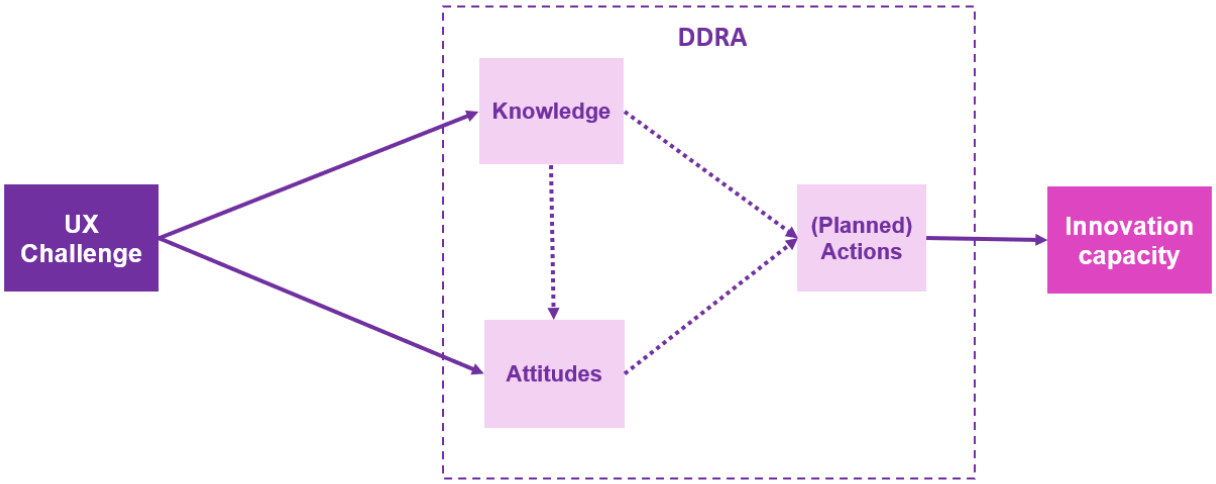
The impact of the initiative was evaluated in project 200SMEchallenge through a Randomized Controlled Trial (hereafter also RCT), whose implementation and results are illustrated in this report.[5] The ultimate outcome (not measured) is SMEs innovation capacity. In the long run, participating in the intervention should lead to an enhanced capacity of the companies to design more innovative and valuable products and services and therefore be more competitive. Measuring such long-term impacts is out of the scope of this RCT, which rather focuses on intermediate, short-term outcomes. Particularly, it focuses on the concept of Digital Design Readiness and Awareness (DDRA). A positive link between DDRA and innovation capacity is assumed. DDRA is meant as a mix of knowledge, attitudes and behaviors linked to SMEs' take up of digital design approaches in their activity.

First, it is expected that the treatment increases perceived and objective knowledge of user-centered design approaches and design sprint by companies. The treatment should also lead companies to develop more positive attitudes towards the use of innovative design techniques and to value the potential benefit of user-centered design for business.

Finally, as a consequence of increased knowledge and enhanced recognition of the benefits coming from user-centered design, companies should show higher willingness to undertake concrete actions to widen and improve the use of innovative design techniques in their business (indeed a positive, even if not very strong correlation is found between knowledge on design thinking and intention to adopt design thinking). Because of the limited time frame between the implementation of the intervention and the outcome data collection, the analysis focuses on "planned" actions instead of concretely implemented actions.

[5] The study was preregistered at the AEA RCT Registry: https://doi.org/10.1257/rct.6246-1.0.

Figure 1 The UX-Challenge's Theory of Change



Hence, the evaluation question addressed within the experiment reads:

> for SMEs who operate in the digital industry sector or other SMEs who develops products bearing digital interfaces (the population), does participating in the UX Challenge (the intervention), rather than not participating (the control), enhance knowledge, attitudes and intention to adopt the innovative approaches in the design of digital products (the outcome)?

The project was conducted between February and March 2021 in seven EU cities and related regional ecosystems: Trentino (Italy), Karlsruhe (Germany), Oulu (Finland), Vilnius (Lithuania), Castellon (Spain), Tallinn (Estonia), Copenhagen (Denmark). Because of the COVID-19 pandemic, the intervention had to be changed in regard to both its setting and its duration. Originally the UX Challenge should have taken place in the form of a face to face event, allowing not only for simultaneous interaction and teamwork, but also for networking amongst all participants (e.g. between the many involved companies and mentors). Differently, in order to cope with social distancing, the UX Challenges took place online. Second, originally the UX Challenge should have lasted 2 full days. Because of the change of setting, the schedule was changed too, as it was deemed unsustainable to plan for full-time day operations on a remote / online setting. As a result, the Challenge lasted 2 days in Lithuania, 2.5 days in Finland and Germany, 3 days in Estonia, Denmark and Spain and five days part-time in Italy.[6]

[6] See Appendix I for the detailed timetable of the entire project and deliverable 2.2 (available at: https://www.200smechallenge.eu/deliverables/) for a detailed description of the intervention.

2. RCT design and data collection plan

2.1 Surveys and data collection

Baseline data were collected at the moment of company application. The application consisted in a module (Application Form, AF) in which the applicants provided information on the product/challenge they wanted to include in the Challenge and some information about the reference person within the company (i.e., the person who is in charge of filling in the questionnaires and participates in the challenge, if randomized in).

On top of the AF, the reference person in the company had to fill in a Baseline Survey (BS), which was delivered online and which collected a company and respondent information as well as the pre-intervention levels of the outcome variables.[7]

The online form was subject to internal testing and was also tested with a small number of companies. The google form was made available in English and in the countries' national languages (i.e., Italian, Spanish, Finnish and German), where requested.

Three weeks after the UX-Challenge all companies were invited to take part in the Follow Up Survey (FUS), which was delivered in the same online format and which collected post-intervention outcomes as well as some information about UX-Challenge participants' satisfaction with the Challenge (the full questionnaire is available in Appendix II).

2.2 Outcome measures

Based on the theory of change presented above (Figure 1), three outcome dimensions were identified and measured through batteries of items and Likert-scale questions based on the FUS questionnaire (Appendix II). A literature search was carried out in order to identify validated scales to be used. Unfortunately, this search did not lead to any useful results, hence the research team had to build new indices in regard to the each of the three dimensions.

As part of the knowledge dimension, the evaluation considered three indicators;

(1) "**General Design Knowledge**" is aimed at capturing respondents' self-perceived general knowledge about methodologies such as User Centered Design, Design Thinking and Design Sprint and is measured through a Likert-scale question analyzed with principal component analysis.

(2) "**Design Sprint Knowledge**" is aimed at measuring respondents' actual knowledge about the contents of the specific five phases of the Design Sprint and is computed through a quiz-like battery of five questions. Respondents were given 4 answer options: a wrong answer gave 0 points, a correct answer gave 4 points, a partially correct answer gave 1 point, while those responding "I don't know" received 0 points. Other scoring modalities (e.g. assigning 3 instead of 4 points to the correct answers) were also used to test the robustness of the index.

[7] The questionnaire is available in Deliverable 4.1 "Research plan for pilot scheme impact evaluation" (https://www.200smechallenge.eu/deliverables/).

(3) "**Knowledge to Implement Design Sprint**" captures respondents' self-reported ability to perform a Design Sprint and, more precisely, to implement the five phases of it. It is measured through a Likert-scale question also analyzed with principal component analysis.

The second dimension—i.e., attitudes towards digital design—is measured with one additive index ("**Attitudes towards Design Sprint**") based on the responses to a set of items aimed at capturing the benefits that their companies would enjoy from each of the five phases of Design Sprint for their company. The obtained index is then rescaled using the answer to a second question (Q11 in the BS and Q12 in the FUS) as a weight of the importance that respondents assign to design thinking and user-centered design to improve innovation in their companies.

Finally, the third dimension (i.e. **Planned actions**) is measured through two indices, which capture respondents' aspirations and expectations about the investment in digital design and adoption of digital design techniques by their company in the next 6 to 12 months. The first question asks the extent to which the respondents would like that their company undertake any of the listed actions, while the second question asks the extent to which they believe that their company will actually undertake the same list of actions. Both questions are Likert questions and they are analyzed with principal component analysis.

Table 1 provides a detailed description of how each outcome variable was constructed, while the wording of the questions and the items can be found in the questionnaire directly (Appendix II). To improve understandability and comparability of the computed scores, all of them have been normalized having 0 as a minimum value and 10 as a maximum value.

Table 1 Overview of the outcome variables

Indices	Question				Index		Cronbach's alpha	
	BS	FUS	N° Items	Type	Method	Metric	BS	FUS
Knowledge								
General Design Knowledge (Self-perceived)	Q9	Q5	6	Likert scale	Principal Component Analysis	Normalized score, 0-10	.905	.906
Design Sprint Knowledge (Quiz)	n.a.	Q7-Q11	5	quiz	Summative index	Normalized score, 0-10	n.a.	n.a.
Knowledge to Implement Design Sprint	Q10	Q6	5	Likert scale	Principal Component Analysis	Normalized score, 0-10	.824	.876
Attitudes								

Attitudes towards Design Sprint	Q12	Q13	5	Score	Weighted summative Index	Normalized score, 0-10	.688	.761
Planned actions								
Desired Design Sprint Adoption by the Company in the next 6-12 months	Q13	Q14	7	Likert scale	Principal Component Analysis	Normalized score, 0-10	.774	.791
Expected Design Sprint Adoption by the Company in the next 6-12 months	Q14	Q15	7	Likert scale	Principal Component Analysis	Normalized score, 0-10	.838	.809

3. Recruitment and participant profile at baseline

3.1 Recruitment

Company participation happened on a voluntary basis in response to an open recruitment campaign that was carried out by national partners' exploiting several channels, including social media, internet advertisements, direct contacts. Recruitment took place between October 2020 and January 2021. The recruitment period was extended in some countries in order to collect more applications (Table 2).

A total of 208 applications were collected across the seven EU regions. 16 companies were excluded because either non-eligible[8] or because they presented a product or a challenge, which was not considered suitable.[9] Two more companies were excluded after formal checks in the applications that were communicated at a later stage. The remaining 190 companies were finally included in the randomization (see Figure 8).

Table 2 Recruitment process, by country

Country	Recruitment closed	Total applications	Eligible and suitable applications
DENMARK	Feb 2 2021	23	23
ESTONIA	Jan 8 2021	38	35
FINLAND	Feb 1 2021	25	21
GERMANY	Dec 18 2020	31	29
ITALY	Dec 11 2020	37	32
LITHUANIA	Dec 18 2020	33	32
SPAIN	Jan 22 2021	21	18
Total	**Jan 22 2021**	**208**	**190**

Note: See Appendix I for details on the timeline of the experimentation.

[8] To be eligible a company had to be an SME, with less than 250 employees and a 2019 turnover below 50 M€ or a balance sheet total lower than 43 M€. Moreover, the applicants had to complete the application form and the baseline survey within the set deadline.

[9] The products presented at applications were rated by each national partner on a score from 5 to 25, resulting from the following five indicators: ease of use; possibility to involve generic users; interactivity; innovative feature; motivation and expectations. See Deliverable 4.1 "Research plan for pilot scheme impact evaluation" for more details about the recruitment protocol.

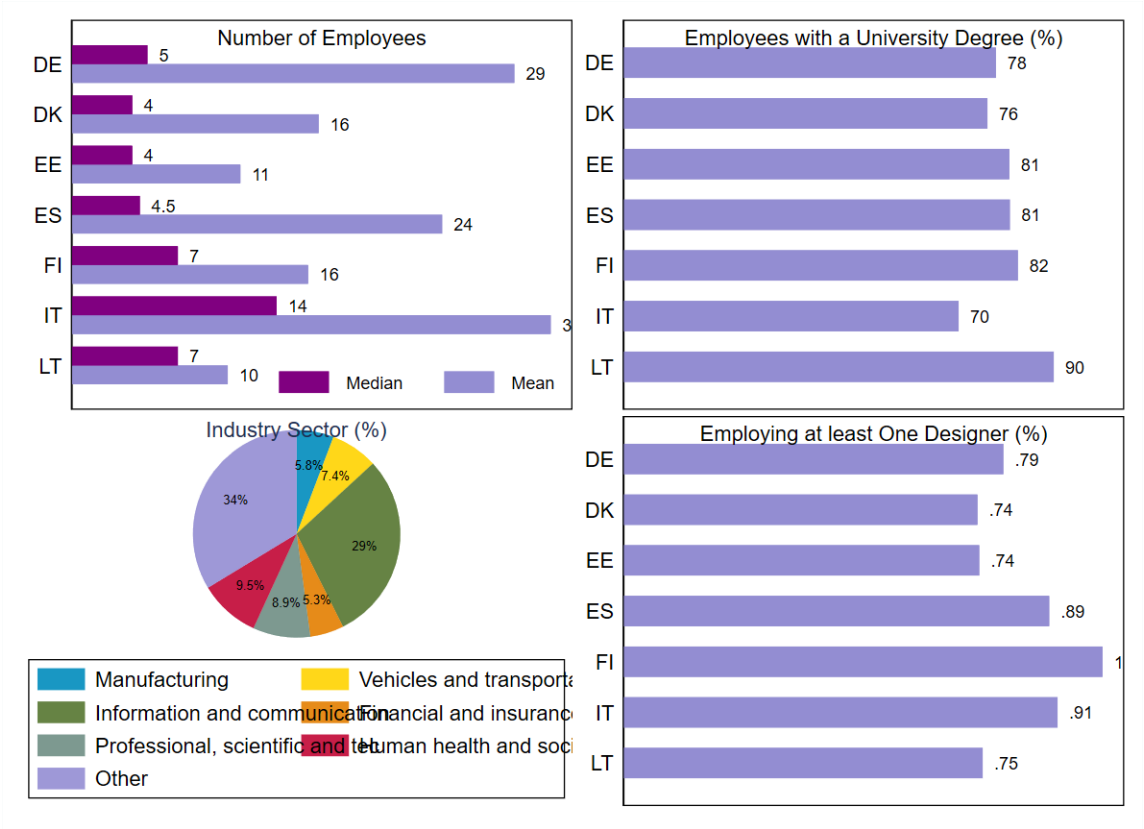
3.2 Participant profile

The average admitted company has 19.5 employees, while the median company has 6 employees. The discrepancy between the mean and the median values is due to the few, very large companies in the sample, which inflate the average estimate.

The largest industry sector in the sample is represented by ICT, accounting for 29.6% of all companies. Companies also show high levels of connection with Tertiary Education institutions as, on average, 79.6% of all the employees of the participating companies hold a University degree and nearly 50% of the companies have an active collaboration with a university or a research center.

Finally, 8 company of 10 have at least a designer among their employees.[10] Differences between countries are shown in Figure 2.

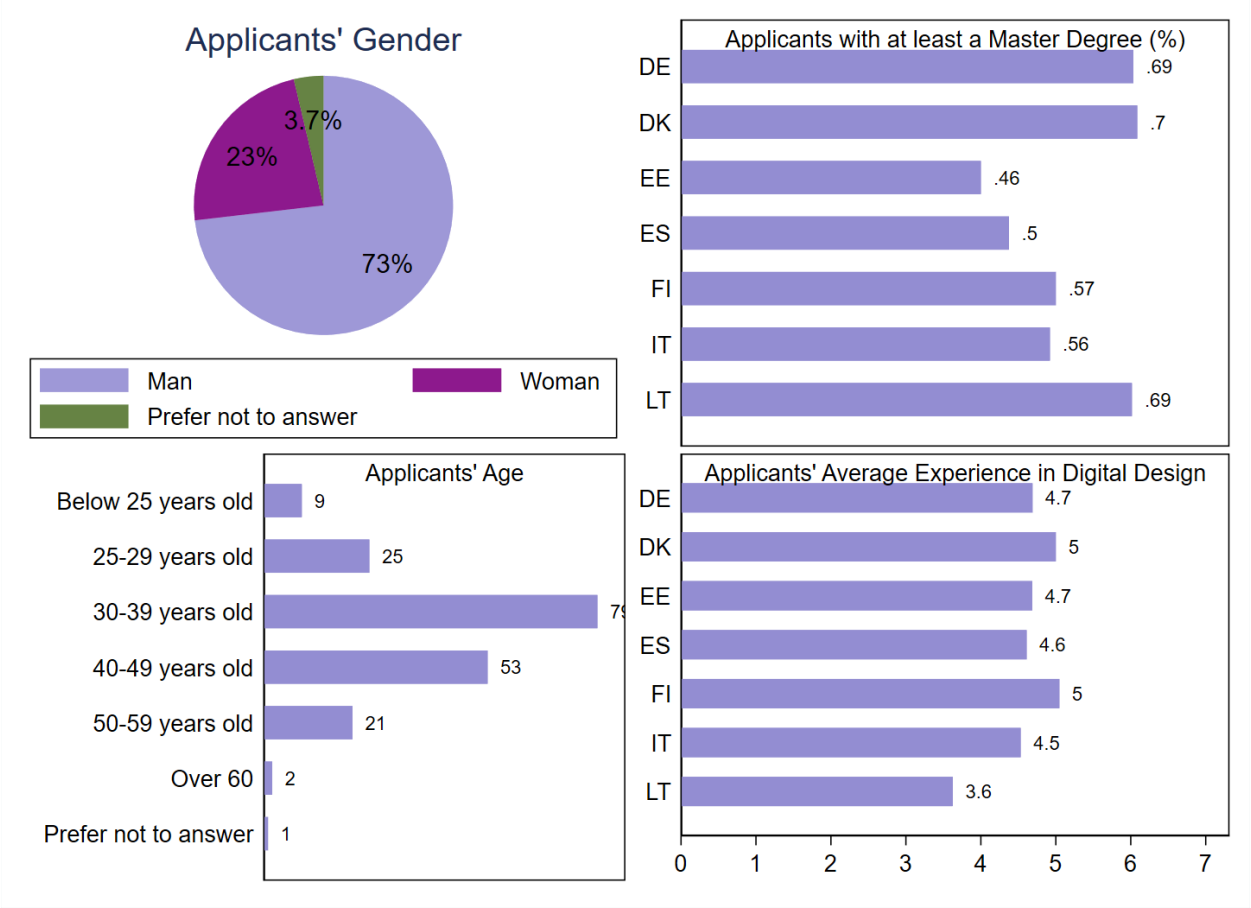
Figure 2 Company characteristics



[10] Question Q8 in Baseline Survey: At least one person in the company holding any of the following roles: UX (User Experience) Designer," "Interaction Designer, Information Architect, UI (User Interface) Designer, Service Designer, Research and Development Staff.

Regarding the 200SME Challenge reference persons within the companies, the largest majority of them (73%) are males. The majority (59.5%) is younger than 40 years old and 57.5% has a Master degree (or a higher degree). Also, on a scale from 0 to 7, respondents show an average expertise in digital design of 4.6.[11]

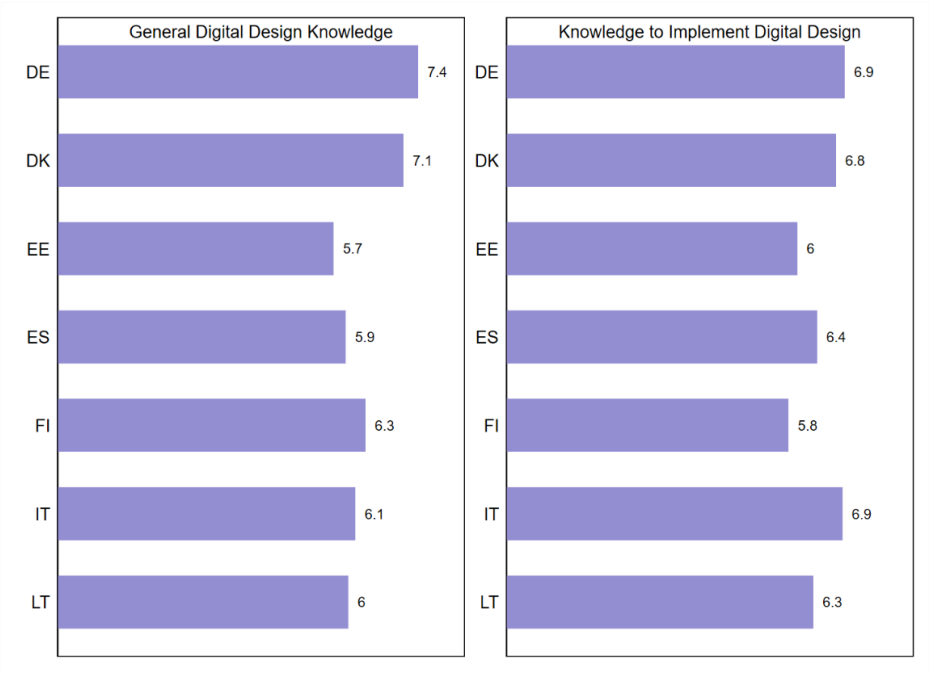
Figure 3 Applicant characteristics



On a scale from 0 to 10, applicants show an average self-perceived general knowledge about digital design of 6.3, while, on the same scale from 0 to 10, they show an average knowledge to implement design sprint of 6.4. Figure 4 shows country values for these two indicators.

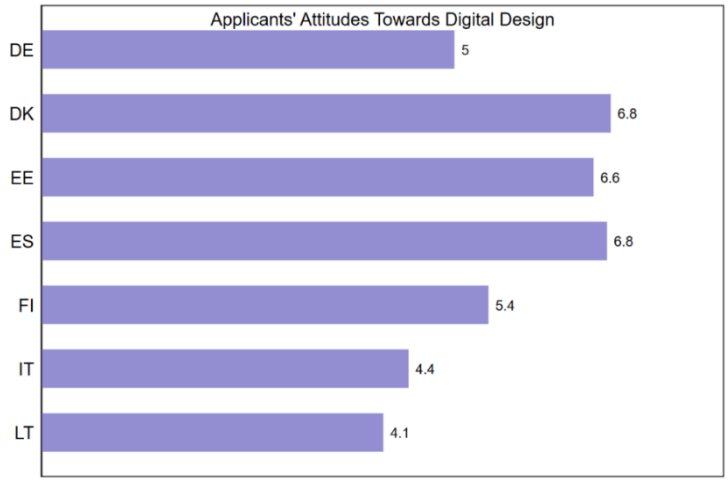
[11] Question Q23 in the Baseline Survey: Have you ever engaged in any of the following activities? Answer modalities: 1) Yes; 2) No; Involved users or customers to test ideas or prototypes of new products and services, or their functionalities; Collected direct feedback (e.g. via interview) from your users or customers about your existing products in order to improve their functionalities; Utilized methods such as "idea sketching", "scenarios", "storyboarding") to support the ideation and early design of new products or functionalities; Taken part to a "Design Sprint" (a 5-phase process developed by Google Ventures used to develop user-validated solutions to design problems); Taken part to an innovation contest / innovation challenge (including hackathons); Innovated existing products or ideated / designed new ones in collaboration with customers; Innovated existing products or ideated / designed new ones in collaboration with suppliers. The index is a sum of the question's items. Range 0-7.

Figure 4 Design knowledge at baseline, country averages



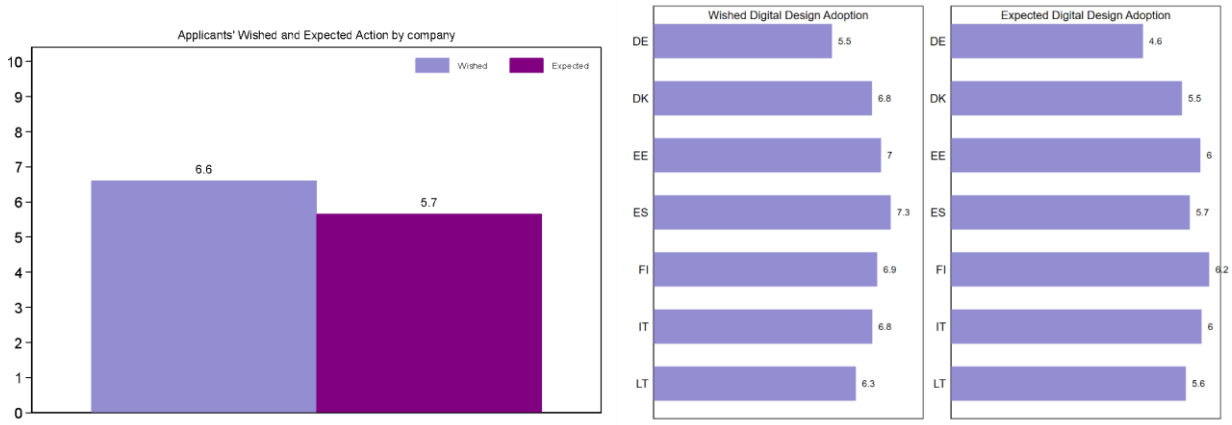
On a scale from 0 to 10, applicants show an average level of positive attitudes toward digital design of 5.5.

Figure 5 Attitudes towards design at baseline, country averages



On average, on a scale from 0 to 10, the extent to which applicants wish that their companies take action in regard to digital design is estimated at 6.6, while a lower value (5.7) is found when applicants are asked to state whether they expect that their company will actually takes concrete action. The difference is highly statistically significant (t=6.4, p-value=.00); hence it can be concluded that in the analyzed sample subjects wish their companies engage more in digital design than they think they actually will. As above, Figure 76 shows country differences on these two indicators. In all countries, expectations are lower than wishes, providing additional support to the conclusion that participants are positive about the usage of design sprint in their companies.

Figure 6 Desired and Expected Design Sprint Adoption by the Company at baseline, country averages

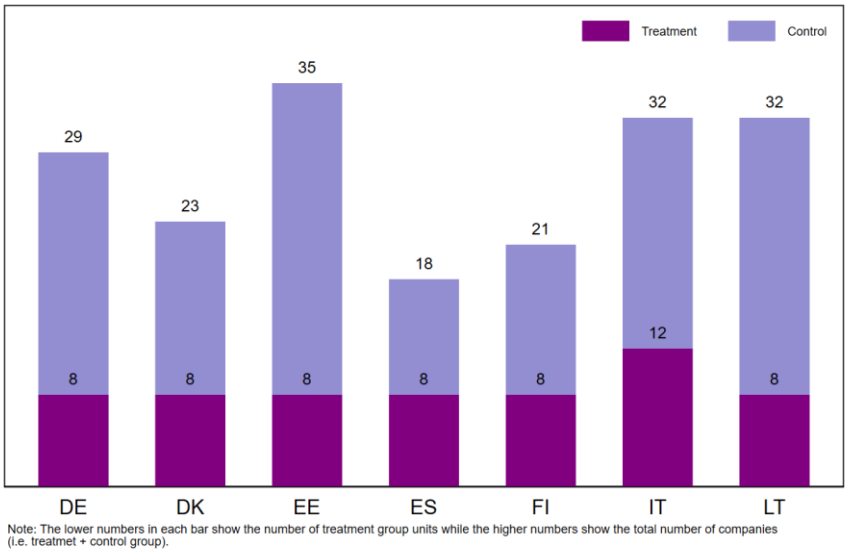


4. Randomisation

4.1 Random assignment

The 190 eligible and suitable applications were collected across the 7 countries and distributed as shown below between treatment (N=60) and control (N=130) groups. With the exception of Italy, each country could cater for 8 companies. Hence, a part from Italy, where 12 companies were randomized in, the treatment group in all remaining countries was composed of 8 companies.

Figure 7 Treatment and control groups size, by country



Note: The lower numbers in each bar show the number of treatment group units while the higher numbers show the total number of companies (i.e. treatmet + control group).

A stratified randomization design was conducted within each country. The randomization strata were based on applicants' level of design experience, as this was found to be a good predictor of pre-treatment outcomes. In all countries, applicants were classified as either below or above the national's median value of design experience. In Italy, a second stratum variable (i.e. location of the company in Trentino vs in another region) was also used. Hence, in total in Italy, 4 instead of 2 strata were used.

Randomization was performed as soon as a country officially closed its recruitment and the list of applicants was checked and established (see section 3). The randomization outcome was then communicated to companies.

Because of the different sizes of treatment and control groups, the allocation ratio slightly differs across countries.

Table 3 Overview of the adopted randomization procedure

Country	Randomization strata	Allocation ratio	Randomization	Randomization communicated to companies
Denmark	experience (2)	0.35	Feb 5	Feb 8
Estonia	experience (2)	0.22	Jan 11	Jan 18-27
Finland	experience (2)	0.38	Feb 3	Feb 4
Germany	experience (2)	0.28	Dec 23	Jan 8 - 15
Italy	experience (2) x Trento (2)	0.38	Dec 23	Dec 23
Lithuania	experience (2)	0.25	Dec 23	Dec 23
Spain	experience (2)	0.42	Feb 10	Feb 15

4.2 Group equivalence checks

Compliance with random assignment was high. Only two treated companies refused to take part in the UX-Challenge because of internal organizational issues. These two companies were replaced with random companies taken from the control group. [12]

The two groups' baseline characteristics are, on average, equivalent, as evident from t-tests, which show that there exist no statistically significant differences between treatment and control group's values of the observed baseline characteristics of companies and individual respondents. Even if not statistically significant, though, some differences between the two groups are worth being noted. At the company level, control companies are more concentrated in the ICT sector (31.5% vs 25% in the treatment group). At the respondent level, control group applicants show a younger age and a higher proportion of Master-level graduated (61 vs 55%). When considering pre-treatment outcomes, the two knowledge indicators are less balanced than the others across the two groups.

[12] On a different level, in two cases the project reference person in the company (i.e. the person in charge of filling in the questionnaires and participating in the UX-Challenge in case of belonging to the treatment group) did not fill in the FUS, but a colleague did it for them.

Table 4 Group balance at baseline

	(1) Controls (mean)	(2) Treated (mean)	(3) T-test (p-value)	(4) Standardized difference (Standardized Effect size)
Pre-intervention outcomes				
General Design Knowledge	6.241	6.511	0.457	.116
Knowledge to Implement Design Sprint	6.372	6.605	0.464	.114
Attitudes towards Design Sprint	5.479	5.502	0.955	.001
Desired Design Sprint Adoption	6.572	6.717	0.695	.061
Expected Design Sprint Adoption	5.620	5.781	0.630	.075
Company characteristics				
Company ICT sector (%)	0.315	0.250	0.361	-.142
N employees	19.054	20.583	0.777	.044
Company has research collaboration (%)	0.485	0.500	0.845	.030
Company has a designer (%)	0.815	0.833	0.766	.046
HE graduates (%)	79.426	79.875	0.920	.016
Respondent characteristics				
Design experience (0-7)	4.531	4.600	0.784	.043
Older than 40 yrs old (%)	0.369	0.483	0.138	.231
Has a master degree (%)	0.615	0.550	0.396	-.132
Suitability score (5-25)	19.469	19.633	0.737	.052

N	130	60	190	190

Overall, based on a joint test (Table 5) the observable characteristics cannot predict treatment assignment; hence the groups are confirmed equivalent based on the baseline characteristics.

Table 5 Joint-test (F test) of being treated at baseline

Variables	Coefficient [95% confidence intervals]
General Design Knowledge	0.011 [-0.027,0.050]
Knowledge to Implement Design Sprint	0.003 [-0.039,0.045]
Attitudes towards Design Sprint	-0.003 [-0.038,0.033]
Desired Design Sprint Adoption	-0.007 [-0.048,0.034]
Expected Design Sprint Adoption	0.005 [-0.040,0.050]
Company ICT sector (%)	-0.071 [-0.244,0.102]
N employees	-0.000 [-0.003,0.002]
Company has research collaboration (%)	-0.014 [-0.173,0.145]
Company has a designer (%)	-0.021 [-0.231,0.190]
HE graduates (%)	0.000 [-0.002,0.003]

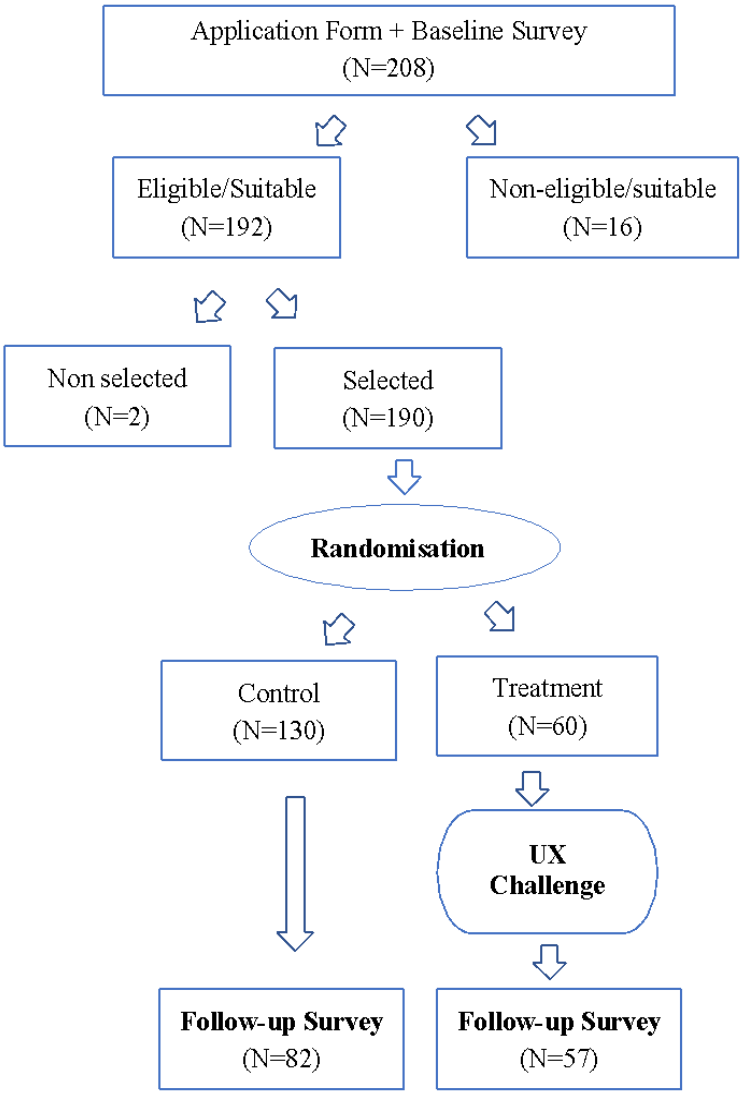
Design experience (0-7)	0.062
	[-0.028,0.152]
Older than 40 yrs old (%)	0.092
	[-0.073,0.258]
Has a master degree (%)	-0.094
	[-0.257,0.068]
Suitability score (5-25)	0.016
	[-0.011,0.043]
Constant	-0.300
	[-0.963,0.363]
N	190

* p<0.10, ** p<0.05, *** p<0.01. F(14, 160) = 0.51 Prob > F = 0.9230

5. Follow up survey participation and attrition

The follow up survey was fielded between 2 and 3 weeks after the UX Challenge in each participating country. It was planned to last three weeks. However, the duration was significantly extended in many countries in the attempt to raise the number of companies taking the survey (see also Appendix I).

Figure 8 Experiment flowchart



Overall, the FUS response rate was 73.2%, but it was very different across groups: 95% in the treatment group and 63.1% in the control group. Even if the same protocol (in terms of timing, invitation messages and planned reminders (both via email and phone) to contact companies was followed, this differential attrition

(31.9 percentage points on the entire sample) is also heterogeneous across the participating countries (Table 6).

Table 6 Overall and differential attrition, total and by country

Country	Control	Treated	Differential attrition (percentage points)
DE	71.4%	0.0%	71.4
DK	46.7%	25.0%	21.7
EE	25.9%	12.5%	13.41
ES	10.0%	0.0%	10.0
FI	38.5%	0.0%	38.5
IT	20.0%	0.0%	20.0
LT	37.5%	0.0%	37.5
Total	**36.9%**	**5.0%**	**31.9**

In order to check if, based on the observed baseline characteristics, this differential attrition introduces bias in the comparison of the treatment and the control groups, a number of checks have been performed.

Table 7 tests if the treated-control difference in attrition is accounted for by companies and applicants' characteristics or pre-treatment outcomes. As shown in the Table, no covariate is found to be statistically associated with the probability of not responding to the FUS. The only statistically significant coefficient being the one relative to the treatment status.

Table 7 Attrition regression predictors

	Coefficient [95% Conf. Interval]
Treated	**-0.316***** **[-0.443,-0.188]**
Company ICT sector (%)	-0.034 [-0.176,0.108]
N employees	-0.001 [-0.003,0.001]

Company has research collaboration (%)	-0.084
	[-0.215,0.046]
Company has a designer (%)	0.094
	[-0.078,0.266]
HE graduates (%)	-0.001
	[-0.003,0.001]
Design experience (0-7)	0.006
	[-0.068,0.080]
Older than 40 yrs old (%)	-0.012
	[-0.148,0.124]
Has a master degree (%)	0.020
	[-0.114,0.153]
Suitability score (5-25)	-0.001
	[-0.023,0.021]
General Design Knowledge	0.008
	[-0.024,0.040]
Knowledge to Implement Design Sprint	-0.022
	[-0.057,0.012]
Attitudes towards Design Sprint	0.010
	[-0.019,0.038]
Desired Design Sprint Adoption	0.025
	[-0.009,0.058]
Expected Design Sprint Adoption	0.016
	[-0.021,0.053]
Constant	0.207
	[-0.337,0.751]
N	190

Table 8 shows the results a of a series of t-tests run only on the subsample of the control group to check if those answering the FUS are on average equivalent to those not answering it. This analysis suggests again that there are no company nor participant characteristics associated with the probability of answering the survey. In other words, there is no indication that those control group subjects refusing to take part in the follow up survey are systematically different from those who decided to participate.

Table 8 T-test equivalence checks of control units non-responding vs responding the FUS

	(1) Controls (mean)	(2) Treated (mean)	(3) T-test (p-value)
Pre-intervention outcomes			
General Design Knowledge	6.411	6.142	0.508
Knowledge to Implement Design Sprint	6.246	6.447	0.584
Attitudes towards Design Sprint	5.785	5.301	0.307
Desired Design Sprint Adoption	6.964	6.342	0.167
Expected Design Sprint Adoption	5.869	5.474	0.336
Company characteristics			
Company ICT sector (%)	0.333	0.305	0.739
N employees	16.042	20.817	0.457
Company has research collaboration (%)	0.417	0.524	0.239
Company has a designer (%)	0.833	0.805	0.689
HE graduates (%)	77.558	80.519	0.576
Respondent characteristics			
Design experience (0-7)	4.417	4.598	0.546
Older than 40 yrs old (%)	0.333	0.390	0.520
Has a master degree (%)	0.667	0.585	0.362
Suitability score (5-25)	19.906	19.213	0.211

N	48	82	130

Table 9, then, replicates the same group equivalence tests showed in Table 4, but conditioning only on the "analytical" sample, i.e. the sample of those who filled in the FUS (N=139). The goal of this analysis is to check if the group equivalence established at baseline holds also after losing many subjects in the control group at follow up. In general, the picture coming out from Table 9 is not very different from the one based on Table 4. However, in addition to the differences detected at baseline, group differences are now noticeable also in regard to the desired and expected adoption indicators and the suitability score.

Table 9 Group equivalence re-tested on the subsample of Follow-Up Survey respondents

	(1) Controls (mean)	(2) Treated (mean)	(3) T-test (p-value)	(4) Difference (Standardized effect size)
Pre-intervention outcomes				
General Design Knowledge	6.142	6.455	0.447	.131
Knowledge to Implement Design Sprint	6.447	6.586	0.684	.070
Attitudes towards Design Sprint	5.301	5.412	0.805	.043
Desired Design Sprint Adoption	6.342	6.655	0.434	.135
Expected Design Sprint Adoption	5.474	5.760	0.421	.139
Company characteristics				
Company ICT sector (%)	0.305	0.246	0.448	-.131
N employees	20.817	21.526	0.912	.019
Company has research collaboration (%)	0.524	0.491	0.703	-.065
Company has a designer (%)	0.805	0.825	0.772	.050
HE graduates (%)	80.519	79.255	0.786	-.065

Respondent characteristics				
Design experience (0-7)	4.598	4.614	0.952	.010
Older than 40 yrs old (%)	0.390	0.474	0.331	.168
Has a master degree (%)	0.585	0.561	0.781	-.048
Suitability score (5-25)	19.213	19.789	0.286	.184
N	82	57	139	

Finally, Table 10 shows the results of a joint test of significance. Based on this test, the only variable that is found to be statistically associated with the treatment group status is the suitability score. This variable was not unbalanced on the starting sample (Table 5).

Table 10 F-test of group balance among FUS respondents

Variables	**Coefficient [95% Conf. Interval]**
General Design Knowledge	0.014 [-0.032,0.061]
Knowledge to Implement Design Sprint	-0.005 [-0.060,0.050]
Attitudes towards Design Sprint	-0.003 [-0.046,0.040]
Desired Design Sprint Adoption	0.005 [-0.051,0.060]
Expected Design Sprint Adoption	0.014 [-0.044,0.073]
Company ICT sector (%)	-0.091 [-0.315,0.133]

N employees	-0.001
	[-0.004,0.002]
Company has research collaboration (%)	-0.087
	[-0.291,0.118]
Company has a designer (%)	-0.033
	[-0.292,0.225]
HE graduates (%)	-0.001
	[-0.005,0.003]
Design experience (0-7)	0.060
	[-0.056,0.175]
Older than 40 yrs old (%)	0.036
	[-0.177,0.248]
Has a master degree (%)	-0.072
	[-0.281,0.137]
Suitability score (5-25)	**0.034***
	[-0.003,0.071]
Constant	-0.464
	[-1.318,0.390]
N	139

* p<0.10, ** p<0.05, *** p<0.01

F(14, 109) = 0.58; Prob > F = 0.8767

6. Impact estimates

6.1 Estimation approach

The impact of the UX-Challenge is estimated on the outcome variables identified above (section 2.1). Technically speaking, the produced impact estimates are 'intent-to-treat' (ITT) estimates, because "assignment to the treatment" rather than "receiving of the treatment" is considered. Hence, what is estimated is the impact of offering the treatment rather than actually giving the treatment. However, because of the very limited incidence of no-shows and crossovers (section 4.2), the distinction between these two estimates would be negligible and the average impact of "treatment on the treated" (TOT) is not estimated.

To account for the randomization strata and the potential bias induced by differential attrition, regression-adjusted ITT estimates are produced. Three main model specifications were performed:

1. Linear regression models (i.e., Ordinary Least Squares, OLS) with stratification variables, which account for stratification design and different allocation ratios;
2. Linear regression models, which add the pre-treatment measure of the outcome (where available, i.e. not for the quiz-based outcome) to improve statistical precision and adjust for possible imbalances;
3. Linear regression models adding the product/challenge suitability score, a dummy variable indicating whether the company is operating in the ICT sector vs another industry sector, as these variables, were found to be weakly unbalanced or associated with FUS non response. In addition, this model also includes a dummy to identify if FUS respondents were the same of BS respondents (93% was the same person).

The third is the preferred specification, due to the limited sample size and the large differential attrition.[13]

To better interpret the magnitude of the impacts, for each outcome, the standardized effect size of the third model is also computed and reported.

As an additional check considering the high differential attrition, all impacts are also estimated through a different estimation approach, i.e. a propensity score matching (PSM) (caliper 0.1, n=10, kernel method). It has to be recognized that this approach cannot by definition solve the issue of potential selection bias, but it allows controlling for the potential bias coming from baseline covariates in an efficient way by matching units which share similar predicted likelihood of being treated. The matching was based on a logit regression model including all baseline variables included in Table 4. Standard errors are obtained through 1,000 bootstrap replications. The estimate was obtained with the Stata routine *psmatch2* and performed well in terms of group comparability and bias reduction, slightly improving comparability, which was already assessed as acceptable in section 5. Eight treatment group observations were dropped because of no common support. More details are shown in Appendix III.

Considered the lower than planned sample size (due to slightly lower number of recruited companies and the relatively high number of companies not responding to the Follow-Up survey) and the resulted different

[13] Table AIII.4 in Appendix III shows a comparison of the outcome variables (mean value and standard deviation) before and after the intervention observed in the treatment group.

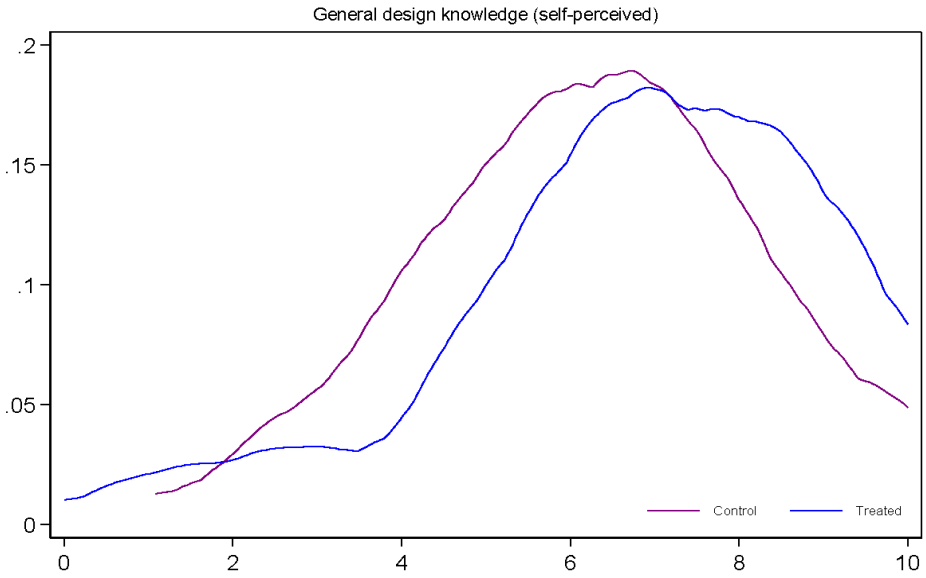
allocation ratio, the statistical power calculations presented in the research plan (Deliverable 4.1). The new calculation, assuming that no covariate is used, is .43 SD.

6.2 Digital design knowledge

Before showing the impact estimates, the post-intervention probability distributions for each of the studied outcome are shown separately for the treatment and control groups.

Starting with self-perceived general knowledge about digital design, Figure 9 provides descriptive evidence that **treated subjects have a higher level of general knowledge about digital design**, as the treatment group's curve is markedly shifted to the right, i.e. towards higher values of the index, as compared to the control group.

Figure 9 Probability density function of self-perceived general design knowledge, by experimental group



This result is confirmed on looking at the impact estimates obtained through the sequence of estimation approaches. Although the magnitude of the point estimates varies across the different estimations (compare 1, 2 and 3), differences between the three estimates are relatively small and statistically insignificant.

A quite sizeable effect is estimated (+.36 points, column 3), which equals a **17% of standard deviation increase** (standardized effect size, column 4), but this effect is not statistically significant because of the limited statistical power of the experiment (see above).

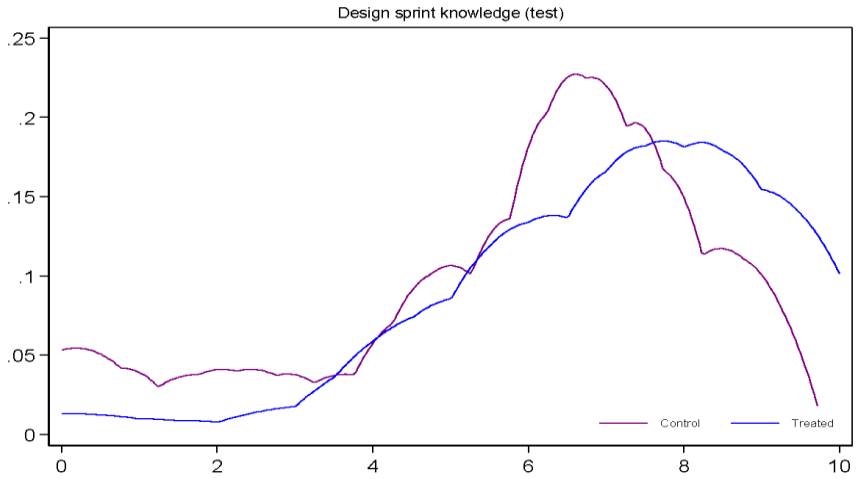
Table 11 Intent-to-treat estimates of the UX Challenge on participants' self-perceived general design knowledge

	(1) OLS	(2) OLS	**(3) OLS**	**(4) OLS Standardized effect size**	(5) Pscore Match.
Treatment	0.480	0.369	**0.361**	**0.170**	.423
	[-0.237,1.196]	[-0.270,1.008]	**[-0.289,1.012]**	**[-0.136,0.476]**	[-.703, 1.55]
Rand. Strata	Y	Y	**Y**	**Y**	Y
Pre. Outcome	N	Y	**Y**	**Y**	Y
Controls	N	N	**Y**	**Y**	Y
N	139	139	**139**	**139**	131

95% confidence intervals in brackets. * p<0.10, ** p<0.05, *** p<0.01. The preferred specification is in bold.

When looking at our second indicator of design sprint knowledge—i.e., an objective and more specific measure retrieved from the quiz embedded in the follow-up questionnaire—we see again that the distribution of test scores of the treatment group is shifted to the right as compared to the one of the control group (Figure 10), hence treatment group participants tend to do better than control ones on the quiz.

Figure 10 Probability density function of tested design sprint knowledge, by experimental group



The graphical, descriptive evidence is confirmed by the regression analyses conducted. Table 12 shows that the effect of the UX-Challenge on this 'objective' measure of design sprint knowledge is large and statistically significant. Based on our preferred specification, **the treatment increases design sprint knowledge by 1.1 points (OLS column 2), which amount to .31 standard deviations (effect size, column 3)**. Hence, a very large and highly statistically significant impact, which is not affected by the particular estimation specification, as

differences as compared to specification 1 and 4 are negligible.

Table 12 Intent-to-treat estimates of the UX Challenge on participants' tested design sprint knowledge

	(1) OLS	**(2) OLS**	**(3) Standardized effect size**	(4) Pscore Match.
Treatment	1.217***	**1.096*** **	**0.435*** **	1.087*
	[0.417,2.017]	**[0.294,1.898]**	**[0.117,0.754]**	[-.183, 2.36]
Rand. Strata	Y	**Y**	**Y**	Y
Pre. Outcome	N	**N**	**N**	N
Controls	N	**Y**	**Y**	Y
N	139	**139**	**139**	131

95% confidence intervals in brackets. * p<0.10, ** p<0.05, *** p<0.01. The preferred specification is in bold.

To check whether this result is driven by some specific items included in the quiz, the effect of the Challenge is also estimated for each of the five questions, each related to one of the five phases of a typical design sprint (Table 13). The effects seem to be particularly driven by Q7 (phase 1 of design sprint), Q10 (phase 4) and to a limited extent to Q11 (phase 5) and Q9 (phase 3), while no effect is found on Q8 (phase 2) (questions are available in Appendix II).

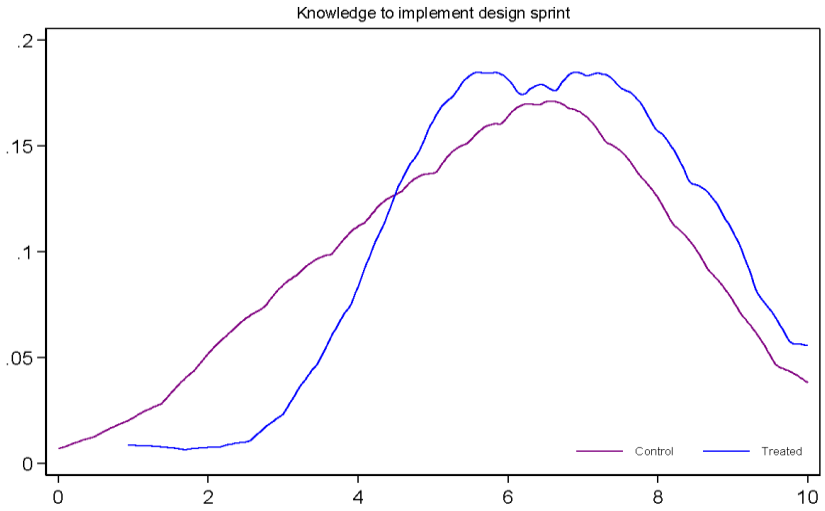
Table 13 Treatment effects on the probability of giving a correct answer to each single question of the quiz (Linear probability model)

	(1)	(2)	(3)	(4)	(5)
	Q7	Q8	Q9	Q10	Q11
Treatment	0.194**	-0.001	0.095	0.158**	0.145
	[0.020,0.367]	[-0.158,0.155]	[-0.039,0.230]	[0.013,0.303]	[-0.031,0.321]
N	139	139	139	139	139

Estimates based on Model 2 specification (table 12). 95% confidence intervals in brackets. * p<0.10, ** p<0.05, *** p<0.01.

Figure 11 shows the probability density functions for treated and control companies of the third and last indicator of knowledge, i.e. knowledge to implement digital design. Overall, the graphical evidence is in line with what observed for the two other dimensions: treated subjects show higher levels of knowledge as compared to the control group.

Figure 11 Probability density function of knowledge to implement design sprint, by experimental group



The different types of impact estimates shown in Table 14 support the graphical evidence. **The UX-Challenge is found to increase subjects' knowledge to implement design sprint by .71 points** (column 3). This effect is large (.34 SDs, column 4), statistically significant and also quite stable across the different specifications, although the estimates obtained with the propensity score matching is not significant.

Table 14 Intent-to-treat estimates of the UX Challenge on participants' knowledge to implement design sprint

	(1) OLS	(2) OLS	**(3) OLS**	**(4) Standardized effect size**	(5) Pscore Match.
Treatment	0.786**	0.737**	**0.711****	**0.337****	.600
	[0.050,1.523]	[0.068,1.405]	**[0.026,1.397]**	**[0.012,0.662]**	[-.507,1.71]
Rand. Strata	Y	Y	**Y**	**Y**	Y
Pre. Outcome	N	Y	**Y**	**Y**	Y
Controls	N	N	**Y**	**Y**	Y
N	139	139	**139**	**139**	131

95% confidence intervals in brackets. * p<0.10, ** p<0.05, *** p<0.01. The preferred specification is in bold.

Table 15 shows the results of a series of linear probability models aimed at assessing the impact of the UX-Challenge on each of the five questionnaire items used to compute the 'knowledge to implement design sprint' index. The effects of the intervention seem to be stronger on items 1 and 4, but smaller yet still positive effects (not significant) are estimated also for the three remaining items.

Table 15 Treatment effect on the probability of agreeing with each single question of the knowledge to implement design sprint index (Linear probability model)

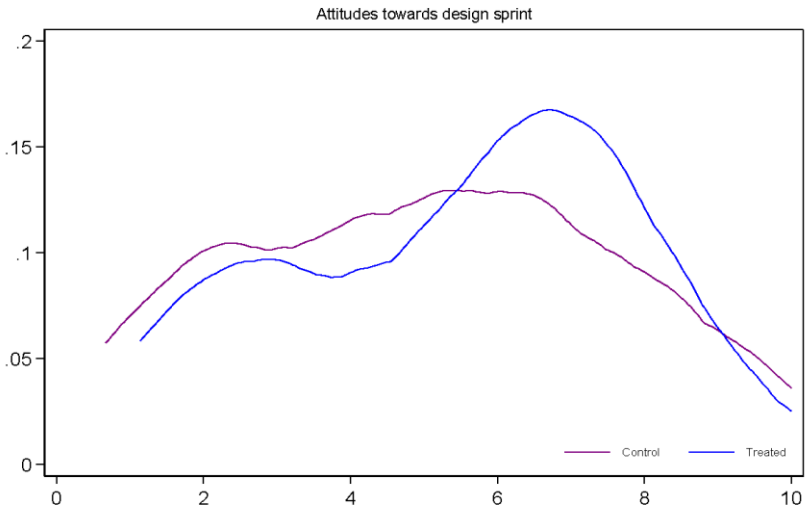
	(1)	(2)	(3)	(4)	(5)
	Q6_1	Q6_2	Q6_3	Q6_4	Q6_5
treated	0.100*	0.030	0.070	0.154*	0.058
	[-0.003,0.202]	[-0.108,0.168]	[-0.050,0.189]	[-0.003,0.311]	[-0.112,0.227]
N	139	139	139	139	139

Estimates based on Model 3 specification (table 14). Agreeing includes 'Slightly Agree', 'Mostly Agree', and 'Completely Agree'. 95% confidence intervals in brackets * p<0.10, ** p<0.05, *** p<0.01

6.3 Attitudes towards digital design

Figure 12 and Table 16 shows evidence about the UX-Challenge's impacts on participants' attitudes towards digital design. Based on the probability distribution of the outcome in the two groups (Figure 12), treatment group participants seem to have slightly higher attitudes towards design as compared to the control group.

Figure 12 Probability density function of attitudes towards design sprint, by experimental group



Indeed, Table 16 shows that the treatment group shows on average more positive attitudes than the controls. Based on the preferred specification (column 3), **the effect of the UX-Challenge is estimated at .45 points, but—even if this is not a small difference (.18 SDs)—the difference is not significantly different from zero**, because of the limited statistical power of the experiment.

The results are also not very stable across the different specifications, as the treatment effect estimated with the propensity score matching approach is much smaller (.15, column 5) than the one obtained with the linear regression shown in column 3. Using an unweighted attitudes measure (see section 2.2) yields the same results: positive point-estimate for the treatment effect but not statistically significant.

Table 16 Intent-to-treat estimates of the UX Challenge on participants' attitudes toward design sprint

	(1) OLS	(2) OLS	**(3) OLS**	**(4) Standardized effect size**	(5) Pscore Match.
Treatment	0.538	0.484	**0.447**	**0.180**	.147
	[-0.315,1.392]	[-0.324,1.292]	**[-0.382,1.277]**	**[-0.154,0.513]**	[-1.22,1.511]
Rand. Strata	Y	Y	**Y**	**Y**	Y
Pre. Outcome	N	Y	**Y**	**Y**	Y
Controls	N	N	**Y**	**Y**	Y
N	139	139	**139**	**139**	131

95% confidence intervals in brackets. * p<0.10, ** p<0.05, *** p<0.01. The preferred specification is in bold.

6.4 Planned actions

In this section, the effects of the UX-Challenge of the two indicators of planned actions are investigated.

The results for the first indicator (desired design sprint adoption by the company) are shown in Figure 13 and Table 17. Both graphical evidence (Figure 12) and the different impact estimation approaches (Table 17) suggest that the intervention had **no impact on participants' wish that their companies take concrete steps to implement design sprint** in the 6-12 months after the interview. The point estimates for the coefficients of the treatment effects have negative sign, but they are small and statistically indistinguishable from zero.

Figure 13 Probability density function of desired design sprint adoption, by experimental group

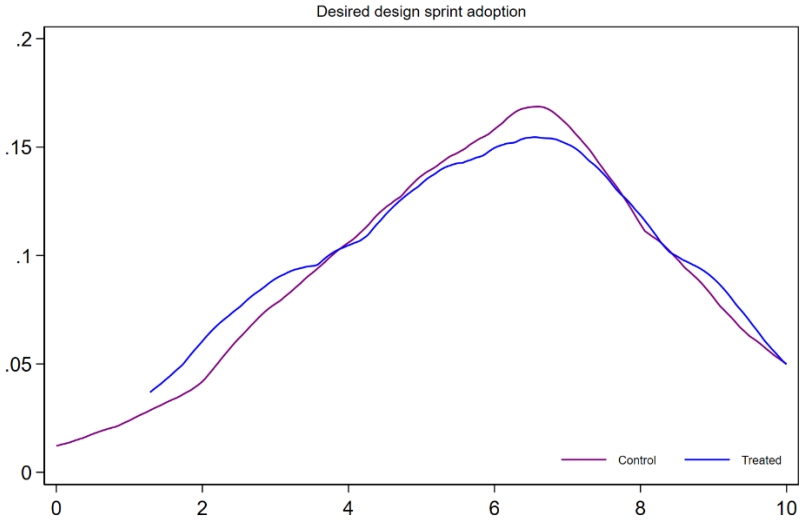


Table 17 Intent-to-treat estimates of the UX Challenge on participants' wish that their company adopts design sprint in the next 6-12 months

	(1) OLS	(2) OLS	**(3) OLS**	**(4) Standardized effect size**	(5) Pscore Match.
Treatment	-0.074	-0.224	**-0.179**	**-0.078**	-.233
	[-0.886,0.739]	[-0.988,0.541]	**[-0.964,0.605]**	**[-0.417,0.262]**	[-1.51,1.046]
Rand. Strata	Y	Y	**Y**	**Y**	Y
Pre. Outcome	N	Y	**Y**	**Y**	Y
Controls	N	N	**Y**	**Y**	Y
N	139	139	**139**	**139**	131

95% confidence intervals in brackets. * p<0.10, ** p<0.05, *** p<0.01. The preferred specification is in bold.

The same conclusions are reached when looking at the results for the participants' expectations that their companies act to implement digital design (Figure 14 and Table 18).

Figure 14 Probability density function of expected design sprint adoption, by experimental group

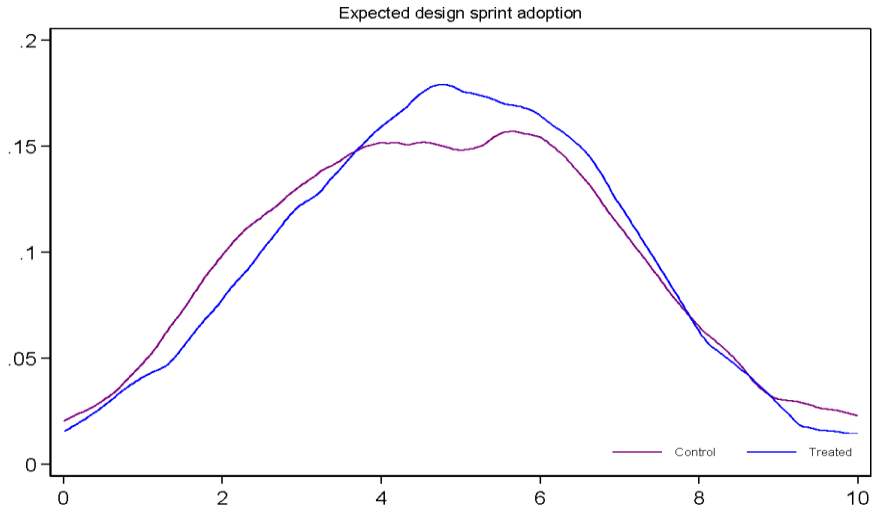


Table 18 Intent-to-treat estimates of the UX Challenge on participants' expectation that their company adopts design sprint in the next 6-12 months

	(1) OLS	(2) OLS	**(3) OLS**	**(4) Standardized effect size**	(5) Pscore Match.
Treatment	0.182	-0.072	**-0.096**	**-0.044**	-127

	[-0.602,0.966]	[-0.715,0.571]	**[-0.749,0.556]**	**[-0.346,0.257]**	[-1.29, 1.04]
Rand. Strata	Y	Y	**Y**	**Y**	Y
Pre. Outcome	N	Y	**Y**	**Y**	Y
Controls	N	N	**Y**	**Y**	Y
N	139	139	**139**	**139**	139

95% confidence intervals in brackets. * p<0.10, ** p<0.05, *** p<0.01. The preferred specification is in bold.

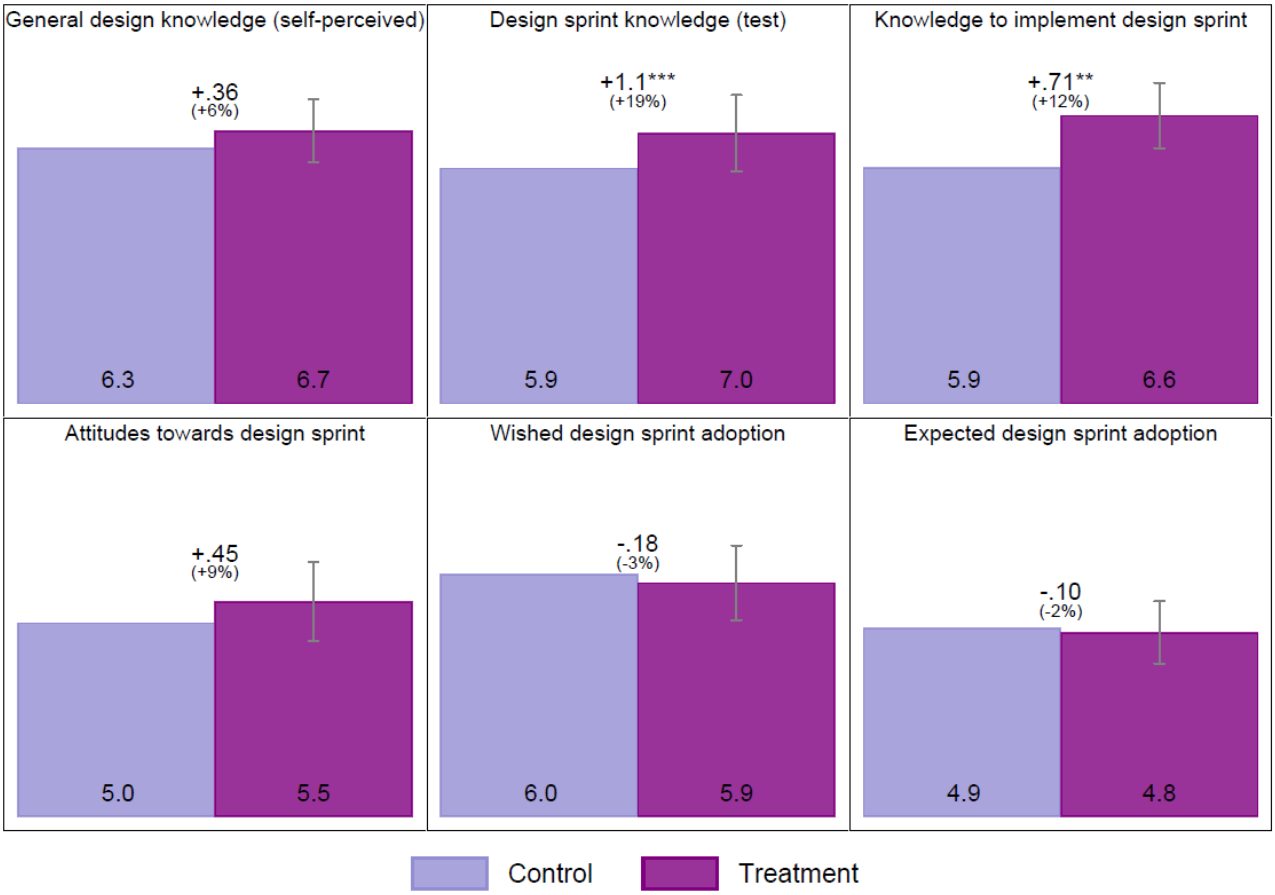
6.5 Summary of findings and interpretation

Figure 15 provides a summary of the experimental estimates of the UX-Challenge on the knowledge, attitudes and planned actions indicators. In particular, for each of the six outcomes, the figure shows the control group and treatment group's mean values predicted from models 3 and 2 (the latter for the test-based outcome). The difference between the two bars represents the regression-adjusted impact estimates coming from the same models. The figure also shows the impact estimates in terms of percentage increase, as an alternative way of presenting and interpreting the results.

Overall, the UX-Challenge had positive and significant impacts on the 2 out of 3 knowledge outcomes. **The impacts on design sprint knowledge (test) and knowledge to implement digital design are substantively large: 19% and 12% increase, respectively**.

The UX-Challenge also had **positive, and not small (+9%), although insignificant, impacts on attitudes toward design**. However, **no effects of the UX-Challenge are detected on participants' planned actions**.

Figure 15 Summary of impact estimates



Note: Estimates based on columns 3 from Tables 11, 14, 16, 17, 18 and column 2 from Table 12. The vertical lines show the 95% confidence intervals of the treatment effects. * p<0.10, ** p<0.05, *** p<0.01.

The discrepancy between the positive impacts found on knowledge and attitudes (though the latter not statistically significant) and the nil impacts found on the two indicators of planned actions, may be accounted for by the respondents being aware of the existence of factual constraints for companies to invest more in digital design. According to the FUS data (Table 19), respondents think that the main obstacles are related to budget/economic reasons (such as existence of prior investments, unfavorable market conditions or excessive perceived economic risks).

Table 19 Obstacles that companies would face in undertaking digital design approaches (% of respondents "probably", "very probably" or "definitely")

Variable	Treated	Controls	Stat sign
1. Prior investments	33.3%	34.1%	
2. Market conditions or excessive perceived economic risks	26.3%	18.3%	
3. Organizational rigidities within the enterprise	8.8%	14.6%	
4. Lack of qualified personnel capable to coordinate and drive such initiatives	**8.8%**	**23.2%**	**
5. Lack of information on how user-centered design methodologies work	**5.3%**	**18.3%**	**
6. Lack of information on market suppliers (do not know potential service providers)	3.5%	11.0%	*
7. Insufficient flexibility of regulations or standards	1.8%	6.1%	
8. Lack of customer responsiveness to new goods or services	19.3%	8.5%	
9. Lack of trustworthy evidence about the benefits of these methodologies (e.g. ROI – Return on Investment)	17.5%	14.6%	
10. Lack of awareness of benefits of these methodologies	12.3%	13.4%	
11. We fear that adopting these methodologies will disrupt our current product development practices	5.3%	11.0%	
12. We do not cover the entire manufacturing process (the interaction design is done by our suppliers or clients)	3.5%	12.2%	

Note: Table based on question # 16 ("What do you think are the obstacles that your company would face in undertaking any of the actions listed in the previous question?"). *6-point Likert scale: Definitely Not; Probably Not; Possibly; Probably; Very Probably; Definitely.* Stars indicate the level of statistical significance of the treatment vs control average difference, estimated with the same model (3) used for the main impact estimates. * p<0.10, ** p<0.05, *** p<0.01

Interestingly, though, **treatment group participants indicate less often lack of information or lack of competence as the main reason for their companies not investing further in digital design**. This finding is interpreted as a further, indirect confirmation of the positive impact of the UX-Challenge on participants knowledge about digital design.

6.6 Additional checks

Assignment to treatment weights

To check if the different treatment allocation ratios across blocks bias the results, the main impact models (i.e. M3 in Tables 11, 14, 16, 17 and 18 and M2 in Table 12) are re-estimated including inverse probability weights. These weights are defined as the 1/p for treated units and 1/(1-p) for control units, where p refers to the probability of assignment to treatment (https://egap.org/resource/10-things-to-know-about-randomization/). The results shown in Appendix III are qualitatively very similar to those reported in the tables mentioned above.

Multiple outcomes

Considered that the effects are estimated on six different outcomes, there's a chance that the two statistically significant results are purely to chance. In other words, the risk of incorrectly rejecting a null hypothesis (i.e., making a Type I error) increases. To check this, the so called 'Bonferroni correction' is performed. The Bonferroni correction implies rescaling the significance level of α by m, where α is the desired overall alpha level and m is the number of hypotheses. Applied to the 200SME trial, the conventional α (= .005) is divided by the number of outcomes (m = 6). Hence, with the Bonferroni correction, the resulting α would be 0.0083 instead of .005. This implies, that of the two statistically significant impacts found, only the one on Design sprint knowledge (α=.003) would be robust to the Bonferroni correction, while the effect on Knowledge to implement design sprint (α=.03) would not be significant.

Treatment effects bounds

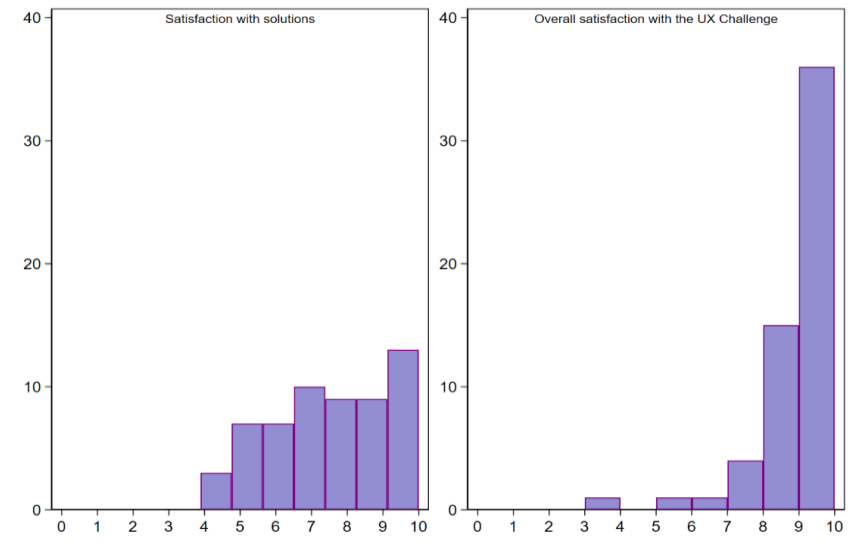
To further check the extent to which the above presented results are driven by the high differential attrition, lower and upper bounds for the treatment effects are estimated. This exercise consists in inputing arbitrary values to replace the missing values on the outcomes. Beyond the extreme, and perhaps unrealistic, minimum and maximum values, also more realistic scenarios are computed using 25th, 50th and 75th percentiles. The values are taken separately from the control and treatment group distributions. In each scenario, controls and treated are flipped: e.g. when minimum value is imputed for controls, the maximum value is imputed for the treated. The results of these additional analyses are shown in Appendix III. In general, this exercise shows that the results are confirmed under the most 'realistic' scenarios. More specifically, regarding the first outcome measure (general design knowledge), the effects would be statistically significant in the less conservative scenarios, up to the 25th percentile and weekly at the 50th percentile, then become smaller and not significant at the 75th percentile. The results on Design sprint knowledge (quiz) also happen to be strongly robust to this check (statistically significant up to the 75th percentile), while the positive and significant impacts on Knowledge to implement design sprint would hold up to the 50th percentile. The results on the remaining three outcomes confirm the insignificant effects, with the possibility of positive and significant effects on Attitudes toward design sprint in the 25th percentile scenario and negative effects on Desired design sprint adoption under the 75th percentile scenario.

7. Participants' satisfaction with the UX Challenge

Treated group subjects were invited to answer a few additional questions in the FUS, which were aimed at surveying their satisfaction with the UX-Challenge. Figure 16 (left panel) shows that, **participants were quite satisfied with the solutions that were produced within the UX-Challenge**. The index—which was constructed through a principal component analysis based on question 18 in the FUS and normalized (values range from 0 to 10)—shows an average value is 7.5.

A higher score is given, on average, by participants on the UX-Challenge in general (8.8 out of 10), even if it has to be noted that the two measures were different and only in this latter case, respondents were asked directly for a numerical rating.

Figure 16 Satisfaction with the solutions produced and with the UX-Challenge overall



Although the formats of the two questions are not identical and hence the two indices are not directly comparable, these findings seem to suggest that the satisfaction of companies in the initiative as a whole may have only partially been due to the relevance quality of its outputs (prototypes, designs, mockups, user insights), and can therefore be related to other aspects such as increase of knowledge and awareness about the core methodologies (as demonstrated in the previous pages), but also networking opportunities, talent scouting, and other benefits normally mentioned by companies participating in the UX Challenge[14].

Treated companies show relatively high levels of intention to take follow-up actions (question 19), such as using design sprint in future projects, staying in touch with solvers or mentors. **Nine out of ten participants state that they would apply to a new edition of the UX-Challenge**. These results confirm once more the fact

[14] For more insight on qualitative outcomes and companies' feedback about the UX Challenge, see D4.3, also available on the project website: www.200SMEchallenge.eu.

that participants appreciated the UX-Challenge and recognize the value of digital design, but at the same time also suggest that companies may not be ready to adopt design sprint in their companies, in light of the organizational burden and the associated costs.

Table 20 Intended follow-up actions

	% of Agreement	
	Slightly agree to Completely agree	Mostly agree to completely agree
1. We will utilize the "Design Sprint" in future projects, probably without the help of external facilitators	**69.0%**	**46.6%**
2. We will utilize the "Design Sprint" in future projects, with the support of an external agency	**46.6%**	**20.7%**
3. We will stay in touch with the solvers of the UX Challenge to further develop the outputs of the Challenge	**62.1%**	**32.8%**
4. We will stay in touch with the mentors of the UX Challenge to further develop the outputs of the Challenge	**53.5%**	**25.9%**
5. We would apply to the next edition of the UX Challenge, in case there was one	**93.1%**	**67.2%**

8. Conclusions

Between February and March 2021, 60 companies based in 7 different EU countries took part in an online User Experience Challenge (UX Challenge) pivoted on the Design Sprint methodology. To establish if taking part in the UX Challenge had an impact on companies' digital design readiness and awareness, a set of indicators of digital design readiness and awareness were collected from the 60 participating companies after the Challenge and were compared with the same set of outcomes observed in a control group. The latter was made of 130 companies, which did not participate in the intervention. To gauge the causal impacts of the intervention, access to the UX Challenge was strictly dependent on randomization. Thanks to randomization, the two groups of companies were, on average, equivalent and hence comparable.

The results of this Randomised Controlled Trial (RCT) suggest that the UX Challenge is a promising way to improve participants' objective and practical knowledge about design sprint and digital design. Positive, even if not statistically significant, impacts were also found on participants' positive attitudes towards digital design. However, participants did not show any higher intention to adopt digital design in their companies as compared to the control group. Some organizational and financial constraints may be the reason behind this discrepancy between the largely positive impacts on knowledge (and the tentative positive impacts on attitudes) and the zero impacts on intention to adopt design sprint. More research is needed to investigate these aspects further and to understand whether, and under which circumstances, the increased knowledge about digital design leads to concrete, tangible changes in companies' approaches to digital design.

To the best of our knowledge, this is the first and only experimental study on the impact of an innovation contest on user-centered design offered as-a-service to digital companies with the aim of increasing digital design readiness and awareness. Future studies are needed to consolidate these findings. Particularly, this study suffered from small sample size, that limits the statistical power of the experiment, and from a very high differential attrition, due to the much lower response rate in the Follow Up survey obtained in the control group. A number of statistical checks and a range of different impact estimation approaches have been performed, and these are to some extent reassuring that attrition was not systematically linked to some relevant company or participant characteristic. However, future studies in this field should assign highest priority to experiment designs or incentives mechanisms aimed at reducing attrition.

Appendix I Experiment timeline

Table AI.1 Experiment timeline (Years 2020/2021)

Country	Recruitment closed	Checks	Randomization	Randomization communicated to companies	UX Challenge started	UX Challenge ended	FUS launched	FUS closed
DENMARK	Feb 2	Feb 5	Feb 5	Feb 8	Mar 17	Mar 19	Mar 31	May 17
ESTONIA	Jan 8	Jan 8	Jan 11	Jan 18-27	Mar 3	Mar 5	Mar 25	May 24
FINLAND	Feb 1	Feb 3	Feb 3	Feb 4	Feb 16	Feb 18	Mar 4	Apr 12
GERMANY	Dec 18	Dec 21	Dec 23	Jan 8 - 15	Mar 10	Mar 12	Mar 29	May 21
ITALY	Dec 11	Dec 18	Dec 23	Dec 23	Feb 15	Feb 19	Mar 5	Apr 28
LITHUANIA	Dec 18	Dec 21	Dec 23	Dec 23	Feb 18	Feb 19	Mar 5	Apr 13
SPAIN	Jan 22	Feb 10	Feb 10	Feb 15	Mar 10	Mar 12	Mar 26	Apr 19

Appendix II Follow Up survey

Brief introduction

TREATMENT GROUP VERSION

Thank you again for accepting to participate in the "200SMEchallenge" project [Link: 200smechallenge.eu], which aims at evaluating the impact of the UX Challenge across Europe.

As agreed when you applied to the UX Challenge, we kindly ask you for the second and last time to answer to some questions regarding user center design and your experience of the UX Challenge.

As you will notice, some questions will be similar as those asked to you in the initial questionnaire (the one you filled in when you applied to the UX Challenge). This is intentional, as our purpose is to study how given attitudes and behaviors related to user-center design evolve over time. All data will be treated in an aggregated way and in full respect of your privacy.

As a recognition for your availability to filling in this questionnaire, you will receive free access to a special Webinar on User-Center Design offered by the Danish Design Center [Link: https://danskdesigncenter.dk/en] that will take place in early May.

This survey will take you approximately 15 minutes. Unfortunately, you cannot save your answers and complete the survey in a different moment. So please, make sure that you have 15 minutes available before starting to answer it.

IMPORTANT: This second and last questionnaire has to be filled in by the same person in your company who filled in the initial survey requested for the application to the "200SMEChallenge" project and then participated in the UX Challenge. So, if you are not that person, please forward the survey link to the right person.

We sincerely thank you in advance for this last effort! Your participation in this project helps us spreading the adoption of User-Centered Design and Design Thinking amongst European Small- and Medium-sized Enterprises.

For any requests, please feel free to contact XXXXXXX.

CONTROLS GROUP VERSION

Thank you again for accepting to participate in the "200SMEchallenge" project [Link: 200smechallenge.eu], which aims at evaluating the impact of the UX Challenge across Europe.

As agreed when you applied to the UX Challenge, we kindly ask you for the second and last time to answer to some questions regarding user center design.

As you will notice, some questions will be similar as those asked to you in the initial questionnaire (the one you filled in when you applied to the UX Challenge). This is intentional, as our purpose is to study how given

attitudes and behaviors related to user-center design evolve over time. All data will be treated in an aggregated way and in full respect of your privacy.

As a recognition for your availability to filling in this questionnaire, you will receive free access to a special Webinar on User-Center Design offered by the Danish Design Center [Link: https://danskdesigncenter.dk/en] that will take place in early May.

This survey will take you approximately 10 minutes. Unfortunately, you cannot save your answers and complete the survey in a different moment. So please, make sure that you have 10 minutes available before starting to answer it.

IMPORTANT: This second and last questionnaire has to be filled in by the same person in your company who filled in the initial survey requested for the application to the "200SMEChallenge" project. So, if you are not that person, please forward the survey link to the right person.

We sincerely thank you in advance for this last effort! Your participation in this project helps us spreading the adoption of User-Centered Design and Design Thinking amongst European Small- and Medium-sized Enterprises.

For any requests, please feel free to contact XXXXXXX.

A. Company information

Q1. Country where the company's operational headquarters are located

Only one answer possible

1. Denmark
2. Estonia
3. Finland
4. Germany
5. Italy
6. Lithuania
7. Spain

Q2. Company name

[alphanumeric space for company name]

Q3. Company VAT number

If your company does not have a VAT number, please just write "none"

[alphanumeric space for VAT number]

Q4. Who filled in the initial survey of the project?

Only one answer possible. Remember that this second and final questionnaire should be filled in by the same person who filled in the initial survey of the project.

1- I filled it in
2- A colleague/another person in the company filled it in, but s/he is no longer available

B. Knowledge of user-centered design

Q5. Please, express the extent to which you agree/disagree with the following statements

One answer per item. 6 point Likert scale

1. *Completely Disagree*
2. *Mostly Disagree*
3. *Slightly Disagree*
4. *Slightly Agree*
5. *Mostly Agree*
6. *Completely Agree*

1. I know what “User Centered Design” is
2. I would feel confident to explain to my colleagues what “User Centered Design” is
3. I know what “Design Thinking” is
4. I would feel confident to explain to my colleagues what “Design Thinking” is in practice
5. I know what a “Design Sprint” is
6. I would feel confident to explain to my colleagues what a “Design Sprint” is in practice

Q6. Please, express the extent to which you agree/disagree with the following statements

One answer per item. 6 point Likert scale

1. *Completely Disagree*
2. *Mostly Disagree*
3. *Slightly Disagree*
4. *Slightly Agree*

5. *Mostly Agree*
6. *Completely Agree*

1. I am able to **define a design problem** in such a way that it is easily comprehensible by people outside our company (consultants, suppliers, partners)
2. I am able to effectively managing **creative ideation** processes
3. I am able to **take up decisions** on the best design solution to implement starting from a large variety of ideas
4. I am able to pursue **rapid and cheap prototyping** of a design solutions (e.g. wireframing, mockups, interactive prototypes) in order to test it with users
5. I am able to set up and **execute reliable user testing** (the right profile and number of users) to validate those ideas/solutions

C. Knowledge of Design Sprint

In this section, you'll find five questions aimed at investigating how widespread the knowledge of Design Sprint method is among companies. If you don't know something that's totally OK!

Please, select, among the three options for each of the following questions, the one you think is the most appropriate. Select "I wouldn't know" only if you really can't choose from the previous three.

Q7. In the Design Sprint, how should the company frame the design problem?

Only one answer possible

1. The problem should be described after a sound and extensive **research** within the company and possibly with the support of external consultants
2. Along with the problem, the company should envision the **ideal scenario** (final outcome) that it wants to achieve with a design solution (whatever it be)
3. The problem should **not be defined** at the beginning in order to allow for more creativity and serendipity
4. I wouldn't know

Q8. How is the ideation phase done in Design Sprint?

Only one answer possible

1. Team members involved in the Sprint develop a few ideas (2-3) **individually**, and only after they show ideas to their team members, one by one, to allow for a more informed discussion
2. Ideas must be developed in a group **brainstorming** setting, where everybody in the team is free to come

up with as many rough ideas as possible, without elaborating too much on them
3. The **product manager** alone is responsible for the ideation, after a specific indication from the CEO; only afterwards the product manager shares with the rest of the team the chosen idea in order to define the product specifications to be developed
4. I wouldn't know

Q9. How are ideas of solutions expressed and shared in the Design Sprint?

Only one answer possible

1. After a considerable research investment, ideas of solutions should be described in detail **by designers** and creative people in a single-page document, and they should be shared afterwards with the rest of the team
2. Ideas of solutions must be carefully crafted by the **Art Director**; in general, only creative people should take part to the ideation process and should later present those ideas to the whole team.
3. Ideas of solutions are produced by **all team members** and come in a visual format (low fidelity sketches) to make for team members easier to grasp their meaning and understand all the many options on the table
4. I wouldn't know

Q10. What is a prototypee in the Design Sprint?

Only one answer possible

1. A prototype is a highly **technological device** that technology companies develop if they want to test system problems and bugs with external consultants
2. A prototype is a first, **unfinished version** of the product, still missing many functionalities and normally cheaper than the finished product but essential to allow the realization of the final product.
3. A prototype is an object that allows the team to **simulate the adoption** of certain design solutions by users and/or customers, in order to quickly and cheaply generate a feedback needed to evaluate its viability
4. I wouldn't know

Q11. What is the main purpose of involving users and customers in the Design Sprint?

Only one answer possible

1. Users and customers are involved in the testing phase of the Alfa or Beta versions of the product, so that the product's **bugs can be spotted** before the commercialization.
2. Users and customers take an active part in the Sprint as they are asked to test and **provide feedback** on the developed prototype, in order for the team to evaluate whether it is the appropriate solution to the problem
3. Users and customers are invited to take part to the **ideation session**, and possibly also to the prototyping phase according to a co-design approach, so that the needs and wishes of future users/customers are included.
4. I wouldn't know

D. General attitudes

Q12. How would you rank the importance of the following aspects when pursuing innovation of products or processes in your company?

Please sort the following aspects according to their relevance: f*rom 1st (the most important) to 6th (the least important)*

1. Having a **leadership** with a strong vision
2. Incorporating the state-of-the-art **technology**
3. Creating strategic **partnerships** with key players
4. Using design thinking and **user-centered design**
5. Optimizing processes, **organization** and operations
6. Focusing on **finance**

Q13. How much do you think each of these aspects of design thinking could benefit your company?

Please, assign a value from 0 (no benefits) to 5 (max benefits)

1. Defining a design **problem** in such a way that it is easily addressable by others (consultants, suppliers, partners, customers, users)
2. Effectively managing **creative processes** to ideate solutions to design problems
3. Taking up **decisions** on the most appropriate design solutions to implement, starting from a large variety of ideas
4. Pursuing rapid and cheap **prototyping** of a design solutions (wireframing, mockups, interactive interfaces) in order to test it as soon as possible with users
5. Setting up and execute reliable **user testing** (the right profile and number of users) to validate those design ideas/solutions

E. Planned actions

Q14. Thinking about the next 6 to 12 months, WOULD YOU LIKE that your company undertake any of the listed actions?

Only one answer per item is possible: 6 point Likert scale

1. *Definitely no*
2. *Mostly no*
3. *Rather no than yes*
4. *Rather yes than no*
5. *Mostly yes*
6. *Definitely yes*

1. Collect feedback from users or customers with regards of your **existing products** in order to improve their value
2. Involve users or customers to **test ideas and prototypes** of new products and services (or new functionalities of existing products)
3. **Hire new staff** trained/experienced in design (e.g., User Experience Designer; Interaction Designer; Information Architect; User Interface Designer; Service Designer)
4. Increase the **time** dedicated to the design phases of new projects
5. Increase the **budget** dedicated to design phases of new projects
6. Hire an **external** User Experience design agency or freelancer to improve our capability of designing better digital products
7. Invest in user-centered design **training** for its employees

Q15. To what degree do you think that in the next 6 to 12 months your company WILL ACTUALLY undertake any of the actions listed below?

Only one answer per item is possible: 6 point Likert scale

1. *Definitely Not*
2. *Probably Not*
3. *Possibly*
4. *Probably*
5. *Very Probably*
6. *Definitely*

1. Collect feedback from users or customers with regards of your **existing products** in order to improve their value
2. Involve users or customers to **test ideas and prototypes** of new products and services (or new functionalities of existing products)
3. **Hire new staff** trained/experienced in design (e.g., User Experience Designer; Interaction Designer; Information Architect; User Interface Designer; Service Designer)
4. Increase the **time** dedicated to the design phases of new projects
5. Increase the **budget** dedicated to design phases of new projects
6. Hire an **external** User Experience design agency or freelancer to improve our capability of designing better digital products
7. Invest in user-centered design **training** for its employees

Q16. What do you think are the obstacles that your company would face in undertaking any of the actions listed in the previous question?

Only one answer per item is possible: 6 point Likert scale

1. *Definitely Not*
2. *Probably Not*

3. *Possibly*
4. *Probably*
5. *Very Probably*
6. *Definitely*

1. Prior investments
2. Market conditions or excessive perceived economic risks
3. Organizational rigidities within the enterprise
4. Lack of qualified personnel capable to coordinate and drive such initiatives
5. Lack of information on how user-centered design methodologies work
6. Lack of information on market suppliers (do not know potential service providers)
7. Insufficient flexibility of regulations or standards
8. Lack of customer responsiveness to new goods or services
9. Lack of trustworthy evidence about the benefits of these methodologies (e.g. ROI – Return on Investment)
10. Lack of awareness of benefits of these methodologies
11. We fear that adopting these methodologies will disrupt our current product development practices
12. We do not cover the entire manufacturing process (the interaction design is done by our suppliers or clients)

Section F Only for TREATED

F. Satisfaction with the UX Challenge

This section is dedicated to collecting your opinion about the UX Challenge. Alongside the other data, your feedback is very important to us.

Q17. Did you personally take part in the UX-Challenge?

Only one answer possible

1. Yes
2. No

Q18. Overall, what is your opinion about the solutions developed by the teams from the UX Challenge (mockups, wireframes, prototypes, ideas, and feedback from users)?

Please, express the extent to which you agree/disagree with the following statements. One answer per item.

6 point Likert scale

1. Completely Disagree
2. Mostly Disagree
3. Slightly Disagree
4. Slightly Agree
5. Mostly Agree
6. Completely Agree

1. The solutions regarded optimization of the existing product
2. The solutions regarded incremental product innovation (e.g. new functionalities)
3. The solutions featured radical product innovation (novel added value or new meanings)
4. The solutions were in line with the initial problem statement
5. The solutions were enough mature / completed to be exploitable by our company
6. The solutions increase the user experience of our product
7. The solutions will be used by our company to develop an improved version of the product

Q19. Please, express the extent to which you agree/disagree with the following statements

One answer per item.

6 point Likert scale

1. *Completely Disagree*
2. *Mostly Disagree*
3. *Slightly Disagree*
4. *Slightly Agree*
5. *Mostly Agree*
6. *Completely Agree*

1. We will utilize the “Design Sprint” in future projects, probably without the help of external facilitators
2. We will utilize the “Design Sprint” in future projects, with the support of an external agency
3. We will stay in touch with the solvers of the UX Challenge to further develop the outputs of the Challenge
4. We will stay in touch with the mentors of the UX Challenge to further develop the outputs of the Challenge
5. We would apply to the next edition of the UX Challenge, in case there was one

Q20. Overall, how would you rate the UX Challenge?

From 0 (I did not like it at all) to 10 (I liked it very much)

|_ _|

[space for number]

Q21. Comments

Please, leave your comments and suggestions for improvement of the UX Challenge here

[Leave space for comments]

Appendix III Additional analyses

Table AIII.1

Sample	Ps R2	LR chi2	p>chi2	MeanBias	MedBias	B	R	%Var
Unmatched	0.11	20.62	0.873	8.3	5	78.9*	1.09	0
Matched	0.009	1.23	1	3.7	3.4	22.4	0.87	11

Table AIII.2 Impact estimates using inverse probability weights of being allocated to the treatment or the control group

	(1) General design knowledge (self-perceived)	(2) Design sprint knowledge (quiz)	(3) Knowledge to implement design sprint	(4) Attitudes toward design sprint	(5) Desired design sprint adoption	(6) Expected design sprint adoption
Treatment	0.396 [-0.321,1.113]	1.066*** [0.346,1.786]	0.770** [0.110,1.431]	0.420 [-0.492,1.333]	-0.162 [-0.966,0.642]	-0.059 [-0.686,0.568]
Rand. Strata	Y	Y	Y	Y	Y	Y
Pre. Outcome	Y	N	Y	Y	Y	Y
Controls	Y	Y	Y	Y	Y	Y
N	139	139	139	139	139	139

95% confidence intervals in brackets
* p<0.10, ** p<0.05, *** p<0.01

Table AIII.3 Bound estimates of impacts to account for differential attrition bias

	(1)	(2)	(3)	(4)	(5)	(6)
	Original estimate	C: Min T: Max	C: p25 T: p75	C: p50 T: p50	C: p75 T: p25	C: Max T: Min
General design knowledge (self-perceived)	0.361 [-0.289,1.012]	2.530*** [1.680,3.380]	1.050*** [0.502,1.598]	0.502* [-0.012,1.017]	0.078 [-0.452,0.609]	-0.681** [-1.361,-0.001]
Design sprint knowledge (quiz)	1.096*** [0.294,1.898]	3.420*** [2.469,4.370]	1.534*** [0.907,2.161]	0.908*** [0.285,1.532]	0.728** [0.092,1.364]	-0.181 [-0.997,0.635]
Knowledge to implement design sprint	0.711** [0.026,1.397]	2.984*** [2.084,3.884]	1.249*** [0.697,1.801]	0.677** [0.148,1.206]	0.109 [-0.472,0.689]	-0.569 [-1.315,0.177]
Attitudes toward design sprint	0.447 [-0.382,1.277]	2.184*** [1.339,3.029]	1.256*** [0.564,1.947]	0.370 [-0.265,1.006]	-0.168 [-0.839,0.502]	-1.179** [-2.077,-0.282]
Desired design sprint adoption	-0.179 [-0.964,0.605]	2.243*** [1.279,3.207]	0.596* [-0.046,1.239]	-0.208 [-0.805,0.389]	-0.639** [-1.266,-0.013]	-1.400*** [-2.179,-0.622]
Expected design sprint adoption	-0.096 [-0.749,0.556]	2.081*** [1.235,2.927]	0.751** [0.164,1.338]	0.002 [-0.525,0.529]	-0.483* [-1.035,0.069]	-1.583*** [-2.390,-0.776]
N	139	190	190	190	190	190

Table AIII.4 Treatment group's pre-post outcome variables comparison

Outcome	Measurement	mean	sd
General design knowledge (self-perceived)	Pre	6.45	2.56

	Post	6.81	2.25
Knowledge to implement design sprint	Pre	6.59	2.07
	Post	6.65	1.91
Attitudes toward design sprint	Pre	5.41	2.52
	Post	5.43	2.37
Desired design sprint adoption	Pre	6.65	2.11
	Post	5.92	2.31
Expected design sprint adoption	Pre	5.76	1.84
	Post	4.95	2.09

Note: Figures related to FUS respondents only.