

TESTING THE USABILITY OF RESEARCH PORTAL DENMARK

Report by

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The screenshot shows the top navigation bar of the Research Portal Denmark website. On the left is the crown logo, followed by the text "Research Portal Denmark – Discover and explore Danish research". On the right is a language selector with "En" (English) selected and "Da" (Danish) as an option. Below the navigation bar is a main content area with a light gray background. At the top of this area is a banner with a colorful icon of a funnel and a bar chart, and text stating: "We have celebrated the official launch of Research Portal Denmark with a conference on March 21, 2024. See the presentations and the posters at the [Conference page](#)." Below the banner are two columns of menu items. The left column is titled "Publications" and includes "Search Global Data", "Search Local Data", and "Search Open Data - Coming". The right column is titled "Analytical Overviews" and includes "Open Access", "Green Research - Prototype", and "More Information". Below these are two more sections: "Patents & Innovation" with "Search Patent Families - Prototype", and "Grants & Funders" with "Danish Funders' Data - Coming". The "More Information" section includes "About the Research Portal", "About Data & Documentation", and "FORAN - Research Analytics Network".

 **Research Portal Denmark** – Discover and explore Danish research En Da


 We have celebrated the official launch of Research Portal Denmark with a conference on March 21, 2024. See the presentations and the posters at the [Conference page](#).

 **Publications**


- Search Global Data**
- Search Local Data**
- Search Open Data - Coming**

 **Patents & Innovation**

- Search Patent Families - Prototype**

 **Grants & Funders**

- Danish Funders' Data - Coming**

 **Analytical Overviews**

- Open Access**
- Green Research - Prototype**
- More Information**

- About the Research Portal**
- About Data & Documentation**
- FORAN - Research Analytics Network**

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1 Introduction

1.1 About Research Portal Denmark

Research Portal Denmark has been under development since 2020 and was launched on March 21, 2024. The portal is funded by The Ministry of Higher Education and Science and developed and operated by NORA, the National Open Research Analytics initiative at The Technical University of Denmark.

The mission of the Research Portal Denmark is stated on the portal website¹ and can be summarised as: **to enable robust and open discovery, exploration, and analysis of Danish research – from input, to output, and impact.** This involves building a robust data infrastructure that collects and aligns the best available data from local, national, and global sources. On top of these databases, analytical and discovery platforms are created using high-quality, reliable tools and concepts.

At the launch, Research Portal Denmark included both modules that facilitate search of Danish publications as well as analytical overviews with dashboards that give an overview of selected high priority strategical research initiatives. In the usability test presented here, we analyse both the **Publications module**, that allows search in Global and Local publication data² as well the first **prototype analytical overview on Green Research.**

Note that this report and the usability study of Research Portal Denmark is closely modelled on a usability study of its predecessor - the NORA platform (Larsen, 2021).

2 Purpose

We aim to study the following overall issues:

1. How do different user groups, e.g. experienced information professionals, researchers, and civil servants, perceive the usability, functionality, and overall user experience of the Research Portal Denmark's homepage and user interface?
2. What are the specific challenges faced by users when performing searches within the publication module of the Research Portal Denmark, particularly in terms of understanding search modes, filtering options, and accessing relevant results?
3. How effective are the help texts, info boxes, and mouseovers within the Research Portal Denmark in aiding users' understanding and navigation of the portal's

¹ <https://forskningsportal.dk/about-the-portal/mission-vision/>

² The **Global publication data** contains records from Web of Science (Clarivate), Scopus (Elsevier) and Digital Science (Dimensions) that have at least one authors with a Danish affiliation. The **Local publication data** contains records harvested from the Research Information Systems of the Danish universities and other research institutions - each listing the publications produced by the researchers of a given university/research institution.

functionalities, and what additional support features might be necessary to enhance user comprehension and engagement?

4. To what extent does the Research Portal Denmark meet the needs and expectations of expert users, such as research analysts and experienced information professionals, in terms of search functionality, data export capabilities, and access to analytical dashboards, and what specific improvements could enhance its utility for this user group?

2.1 Executive summary

We report on the usability test carried out on Research Portal Denmark and give suggestions that may improve the understanding and usability of the platform.

3 Methodology

Platforms like Research Portal Denmark can be evaluated from several different perspectives and using a variety of methods. These include (Sharp, Preece & Rogers, 2019, p. 500):

- *“Controlled settings directly involving users* (examples are usability labs and research labs): Users’ activities are controlled to test hypotheses and measure or observe certain behaviors. The main methods are usability tests and experiments.
- *Natural settings involving users* (examples are online communities and products that are used in public places): There is little or no control of users’ activities to determine how the product would be used in the real world. The main method used is field studies (for example in-the-wild studies).
- *Any setting not directly involving users*: Consultants and researchers critique, predict, and model aspects of the interface to identify the most obvious usability problems. The range of methods include inspections, heuristics, walk-throughs, models, and analytics.”

No consultants were at hand to do e.g. inspections, and given that the portal has only recently been launched there are few, if any, experienced external users with which to do e.g. field studies. Therefore, we chose to do a controlled usability test with different types of users for which Research Portal Denmark is intended to be useful.

We chose to carry out an online and remote usability test. We used the loop11 platform for the tests³. Loop11 makes it possible to set up instructions and number of tasks for participants to work on, while recording their interaction (clicks on links in the interface) and capturing video of their screen and audio of their utterances. We asked participants to think aloud during the test.



³ See <http://www.loop11.com>

This is a standard and much used usability evaluation technique where participants are asked to verbalise what they notice, do and think while solving tasks (See e.g. Charters, 2003). Together with interaction data and screen recordings this provides a rich data set for analysis, where we can analyse for instance 1) what actions the participants did or did not do, and 2) get indications of why they behaved like they did. As two of the authors of this report did not speak Danish the tests were carried out in English.

3.1 Test setup and tasks

The usability test covered two modules: the **Publications** search module and the analytical overview on **Green Research**. Potential users were recruited in collaboration with the NORA team for the test of each of these.

An invitation was sent to potential test participants. After acceptance, a calendar invitation with detailed instructions was sent including instructions on how to install the loop11 plugin. A consent form detailing the purpose of the study and how collected data was included to be signed and returned before recording any data (see Appendix 2 – Consent form).

The test was carried out as a moderated test in loop11 – meaning that a test moderator was present via audio to introduce the test, to answer any questions along the way, and to help participants if they get stuck.

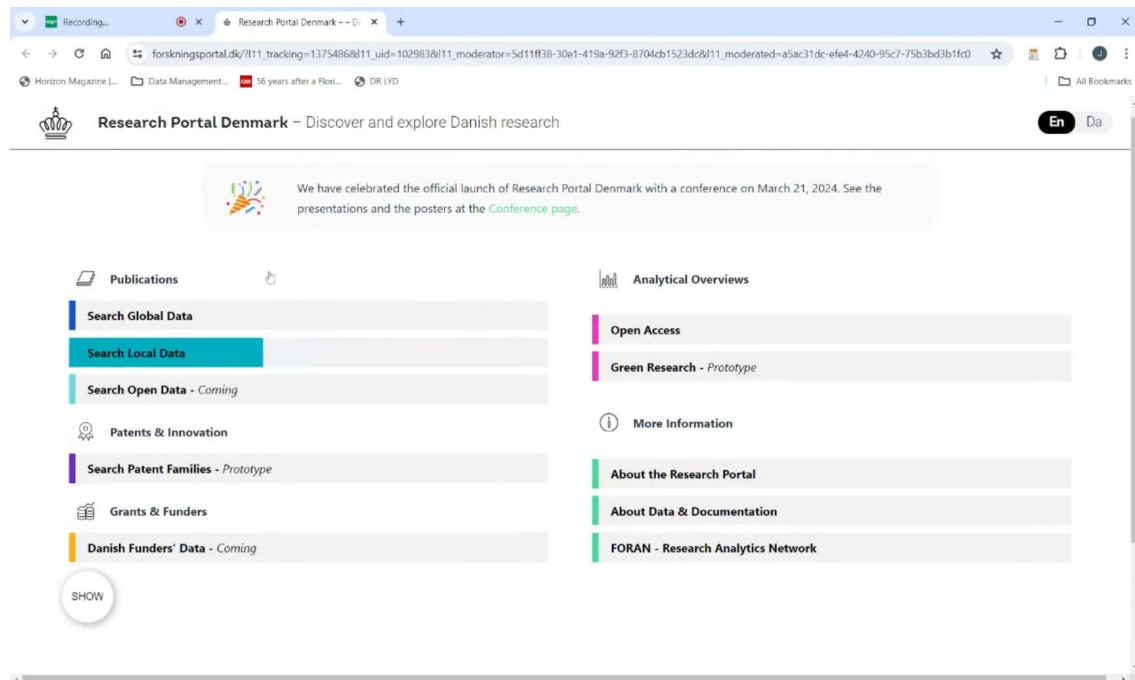


Figure 1. Research Portal Denmark frontpage with loop11 overlay. Task and instructions for the usability test are available from the "SHOW" circle bottom-left.

Following a brief introduction to the test and the Research Portal Denmark platform (along the lines of the information in the invitation, Appendix 1 – Invitation email), participants were asked to work through a number of tasks specific to each module. Participants were free to work on a task for as long as they wanted and to either mark it as completed or to abandon the task at any time they felt like it. Loop11 makes these options and the task itself accessible from a small icon on the lower left of the participants browser (see Figure 1 and Figure 2).

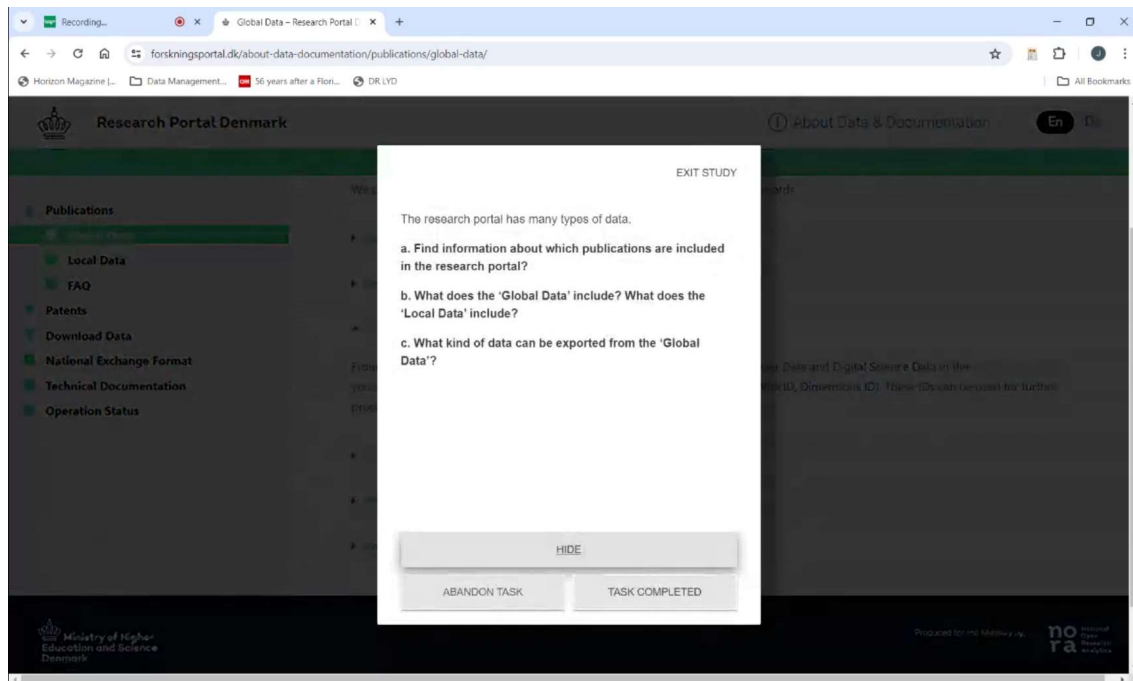


Figure 2. Presentation of sample task in loop11 - with controls to minimise the instructions, to mark the task as abandoned or completed, or to terminate the test.

For the Publications module, the test included 4 tasks with 11 subtasks of varying complexity that can be seen in detail in Appendix 3. The tasks dealt with understanding the sources and content of the Publications module as well as the differences between Global and Local data, trying out search and exporting records and using filters for obtaining complex statistics.

For the Green Research module, the test included 4 tasks with 17 subtasks of varying complexity that can be seen in detail in Appendix 4. The tasks dealt with exploring the national overview, green subtopics, organisations and organisations groups. Given the dashboard nature of the Green Research module, most tasks asked for various statistics that could either be found directly in the dashboard or which required interactive manipulation of dashboard elements to find the answers.

The final task common to both modules was the completion of a **standard System Usability Scale (SUS) questionnaire** with 10 general questions about the overall usability of Research Portal Denmark⁴.

3.2 Participants

To learn if Research Portal Denmark is understandable and usable we recruited participants across a wide range of stakeholders including university top management, research leaders, researchers, funding and project management officers as well as information specialists in various positions. This report is based on fully completed usability tests with ten participants as shown in Table 1.

Table 1. Usability test participants

Participant	Place of work	Job title	Module
Participant 1	University of Southern Denmark	Librarian	Publications
Participant 2	Danish Institute for International Studies	Librarian	Publications
Participant 3	University College of Northern Denmark	Librarian	Publications
Participant 4	IT University of Copenhagen	Librarian	Publications
Participant 5	University of Copenhagen	Chief consultant	Publications
Participant 6	Rigshospitalet	Information Specialist	Publications
Participant 7	Technical University of Denmark	Programme Officer	Green research
Participant 8	Villum/Velux Foundation	Chief consultant	Green research
Participant 9	IT University of Copenhagen	Department Head	Green research
Participant 10	Technical University of Denmark, Research Support	Data Specialist	Green research

⁴ Inspired by Brooke (1986), see also <https://www.usability.gov/how-to-and-tools/methods/system-usability-scale.html>

4 Results

4.1 Overall usability

Overall, the ten participants did not experience major usability issues with the Research Portal Denmark – all were able to navigate and use the platform and almost all could solve all tasks with no or minimal help from the moderator. The System Usability Scale questionnaire administered at the end of each test has an overall score⁵ of **64** for the Publications module and **73** for the Green Research module - with 68 corresponding to an average system (Sauro, 2011). This means that Research Portal Denmark overall scores close to an average system, corresponding to a grade of “C” in the US school grading system or a “4” in the (new) Danish grading scale.

Details of the SUS responses are given in Appendix 5. As can be seen, there is some variability on most questions, and with such a relatively small sample of users and questions of such a generality, strong conclusions should not be drawn. Given that this is the first release of Research Portal Denmark, and that it is a complex and highly specialised platform – this level of perceived usability of first-time users is not surprising nor discouraging.

4.2 Specific usability issues

In the following analysis, we focus on specific usability issues that were identified through the usability tests. The loop11 videos were replayed and annotations made whenever an issue was mentioned or observed by the moderator. The analysis thus mainly focusses on challenges, problems, and errors in Research Portal Denmark – and not on all the things that function well. As mentioned in Section 4.1 the overall usability was perceived as fair by participants, and they were able to solve the tasks given. Our aim here is to provide the designers and developers with a list of issues that can be considered for further improving the platform. Note that by agreement with the NORA team only certain modules and aspects were tested – those that were seen as central to Research Portal Denmark and for which knowledge was sought about their usability and utility. In addition, each task necessarily has a certain focus and encourages the use of certain modules and controls, such as publication search, using filters etc. This means that the issues observed are biased by the tasks and does not represent all possible uses that can be made of Research Portal Denmark, and also that some wishes expressed by participants can have been prompted by the specific task requirements. Thus, the issues

⁵ The SUS responses were scored, and a single overall score calculated following Sauro (2011) – who also gives rules-of-thumb for interpreting this score.

and suggestions given below have to be considered in relation to the intended use of Research Portal Denmark and are not to be taken as absolutes.

The loop11 videos recorded varied in length from 32 minutes to 98 mins, with an average duration of 46 minutes. In the analysis of these, a total of 32 annotations were made. Below we present observations and reflections on identified usability issues. We have grouped these by module and by the tasks to be solved in the test. We have chosen to use utterances and quotes from the participants as well as observations of their actions from screen recordings to prove a rich contextual background for each issue. We believe that this gives the best foundation for understanding each issue. Appendix 6 contains an overview table of all annotations.

4.2.1 Publication module observations by task

Task 1 in the Publication module was to find out whether participants could find information about which publications are included in the portal, the differences between the Global and Local data, and whether they could export the search results from the Global data.

All participants were able to find out the information easily from the 'About Data & Documentation' page except Participant 1. Most of the participants looked in the right place to find information, for example, Participant 4 said *"So I guess I would look into it here first because it says, about data and documentation"*. Even the participants who could not find it easily acknowledged it was easy: cf. Participant 1, *"... So I found that going in here is not difficult. It's just cumbersome"*.

Some participants also noticed and appreciated the help texts which were provided with the publication module. However, the help text does not show up immediately while moving the cursor on the option, which results in some participants missing it. In the words of Participant 1, *"It [the Help Text] doesn't come straight away, which is weird. So you have to hover it over a bit. And by that point, I would love this to come faster because I didn't notice the help text."*

In terms of exporting the data, all participants were able to find the information about which data could be exported, and which data could not be. However, participants recommended that the unavailability of the 'Export Data' option in the global module could be visibly mentioned in the Global Data: cf. Participant 5, *"...there needs to be information here. We don't have the copyright, so therefore you are not allowed to export or something like that. And it must be very visible."*

Task 2 in the Publication module was to find out which author in Denmark has the most amount of literature on a given topic, the difference in the amount of publications in the local and international segments on the given topic, as well as to find out if the participants could find out who from his/her institution has published literature on the given topic.

All the participants completed the tasks. However, the participants felt that the concept of 'Local Data' and 'Global Data' was a bit tricky, e.g. as explained by Participant 3, *"...I think it's very, very tricky to understand. It took me some time as well when they first launched the portal, and I think it's very important that you have to understand how the search interface or the portal works in order to understand what's local and what's global because nobody can guess if they don't know what NORA is."*

In terms of search mode, participants appreciated and used the three versions of search modes (Simple, Basic, Expert). However, it was observed during the test that the participants, who used the 'Expert' search option recommended that instead of writing the codes manually, any option to select or copy the codes would be better (e.g. Participant 1 and Participant 6). For example: instead of remembering and then writing TI for Title, and PY for the Year; they want to click on the term 'TI' or 'PY' and transfer them automatically to the search box. Moreover, Participant 5 used the 'Basic' search mode and got confused while using both the 'AND' operator on the search bar and the filter searches on the left side. In his words, *"What I don't know is this navigation bar, does it combine with these search operators or are these two independent? Like, if I select the University of Copenhagen here [on the left bar], and up here I have the search word, I can't figure out if they automatically combine or if I have to tell them I want this and this. I would like visually that they are talking together."*

The last part of **Task 2** in the Publication module participants was to find out whether any research is going on the given topic (information retrieval) at their department. All the participants were able to find out the answer to the question without any difficulties. However, Participant 5 recommended it would be better to have a drop-down option to select the department/discipline after selecting an organisation. For example: If *"KU University of Copenhagen"* is chosen from the left bar during the search, it would be better to have a subcategory of the departments of the University of Copenhagen under the Applied Filter option".

Task 3 in the Publication module was to find a given article and export the article metadata in Excel format.

All the participants were able to search and find the article without any difficulty. However, some participants faced a bit of difficulty while exporting the article. This happened because when searching the article, the portal took them directly to the page of the article where there is no option to 'Export'. To export an article, they had to return to the Search Page that has options such as 'Save Query', 'Clear Query', and 'Export Results'. Most participants could find the process easily; the probable reason might be that most were librarians or information specialists and had experience working with various research portals that have similar features. For instance, Participant 6 said, *"...I guess I should go out from here (Article Page) because it automatically took me to the article entry, but, in fact, I have to go to the search results in order to get to the Excel spreadsheet... That's not very clear, but I know how search engines usually work. So that's why I was thinking that was what I had to do, and here it is..."*. However, Participant 5 was not able to find the 'Export' option easily, which might have happened as he was not a librarian or information specialist and did not have expertise in research portals. His recommendation for having a visible and clear symbol aligns with this fact: Participant 5, *"... I can't do that, because I want something up here that has a picture of a disk, which is save and export. And it's not here"*. Participant 6 also recommended having some indication of not being able to export in the Global data module. In her words, *"...maybe you should have manual information about that you're not able to explore the data from the global data. So maybe it's because I'm old, but I forgot it as soon as I read it."*

Task 4 in the Publication module was to use filters for complex statistics. The participants had to find out how much collaboration a certain institution (University of Copenhagen) had done with a specific region (Nordic countries: Sweden, Iceland, Norway, Finland) for a limited time period (From 2018 to 2022). Next, they had to find out how many collaborations are open access. Later they had to find out the difference between the records of an article in Clarivate, Elsevier, and Digital Science. Finally, participants had to check if the article was available in the 'Local Data'.

All the participants completed the first part i.e. finding out the collaboration by the University of Copenhagen with the Nordic countries. However, most of the participants had difficulty finding the countries as the order of the countries was based on the total number of records. Having trouble with finding countries, both Participant 1 and Participant 5 recommended arranging the countries alphabetically: Participant 1, *"Is it*

easy to find Iceland? No. It's not. Because I have no option to go by alphabetical order" and Participant 5, *"I would like them alphabetically or like all the European, all the Asian and such. Because now if I have to find Iceland, it's horrible!"* Participant 5 also recommended a typing option for selecting countries with recommendation text. In his words, *"...I mean, it has to be searchable so that I can type in and it shows me all the countries beginning with an I [mentioning I for 'Iceland']. There."* Participant 3 selected the countries from the 'Region' category instead of 'Countries' and mentioned the same issue, *"There are also regions. Europe: EU, Europe: Non-EU but this is so random"*. Next, all participants quickly found publication years and Open-Access records.

In terms of finding the difference between the records of an article in Clarivate, Elsevier, and Digital Science; Participant 1 thought that Elsevier and Digital Science were almost the same. Participant 2 figured out that Elsevier contains funding information, but observed that except for this it looks like the rest is the same for the three databases. Participant 3 remarked on the position of the databases. In her words, *"My eyes automatically went over here to the right [Showing the top right corner under the blue margin]. I was looking for something, with Global or Clarivate or Elsevier, and I can see it's up here"*. Participant 4 mentioned more keywords and more information about the contributors on Clarivate. However, she also mentioned, *"... looks like here on Clarivate, it doesn't say whether or not it's open access over here, but it does say there in Elsevier"*. Participant 5 mentioned that Digital Science and Clarivate contain the full names of the contributors but not Elsevier. Meanwhile, Participant 6 did not find any significant difference between the three databases. All the participants found the option to check if the record was available on the Local database without any difficulties.

4.2.2 General observations on the Publication module

The participants using the Publication module also made some remarks after the task completion during the SUS and post-SUS short interviews. Participant 2 remarked that the research portal works like the other research portals. In his words, *"...actually, there was only the one part where I was looking on how to export, and that was a little bit, tricky. But other than that, I would say it's very much like other databases."* He also mentioned that he did not think the inconsistencies were too many: *"...there will always be some inconsistency that's unavoidable. So, no, there was not too much inconsistency'.* Participant 3 also remarked the same: *'...it's always the same with databases. There are a lot of features, and it takes some time to get to know a database. So, I'm used to investing some time in a database in order to use it properly'.* Nevertheless, Participant 6 thought that the interface was not very easy to use, and she was not confident enough to

use the research portal, but she also mentioned that it was her first time and no database is easy. In her words, *“I don't think it's very easy, but no databases are very easy. You have to get familiar with the databases in order to do these things quickly.”*

Participant 3 acknowledged that it was possible to navigate between the Global and Local data, however, felt like the feature was not visible enough, *“...I like the way you can navigate between the Local and the Global data. I like that very much, but it's too hidden in the filters. I would put that option much more visible because I actually think I would have tried to do that”*. On the question of ‘Most people will learn this portal quickly’, Participant 3 felt that the bachelor's degree teachers and students from her university would use this portal if the whole portal was in Danish and a bit more simple. According to her, *“They [the teachers and the students] primarily use Danish research, and they wouldn't use an interface like this if it's in English. Also, they would use the simple search, but they would get lost in the filters. So, if they have to use this regularly, it would have to be in Danish and maybe a little more simple”*. Participant 5 also mentioned that he was afraid that if the portal was not made a bit simpler, a huge number of potential general users would be disappointed and stop using the research portal. Nevertheless, Participant 5 acknowledged that with frequent use, the confidence level in using the research portal would be increased. In his words, *“It's too complicated to use as a new user. If you do it on a daily or weekly basis, of course, you will learn parts of it and feel confident.”*

In the post-SUS interview, the moderators asked different questions on overall usability, functionality, organisation of the filters, design, recommendation, etc., based on the participant interactions and attitude during the task completion.

Participants were in particular **ambivalent about the segregation into Local and Global data**. Some participants were not clear about the meaning of ‘Global’ and ‘Local’. Others were confused about whether there were any other differences in functions, speed, usability, or something like that other than the data provider, which is clearly explained by Participant 2, *“... It's a little hard to say what the performance difference is. I mean, we compared 2 results [Talking about the first part of the second task], and they were almost the same. It was only one number apart. And so in terms of performance, scores, like recall and position, I didn't measure that much”*. The participant also felt like it was unclear when to use which module. *“I'm still not really aware of what purpose I will use the one module and what purpose I will use the other”* (Participant 2). Participant 3 explained how the ‘Local’ and ‘Global’ terms might make people confused. In her words, *“Nobody understands what local data is. If you say local data to me, I will say local data*

is from Aalborg because I'm from Aalborg. Then it should be National data. I know that they are from local providers, but the terms local and global make no sense to our users.” She recommended that instead of ‘local’, the data can be called ‘Research from Denmark’, which could be clearer to the people using the research portal. The unclarity was also mentioned by Participant 5. According to him, “*the blue text says ‘search global data’, and here it says ‘search local data’. That's not what you mean. You mean to search global publications. I know, of course, that it's a kind of data, but it should say ‘search global publications’, and here ‘search local publications’. Because now it's confusing. Like, because down here, data means actually only datasets. Right?*” Like other participants, Participant 5 also thought that it would be hard for general users to distinguish the difference between the Local and the Global data. He suggested that it would be better if there were two circles for representing the global and local databases to make it easy for the general users to understand the distinction between those two. In his words, “... *at the bottom of the page, I want 2 circles that are overlapping. One is the big one which shows global scientific publications, 100,000 or 1,000,000. And then the smaller one, which is a local one, and they [the two circles] are partly overlapping. And partly because most users, I think, don't understand why all local data should be inside global data. They don't understand what's the difference.*” He further recommended that the figures that were used in the Official Launch Program of the research portal, could be used in this regard.

Both Participants 2 and 4 found the back-and-forth between Local and Global data very easy.

In terms of the **Search Interfaces** and **Filter Organisation** function; Participant 2 and Participant 4 thought that the search function works fine. However, Participant 3 thought that the filters and subfilters were not organized properly. In her words, “*...I think it was a bit messy, the things that I did [talking about the filters she used during the search], and it wasn't very logical to me the way the filters are arranged and how the subfilters are subcategories*”. She felt like some filters are not well-defined, “*What is ‘the general’? And I also said the thing about organizations and providers. What's the exact difference between them?*”. She also suggested rearranging the filters.

In terms of the **Help Text**, even though Participant 6 did not take much help from the help text, yet she thought the help texts were a great idea. It is to be mentioned that most of the participants missed the opportunity to get help from the Help Text. The delay of the Help text was one of the probable reasons for that. This delay was also reflected by Participant 1, “*It (the Help Text) doesn't come straight away, which is weird. So you have*

to hover it over a bit. And by that point, I would love this to come faster because I didn't notice the help text. Furthermore, Participant 1 recommended having some help text in the filters where the filters are too long and not showing the full name. In her words, '*...this whole section here to be legible, which it is not right now because it's cut off. And I don't have an option to show it all. So it'd be great if I could have shown all...So I would love for an option (Help text) to see, like click here to see the entirety of the names rolled out, all of them, that would be great.*' In addition, she suggested having some help text with the Search modes (Simple, Basic, Expert) in the Local data Module.

Regarding the **Overall Design** of the Portal, Participant 2 and Participant 6 were okay with the overall design. However, Participant 3 was not satisfied with the design. "*...It's very old-school design. And I'm sorry, I don't like the design. Now what's it called? The fonts and others, yeah. I don't like the look of it. And, also, I don't like the way the records are shown because I think it's the ORCID ID that is highlighted and the affiliation. And my eyes go to that and it's irrelevant...*". Participant 4 also felt that the research portal is a bit old-fashioned and he did not like it much either. His remark was, "*...I also think that it is a bit very text heavy, classic, information database, the look of it*".

Concerning **Overall Usability**, Participant 2 believes that the research portal is usable. In his words, "*I think my overall experience is that it [Research Portal Denmark] was usable. I could work out how to find the different functions. I did have to look a bit for them, but, eventually, I found them. And it didn't take too long.*" Participant 6 also thought that with some time, the research portal could be a good thing. She said, "*... I don't think overall the database, the interface is bad. I just think, for me, it takes some time to look into the different fonts, the different things you have to define. And then, yeah, spend a little time on it, then I think it's good. it's a good way to be able to show what the Danish universities are doing, and publishing.*"

It is important to mention that all the participants (Except Participant 5) using the Publication module were librarians or information specialists in their professional life. As a result, they have experience working with various databases and research portals. That could have been a potential reason for completing the tasks easily, which was mentioned by some participants themselves. For example, "*...That's not very clear, but I know how search engines usually work. So that's why I was thinking that was what I had to do, and here it is.*" (Participant 4) and "*...most people would learn it quickly? I don't know, well, people who have the same job as me, yes, most people. Not researchers* (Participant 2)." Participant 3 also believed that the research portal was a bit inconvenient for the students and the teachers. In her words, "*I'm not sure that I agree that most people would*

learn to use this very quickly. The students, that's what I'm talking about, they're not very trained in library interfaces, and this is a very complex one.” While completing the third task (finding out the specific article), Participant 4 made a similar remark, *“It was a bit unclear where exactly I was searching, but I think that's not how most people who are not librarians would do it.”* The difficulties for the general users were further mentioned by Participant 5. In his words, *“It's designed with the view of the people who put in the data. It's not designed with the viewpoint of someone like me who is sort of a medium-level user, but not an expert.”*

4.2.3 Green Research observations by task

In the Green Research module, the first part Task 1 was to find out the number of green publications involving collaboration between public and private partners in Denmark.

All the participants were able to complete this part. Some participants found it very easily such as Participant 8 and Participant 10. In Participant 8's words, *“...I need to find green publications between public and private practices. So, I'm looking for partners.”* However, some participants were a bit confused. For example, Participant 7 was looking for a percentage. *“Okay. I'm looking for a number”.*

In the second part of Task 2, we asked them how many collaborations happened between 2012 and 2022.

Every participant could answer it quite easily except Participant 9, He was a bit nervous which was expressed by his words, *“Sorry. Yes. I'm getting stressed. I'm trying to do it rapidly now. Let me see”.* In the end, he was able to do it.

The third part of Task 2 was to find the country that has the most collaboration with Denmark.

In this part, participants 7 and 10 seemed to find the answer without any doubt but participants 8 and 9 found it confusing. Participant 9 mentioned *“Am I right there? Not, it seems. No. Which regions take part? Let me just check them when you say which world region they collaborate the most with. Which country? How many? Which region takes part? See the top 10 collaborative countries at the world level. To me, that's not clear, but I would assume it means collaborative with Denmark in this description here.”* Participant 8 said *“So I clicked on Asia to zoom in, but it doesn't seem to be working. Or should I click here maybe? Is it coming? Oh, right. It's below here”.*

The last two questions in Task 2 were to find how much (in percentage) private research organisations contribute to the Green Research and to find 5 titles on the sustainable food and agriculture subtopic.

Participant 10 completed the task right away. Participant 9 was confused for a while but tried to explore all the possible ways. Participant 9 *“So it's Mhmm. Particular sub-sustainable agriculture and food. Of course, I could look here. I would be inclined to go for green sub-topics as the question is about that. And I would be inclined to look for the particular one that was asked for here. Then I'm not asked about actual numbers. I was asked about actual publications in the search module”*. Participant 8 had to abandon the task for some technical problems *“Okay. I can't, I don't think I can. It seems difficult for me to move on and see the titles. So, I think I need to skip that one”*. For Participant 7 it seemed like he was able to complete the task after wondering for a while.

Task 2 was to explore each of the six subtopics in more detail. The first question was about in which subtopics Private research contributes more than the average across all subtopics.

Participant 7 faced difficulty and skipped this question. Participant 8 was able to finish the task *“So I choose here for every subtopic, and I can see, so it's 6.5. That's the average. So green energy is more than average”*. For participant 9, he found the answer but he was confused about the percentage. Also, it seems like he still has the question from the last task in his mind and here he found the answer or tried to relate to it *“But no. No. It's, I guess it can be confusing, but it's more like thinking about where the private research stats were in a previous task. Organisations. Organisation groups... There's something odd here in my mind again. Private research for all green subtopics, 6½ percent. Now I'm confused since Mhmm. How can the average be 6.5? And that if these are all this large, that tells me that my interpretation is wrong somewhere”*.

And during the test of participant 10 it seems that the participants found the answer but not in the correct value *“So it's a 6.9. Private research for all green subtopics. But here's a 6.5.”*.

The next question in task 2 was to look into the citation impact of green transportation.

Participant 7 faced some problems with the filters while searching for the answer but at the end he was able to find it *“Right? I don't know how to filter for these different topics. Mhmm. So it's confusing, the filtering function for, green energy then. Yeah”*. But for the rest of participants it was easy to find the answers as at this point they were getting used

to the platform. Participant 9 mentioned that *“And we have here and the answer is, yes, it's, it's higher here. We can compare. Yes. Yes. It is. Good. Well, was, was this easier than the the Yeah. Yeah. That was so straightforward”*.

For **the last 2 questions in Task 2**, every participant was able to find the answers. Participant 7 took some time *“So that would be, again, topics. Sustainable agriculture. And then we find collaborations. We were looking for which country we collaborate with the most. So that would be maybe the area specific 1, which is not here.”* Participant 9 said *“That was also straightforward. I'm, I'm back in business.”* Participant 9 had some problems understanding the question properly.

Task 3 in the Green Research module was to look through the organisational groups section. The first question how many (in percentage) universities involve in nature and climate change. Participant 8, 9 and 10 all seemed to answer this right away.

The next questions were about governmental institutes involved (in percentage) in nature and climate change and whether there is an increase or decrease in private research from 2012 to 2022. All the participants were able to find the answers easily.

Task 4 in the Green Research module was also to explore the contribution of a large number of individual organisations.

All of the three participants were able to complete this task without any hint or help. In addition, they did not take much time or ask for any help or hints. One of the potential reason may be that they got used to the pattern after the first 2 tasks and then it was easy for them to find those filters. It is to be mentioned that participant 7 did not participate in the last two tasks due to time restrictions.

4.2.4 General observations on the Green Research module

After finishing the tasks participants also answered a short interview where they were asked about the overall experience of the Green Research module. Participant 10 was not able to take part in the interview. But when we observe him throughout the interview, he answered all the tasks pretty fast and did not have much difficulty exploring the features. If we see his background, it is clear he has experience with different databases. Participants 7 and 8 talked about their confusion and difficulties. For example, Participant 7 mentioned *“So in my line of work, I will not need to use this often, I think. So just know that that's, like, the premise for my answers here. Mhmm. Unnecessarily complex. I mean, it's difficult to just do this because I wasn't completely aware of how the filtering was done with the pre-filtered stuff. But on the other hand, searching in the publications didn't help me much. So, you're doing something, upfront was nice”*. On the

other side participant 9 mentioned that *“I mean, as reflected by my answers just given, I find it quite straightforward, actually, to run through. If there was something that I still feel that I would have to maybe spend an hour more to sort of familiarise myself with was the actual meaning of the top categories”*.

For the rest of the participants, we asked their overall opinion about the search module (that can be accessed throughout the Green Research module through links to see the publications underlying a given table or visualization). Participant 7 mentioned that *“visually, it's a nice page, and it's simple, so it's easy to see what's there. I don't know if you, when you kind of, elaborate on it, if it will be. I hope they will keep the same kind of simplicity so it's easy to find what you want. Maybe some more text, maybe the data available in the table if you want that. I haven't looked at the PDF, so I don't know if that has that. Yes. I don't know what the dots and the thing was when I moused over or clicked on the graphs”*. He also said that *“Being able to do your own filtering easily would also be nice. Uh-huh. Yes. So you need to feel comfortable with the website, I think you need to play around a little bit also. Just kind of. But also, I'm not used to this kind of system”*. Participant 9 mentioned that *“I find it quite straightforward, actually, to run through. If there was something that I still feel that I would have to maybe spend an hour more to sort of familiarise myself with was the actual meaning of the top categories.”* Participant 8 mentioned that although he kind of knew the system but still it is confusing to him. *“So I know of the system before, so I have sort of looked in the global and the local data. So maybe that was where I went first. So, I think it's a bit confusing that there's a separate portal or, you know, that you need to access the green data. Although I do see that, it's more of an analytical overview and not really the raw data that you're in. So, in that sense, it might be a bit confusing that this is a different type of data that you're looking at. It's more statistics. Whereas if you wanted to go to the portal, you usually would go and look for publications”*. To all of the participants having the filter and different search is a little confusing but again all of them said it is easy to understand if someone spends some time.

They were asked if the **Layout** was clear to them regarding the ‘Denmark’ column and ‘Benchmark’ columns, regarding the sequence in the ‘Organisation’ pages and also about the Green Research module’s overall visualisation. All of them were very satisfied with the visuals. They found the Green Research module easy to navigate. Participant 8 mentioned that *“So the different figures were quite good and very easy to read. And I think that's essential when you do an analytical tool like this, that they're intuitive and very easy to access. So, I mean, they weren't exceptional, but I don't think they need to be”*. About the **help texts** he also mentioned that *“I didn't use the help text, and I think that's very*

something I rarely do, which I probably should have done, but that's probably who I am. But I didn't really see them. I mean, they were a bit hidden for me too, so I didn't I probably should have looked more for them to see them". Participant 7 also made a comment about the help texts *"I think maybe a little bit more help text when you mouse over stuff, like in the graph section because there's no text as far as I recall at the bottom of what you're actually looking at. So that kind of requires you to know and be used to using the system so you know what it is".* Participant 9 said he had a some difficulties finding the sequence of the page and columns but anyone can get used to it after exploring a little. He also mentioned about the help text that he found it useful *"I mean, when I needed it, I found it with the unfolding of the individual publications and and, and just the fact you, you need to just learn once that there are certain options like that. So, I find that fine"*

The last interview question was to ask if the links to the **search module** were easy/difficult to find, and if they are useful? Participant 7 answered that because of the pressure of solving the task, he found it a little bit confusing *"I think that took us back to, like, the publication search tools. Uh-huh. Yeah. But then they had a lot of options. Right? And that was a little bit confusing, but maybe also because of the pressure of solving the task with you here".* Participant 8 mentioned that the links were easy to find but the layout was difficult to use from a laptop screen *"I said that before that I've found that quite difficult to find. It wasn't that intuitive. Yeah. Yeah. And, also, I think maybe right now, I'm just sitting with my laptop screen. So, and when you do that, it might be, it's not that visible. And, actually, you can also see when I try to sort of select a subcategory or an organisation, I really sort of had to scroll down while I was sort of looking through the categories list. So, yeah, so maybe you need to think about the layout, thinking about the people sometimes use their laptops or and not a big screen when they view this. So, it could maybe be a bit more accessible when you use laptops or iPads or yeah".* For participant 9 it was easy to find *"I think so. I mean, I've found it in an expected amount of attempts and time, I would say".*

5 Conclusions

Overall, the usability of the Research Portal Denmark can be said to be good. Given that this is the first release of portal, and that it is previously untested with its intended users, and that it is a complex and highly specialised platform – this level of perceived usability of first-time users is not surprising nor discouraging. Basically, the Research Portal Denmark platform makes it possible to perform the kinds of task that it is intended for, and new users are able to use the platform with minimal instruction. Section 4 above presents a number of issues that can be considered for inclusion and improvement in

further development of the platform. Most of these are not critical, but we expect that addressing a number of them would improve the understanding and usability of the platform.

More issues were identified in the Publications module than the Green Research module. Given that the Publications module is much more complex with multiple searchable database, a wide range of filters, three search modes, etc. this is not unexpected. Overall, much fewer usability issues were found when compared to the previous NORA system (Larsen, 2021) – indicating that Research Portal Denmark is on the one hand a much more mature platform, and on the other that NORA had more functioning modules at the time of the test of both systems.

6 Acknowledgments

The test was carried out in collaboration with Aryan Dhakal and Marcell Varga and we are grateful for their input and efforts.

7 References

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8 Appendix 1 – Invitation email

Dear <name>,

Thank you for agreeing to participate in the usability study of Research Portal Denmark. The test takes place in Loop11, an online usability testing platform available through a web browser (Chrome or Firefox) on your laptop or desktop computer. The test was supposed to take less than 60 minutes to complete, and it takes place at the time interval specified in this calendar invitation.

<link to Calendly where participants can choose a slot>

There will be a moderator present online during the entire course who can answer questions along the way.

You can access the test via the following link:

<link to loop11 – unique for each participant>

Before the test, we will ask you to open the link in either Chrome or Firefox and to install loop11 linked plugin. If you use a Mac, we must also ask you to update your security settings as specified in attachment. Immediately before the test, we will ask you to restart your computer so it is fresh and well laid out. At the time of the test, open the link in the same browser again and the test can then begin.

After a short introduction to NORA, we will ask you to solve a number of tasks in the system, and to answer a series of questions. While performing the tasks, we ask you to try to verbalize loudly and clearly what you are thinking and doing.

We record the following data during the test:

1. Video of the browser window in which the test is carried out.
2. Sound from your microphone (if you have a headset it is preferable).
3. And if you allow us – video from your webcam.

We need as a minimum to record your screen and sound in order to complete the test. All data remains anonymized and will not be shared beyond the project team in the NORA project. Data is stored safely and secure according to GDPR. In connection with publication, the data will only be published in anonymized form and no data that can be traced back to you as a person or your institution will be published.

We look forward to introducing you to Research Portal Denmark and to your feedback!

If there are technical problems related to the test, call Birger Larsen on tel. XXXXXXXX.

Kind regards

9 Appendix 2 – Consent form

Research Portal Usability Test Consent Form

Research Title: Research Portal Denmark Usability Test

Researcher: Aalborg University

Introduction

You are invited to participate in a usability test conducted by graduate students of Aalborg University in collaboration with Professor Birger Larsen as part of a research study titled "Research Portal Denmark Usability Test". The purpose of this study is to evaluate the usability and user experience of the Research Portal. Your participation in this study is voluntary, and you have the right to withdraw at any time.

Participant Consent

By participating in this usability test, you agree to the following:

Purpose of the Study: I understand that the purpose of this usability test is to evaluate the usability and user experience of the Research Portal to identify areas for improvement.

Data Collection: I consent to the collection of data generated during the usability test, including my interactions with the Research Portal, audio/video recordings of the test sessions, and any notes or observations made by the researcher(s).

Data Processing: I understand that the data collected during the usability test will be processed and analyzed by Aalborg University and the National Open Resource Analytics (NORA) for research purposes only. My personal data will be treated confidentially and in accordance with applicable data protection laws, including the General Data Protection Regulation (GDPR).

Anonymity and Confidentiality: I understand that my participation in this study will be kept confidential, and my personal information will be anonymous in any research reports or publications resulting from the study. Only authorized personnel involved in the research study will have access to the data collected.

Right to Withdraw: I understand that my participation in this study is voluntary, and I have the right to withdraw at any time without penalty. I understand that I can withdraw from the study by informing the researcher(s) of my decision.

Participant Consent Acknowledgement

I have read and understood the information provided in this consent form. I agree to participate in the usability test conducted by Aalborg University under the terms outlined above.

Participant Name:

Date:

10 Appendix 3 – Publication module tasks

Task 1

The research portal has many types of data.

1. Find information about which publications are included in the research portal?
2. What does the 'Global Data' include? What does the 'Local Data' include?
3. What kind of data can be exported from the 'Global Data'?

Task 2

Information retrieval is the task of identifying and retrieving documents that are relevant to an information need.

1. Find out which researcher has published most on information retrieval in Denmark?
2. How many information retrieval publications can be found in the international databases versus in the ones registered locally by the Danish universities?
3. Are there any researchers in your own university that does information retrieval research? Can you identify the department(s) they are affiliated to?

Task 3

1. Find the following article: 'Using sequences of life-events to predict human lives'
2. Export the article metadata in Excel format.

Task 4

1. The university leadership of the University of Copenhagen will receive a visit from the Nordic Council, and would like to know how many publications the university has collaborated on with the Nordic countries from 2018 to 2022. Use Global Data.
2. How many are Open Access?
3. Look at the record of one of the articles. What is the difference between the records in Clarivate, Elsevier and Digital Science? Can this article also be found in Local Data?

11 Appendix 4 – Green research module tasks

Task 1

The Green Research – National Overview presents overall statistics on Danish Green Research. Use the National Overview to look for answers to the following questions:

1. How many green publications involve collaboration between public and private partners in Denmark?
2. How many in 2012 vs. 2022?
3. Which world region does Denmark collaborate the most with? Which Country?
4. Which are the Top-5 collaboration countries in Asia?
5. How much do the private research organizations contribute to green research (in %)?
6. Denmark has 11.0% of its green publications in the ‘Sustainable agriculture & food’ subtopic. Find those publications in the search module and have a look at the first five titles.

Task 2

The **Green Subtopics** allows you to explore each of the six subtopics in more detail. Use the Green Subtopics to look for answers to the following questions – start by selecting the relevant subtopic at the top of the Green Subtopics section:

1. Find out in which subtopics Private research contributes more than the average across all subtopics (i.e. Private Research for all Green Subtopics = 6.5%)
2. Is the citation impact higher for the ‘Green transportation’ subtopic than ‘All green subtopics’?
3. How many publications are there from Denmark in the subtopic “Green energy” compared to Sweden?
4. Which country does Denmark collaborate the most with in ‘Sustainable agriculture & food’?

Task 3

The **Organisation groups** allows you to explore the contribution of the type of organization (universities, private research, hospitals etc). Use the **Organisation groups** to look for answers for the following questions – start by selecting the relevant subtopic at the top of the **Organisation groups** section:

1. How many percent of the ‘Nature & climate change’ research involve Universities?

2. How many percent of the 'Nature & climate change' research involve Governmental institutions?
3. Is there an increase or decrease in citation impact for Private Research in the period 2012 to 2022?

Task 4

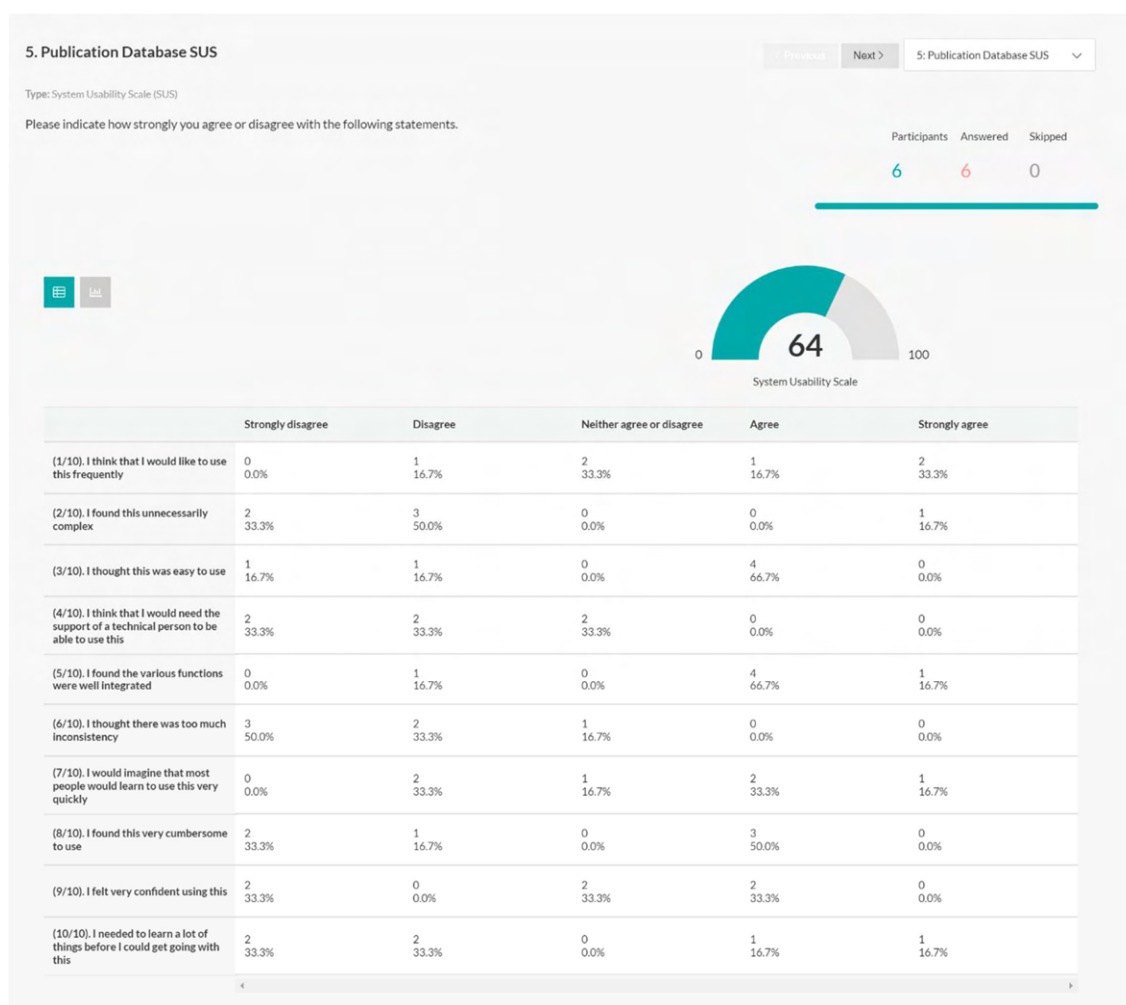
The **Organisations** section allows you to explore the contribution of a large number of individual organizations (for example University of Copenhagen, Novo Nordic, Danish Technological Institute, etc). Use the **Organisations** section to look for answers for the following questions – start by selecting the relevant organization at the top of the **Organisations** section:

1. How many percent of the publications from the Danish Technological Institute are in Green Research?
2. In which of the six subtopics does the Danish Technological Institute do least research?
3. What is the share of green publications from Aalborg University in the top 10% most cited worldwide (field-weighted)?
4. What has the development been in public-private collaboration for the Danish Technological Institute over the last decade?

12 Appendix 5 – System Usability Scale responses

All 6 Publication module participants filled out the System Usability Scale questionnaire in loop11. Below is show an overview of the responses followed by details of responses to each question.

Note that odd numbered questions are positively phrased with even numbered questions being negatively phrased. Some of either type are essentially on the same matter and this allows to check consistency in the answers.



5. Publication Database SUS

Previous

Next >

5: Publication Database SUS

Type: System Usability Scale (SUS)

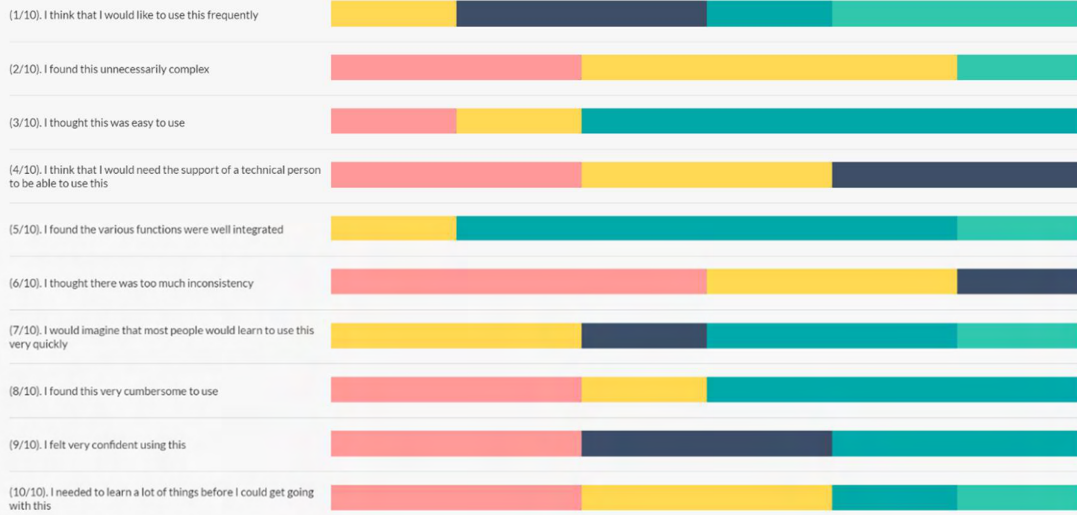
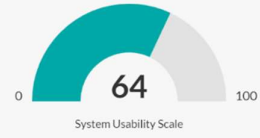
Please indicate how strongly you agree or disagree with the following statements.

Participants Answered Skipped

6 6 0

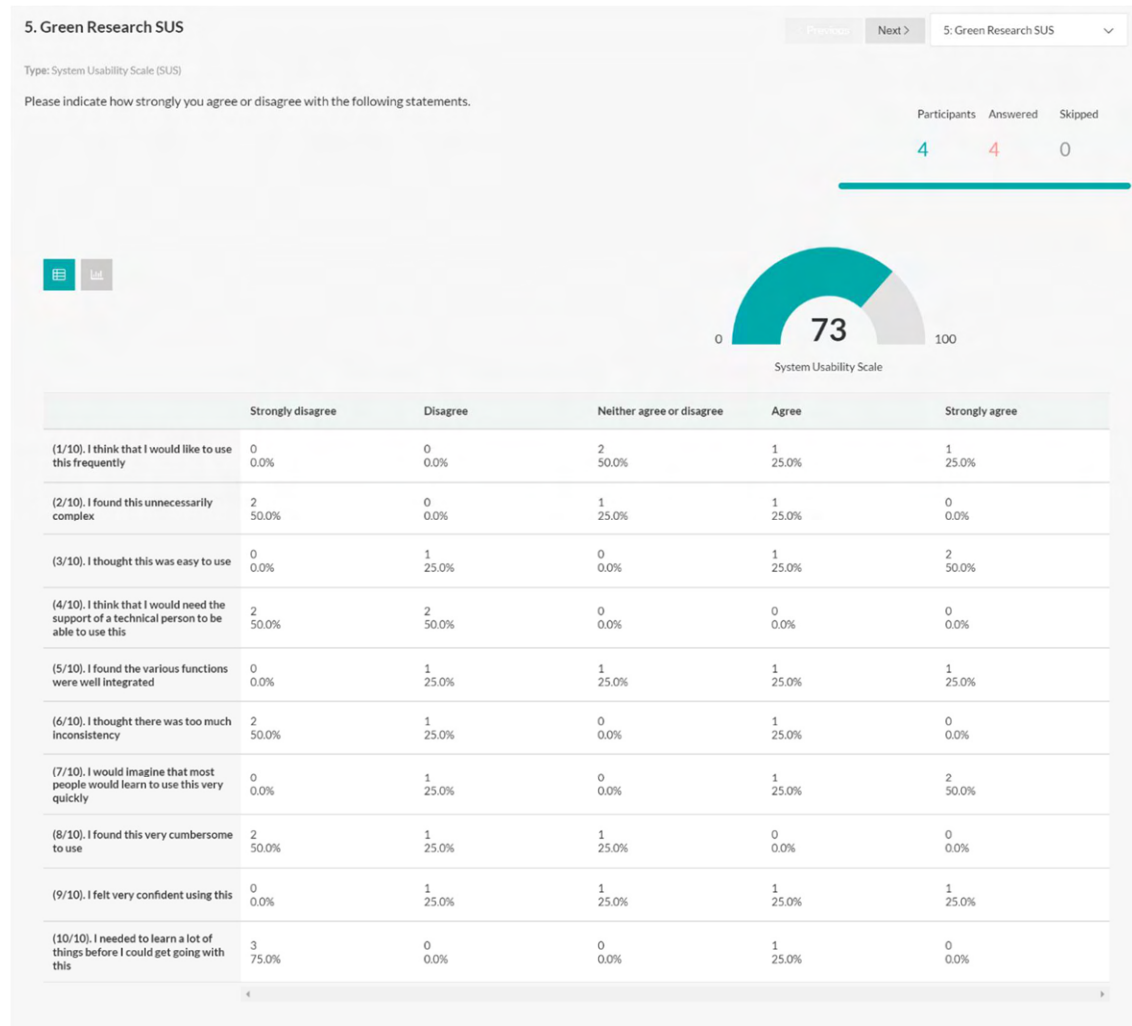


● Strongly Disagree ● Disagree ● Neither Agree Or Disagree ● Agree ● Strongly Agree



All 4 Green Research module participants filled out the System Usability Scale questionnaire in loop11. Below is show an overview of the responses followed by details of responses to each question.

Note that odd numbered questions are positively phrased with even numbered questions being negatively phrased. Some of either type are essentially on the same matter and this allows to check consistency in the answers.



5. Green Research SUS

Previous

Next >

5: Green Research SUS

Type: System Usability Scale (SUS)

Please indicate how strongly you agree or disagree with the following statements.

Participants Answered Skipped

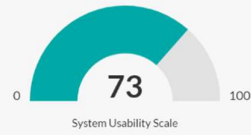
4

4

0



● Strongly Disagree ● Disagree ● Neither Agree Or Disagree ● Agree ● Strongly Agree



13 Appendix 6 – Annotations, usability issues

32 raw annotations from usability test. **Module** refers to the Publications module and Green Research module in Research Portal Denmark. **Type** is a rough classification of observations/utterances into types: suggestions, observations, participant confusion, questions. **Issue** refers to a rough grouping of annotation into issues that each deal with an aspect of the same problem. **Notes** are the moderator brief notes describing the observation/issue, and the last column briefly describes any **solution** proposed by the participant.

#	Participant	Module	Type	Issue #	Notes	Solution proposed by participants
1	P1	Publications	suggestion	1	Help text appears too slow on hover.	Make hover help text appear faster
2	P5	Publications, Global	suggestion	3	It is not clear on the Global search page that data cannot be exported.	Make a very visible statement that data cannot be exported from global search.
3	P3	Publications	confusion	2	Difference between global and local not clear.	
4	P1+P6	Publications	suggestion	5	In expert search, it is cumbersome to transfer code from the overview to the search box.	Add field codes to search field when double-clicking the code in the overview.
5	P5	Publications, basic search	confusion	6	Confusion regarding Boolean AND while using both the 'AND' operator on the search bar and the navigation bar on the left side.	Make them visually talk together.
6	P5	Publications	suggestion	7	Make it easier to select a department/discipline after selecting an organisation.	Have a drop-down option to select the department/discipline after selecting an organisation
7	P5+P6	Publications	confusion	3	Export option only on search page (when viewing document details no export available)	
8	P5	Publications	suggestion	3	Not clear where it is possible to export.	Add clear iconography on pages where it is possible to export.
9	P6	Publications, Global	suggestion	3	It is not clear on the Global search page that data cannot be exported.	Make a very visible statement that data cannot be exported from global search.

10	All, P1, P5	Publications	confusion	7	Difficulty finding countries because of order by frequency.	Order countries alphabetically. Support typing of first letter(s) as a way of filtering the list. Or structure first by region, then alpha by country.
11	All	Publications		12	Only small differences were noticed between WoS, Scopus and Dimensions records.	
12	P3	Publications	suggestion	2	Possibility to switch between local and global data is not sufficiently visible.	Make more visible.
13	P3	Publications	confusion	4	Lecturers and students would get lost in the filters.	Simplify the filters.
14	P5	Publications	confusion	4	The portal is too complex for new users - only by using it often will users be confident.	
15	Several	Publications	confusion	2	Difference between global and local not clear.	
16	P3	Publications	confusion	2	Nobody understands what local data is.	Don't call it local data. Maybe call it 'National data'. or 'Research from Denmark'
17	P5	Publications	confusion	9	'search global/local data' is confusing.	Call it 'publications' not data = search global publications
18	P5	Publications	confusion	2	Too difficult for general users to distinguish the difference between the Local and the Global data	Try to visualise the difference i the interface, e.g. by overlapping circles / Venn diagrams.
19	P3	Publications	confusion	7	Filters and sub-filters are not organized properly	Rearrange the filters.
20	P3	Publications	confusion	7	Some filters are not well-defined ("the general" and difference between 'organizations' and 'providers'.	Work more or the labels.
21	P1	Publications	suggestion	7	Some text in filters is too long and does show the full name.	Add full names as help text (on mouse over on abbreviated text).
22	P1	Publications	suggestion	8	No help text explaining the simple/basic/expert modes in local data.	Add such help text that explains what each does.

23	P3+P4	Publications	observation	10	The overall design feels old-school and old-fashioned; very text heavy.	
24	P3	Publications	observation	11	ORCID is emphasised too much.	Make ORCID and affiliation less prominent in the page design.
25	Several	Publications	observation	4	Not very easy to use for non-experts (like information specialists)	
26	P8+P9	Green Research	observation	13	Some Green Research participants got lost in the interface.	
27	P9	Green Research	confusion	14	Confusion about percentages and averages.	
28	P7	Green Research	observation	15	Visually nice page. Quite easy to navigate through Green Research.	Keep other analytical overviews as simple.
29	P8+P9	Green Research	confusion	16	Confusing difference between an analytical overview and the jump into the raw data.	
30	P7	Green Research	confusion	17	Difficult to understand what the graphs are showing.	Add help text/ explanation for each graph.
31	P7	Green Research	confusion	16	Confusing difference between an analytical overview and the jump into the raw data.	
32	P8	Green Research	confusion	19	The layout is difficult to use from a laptop screen (i.e. a small screen)	