Investigating the Requirements for a Collaborative Platform Supporting the Transition Towards Sustainability at UZH

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Abstract

The Master Thesis presents an analysis of interest and requirements towards sustainability at the University of Zürich, and proposes a design for a collaborative platform that will support the transition towards sustainability at the university. Through the literature review, questionnaire, and focus group study, the Master Thesis gathers critical aspects of an effective platform, such as personal interaction, informativeness, interactiveness, feedback, relevance, and reach. Wireframes and user stories demonstrate the proposed design for a 'Sustainability Photo Board' platform that encompasses these aspects and create the outline of user interactions. In the design, photo posts and embedded comment threads are supported to discuss sustainability topics. Finally, a functional prototype was created which can run on a local machine to demonstrate all important functions of the proposed system: creating photo posts, commenting, browsing, rating, and searching.

The proposed platform addresses concerns to take action, raise awareness, and to share ideas regarding sustainability. The platform aspires to drive involvement and individual commitment in a sustainable campus life by focusing on sustainability issues and on solving them. It is collaborative by nature, as people can discuss issues, rate their relevance, and can even coordinate efforts to address them together. The platform brings personal discussions concerning sustainability online and supports the daily discourse of UZH faculty, staff, and students.

Zusammenfassung

Diese Masterarbeit stellt eine Analyse über die Ansprüche und den Bedarf der Nachhaltigkeit von UZH vor, sowie schlägt einen Plan und ein Design zur Kollaborationsplattform vor, die die Umstellung auf eine nachhaltige Universität unterstützt. Von der Fachliteraturübersicht über den Fragebogen bis zur Fokusgruppenstudie sammelt und stellt die Masterarbeit die wichtigen Gesichtspunkte zu einer gut funktionierenden Plattform vor. Solche Gesichtpunkte sind zum Beispiel die persönliche Interaktion, die Informationsvermittlung, die Interaktivität, das Feedback, die Wichtigkeit und die Erreichbarkeit. Die Wireframes und die vereinfachten Benutzerbedingungen beweisen die geplante Gestaltung von der Sustainability-Photo-Board Plattform, die diese Gesichtspunkte beinhaltet und eine Skizze von der Benutzerinteraktion erstellt. Im Plan werden Fotoposts und eingebettete Kommentare unterstützt, damit die Benutzer die Nachhaltigkeitsthemen diskutieren können. Schliesslich ist ein gut funktionierender Prototyp vorbereitet, der am lokalen Computer ausgeführt wird, damit er alle wichtigen Funktionen des empfohlenen Systems vorstellen kann: Fotoposten erstellen, Kommentieren, Browsen, Auswerten und Suchen.

Die vorgeschlagene Plattform beschäftigt sich mit Bedenken, was die ersten Schritte betrifft, steigert Bewusstsein und hilft, untereinander die Ideen in Zusammenhang mit der Nachhaltigkeit zu teilen. Die Plattform strebt danach, für ein sich selbst erhaltendes Universitätsleben die Benutzer einzubeziehen und persönliches Engagement zu schaffen, dass sie dadurch auf Nachhaltigkeitsfragen fokusiert und sie löst. Sie ist von Natur aus kollaborativ, damit die Benutzer ihre Fragestellungen besprechen, ihre Wichtigkeit auswerten, sowie gemeinsam ihre sorgfältige Arbeit koordinieren können. Unser Projekt wandelt die persönlichen Gespräche in online um und hilft bei täglicher Konversation zwischen dem Fach UZH, den Mitarbeitern und Studenten.

Contents

1 Introduction

1.1 Context

Sustainability is increasingly important in universities around the world, as well as becoming a useful part of the curriculum. The University of Zürich (UZH) has been advancing its efforts to share information concerning sustainability and to promote sustainability among students and faculty. Many teaching modules already engage in different aspects of sustainability, but there might be a need for an encompassing approach.

1.2 Aim of the thesis

The overall aim of the Master Thesis is to understand how sustainability could be improved in the eyes of the university members. Therefore, information is gathered from the community at UZH to discern what is notable for the university members at UZH, and to uncover how students, faculty and staff at UZH relate to the topic of sustainability. This information leads to building a design of a platform based on their answers. They have their opinions and ideas that are considered to create the most appropriate platform design to help the community communicate with each other, share ideas, and execute these ideas together. By learning the best way to enhance sustainability to be part of everyday discourse, this platform can make everyone aware and actively pursue its benefits.

The first goal of the Master Thesis required to reach this aim is to analyse students' and faculty members' views on how sustainability at UZH can be improved, and their requirements for a collaborative platform that supports sustainability discourse. These two groups share different schedules but a standard setting (campus) for their daily activities and research. The second goal of the current research is to evaluate and design a platform to promote and improve sustainability discussions across the University of Zürich. Discussions regarding sustainability do not currently have an official forum at UZH.

1.3   Research methods

The analysis of possible improvements is achieved through a questionnaire. A formative, structured study is conducted, to gain a quantitative understanding of prospects of enhancing sustainability at UZH. The questionnaire aims to ascertain how people relate to sustainability at UZH, what are the sustainability ideas they have been considering or could examine in the future, and what kind of a platform they would use to create a more successful community. The mixed ended questionnaire contains multiple questions about sustainability graded on a Likert scale, as well as some free form questions. Questions are written based on the state and desired transition path towards sustainability at UZH and other universities. The questionnaire contains questions to assess the participant's approach to sustainability, their proficiency with social media, and their requirements for a collaborative platform and their opinions on possible solutions.

The proposed driver of the transition towards sustainability is a forum with an image board and comment section. The site presents a common platform for discussion that is easily usable and promotes sustainability at UZH. The questionnaire assesses the design and requirements for this platform and elicits ideas for further sustainability improvement. Wireframes, mockups, and visual design are created. These contain visualisations of possible interactions with the system, user stories, as well as a description of each wireframe and how the finished design functions.

A small two-way focus group evaluates the wireframes in summative, semi-structured interviews. The focus group assesses and discusses the design as well as new user ideas and desired improvements. The focus group interviews run through multiple stages to achieve both design testing and usability testing. The focus group is asked to evaluate the system based on mockup screens. They then walk through some sample execution paths for previously planned tasks. They explore the wireframes in a 'presentation style' as the moderator explains each screen as the participants arrive there, but they still have to solve the task themselves.

Finally, learning from the results of the focus group study, a prototype design for an Internet-based sustainability forum is created. This prototype is based on the previously created wireframes and mockups and influenced by the results of the questionnaire and focus group study.

1.4 Structure of the thesis

The Master Thesis contains a review of relevant research and reports on the transition towards sustainability at universities. The reports include motivations, practices, culture, and requirements for advancing sustainability. These studies give context to the current goals and processes at UZH, and also serve as guidelines to set aims and expectations. There has been extensive research into awareness of sustainable behaviours in everyday practices or habits (Hobson, 2003). Therefore, it is essential to educate people regarding sustainability and to support a serious discourse about sustainability at UZH. The intention with this is to ensure that students and faculty will not only discuss sustainability within the bounds of the university but will also adopt a sustainable way of thinking and awareness in their personal and professional discussions outside the university as well.

The next part of the thesis discusses the research methodology. The research includes an initial questionnaire about sustainable practices at UZH, design of a wireframe and focus group study, and proposing the design for a system prototype. In the discussion section, the results of each step are presented, as well as the gained knowledge.

The Master Thesis lays the groundwork for adapting a new collaborative platform at UZH that supports students and faculty. The platform will help UZH's task of transforming sustainable practices at the university to be more accessible, natural and efficient, ideally making it a daily topic of discourse. It is important not solely for students, university staff, and faculty, but to everyone since sustainability benefits not one person or one university but globally everyone as well.

2 Related work

In section 2.1, sustainability in universities and different frameworks for implementation and monitoring sustainability is discussed. Through section 2.2, different transitioning towards sustainability and key drivers, phases, and dimensions are evaluated. Finally, section 2.3 discusses concrete university practices that focus on sustainability.

2.1 Sustainability in universities

Many different approaches are present for evaluating sustainability efforts in universities.

- The Talloires Declaration defines a ten point action plan involving multiple aspects of improving sustainability.

- The Lüneburg Declaration argues for education, awareness, and information exchange

- (Bekessy et al., 2003) proposes eight 'phases' of university approaches to sustainability.

- (Clugston et al., 1999) defines several 'dimensions' along which sustainability at universities could be evaluated, with advancement across all dimensions together corresponding to more significant overall progress.

There are several reasons why focusing on sustainability in universities can create a large impact (Bartlett and Chase, 2004). Programs in higher education can affect change in a wider area. Millions of students each year are taught in universities, and these students will play a significant role in future sustainable development. Universities also interact with the surrounding communities and can benefit them (and each other) with sustainable projects. Universities, due to their size, also represent a large economic and ecological factor so they can also significantly affect the environment.

The role of universities is not only to create change around themselves; but also to seek sustainable practices in their future roles as well (Bekessy et al., 2003). This role includes a reform of the university itself, adoption and dissemination of sustainable practices. Universities which embrace sustainability can use it as a selling point for prospective students and potential employers seeking graduates with this knowledge.

One of the well-known frameworks for implementation and monitoring of sustainability in higher education is the **Talloires Declaration** in 1990. The declaration encompasses steps to improve sustainability in 'teaching, research, operations and outreach' at universities and is signed by over 450 universities to date. The Talloires Declaration represents a significant step towards defining sustainable universities and proposes key actions towards sustainability. Some of the most important measures included in the Talloires Declaration are the following (ULSF.org, 1990):

- Encourage all universities to engage in education, research, policy formation, and information exchange on population, environment and development to move toward a sustainable future.

- Establish programs to produce expertise in environmental management, sustainable economic development, population, and related fields to ensure that all university graduates are environmentally literate and responsible citizens.

- Set an example of environmental responsibility by establishing programs of resource conservation, recycling and waste reduction at the universities.

Advancements in sustainability lead to the newer Lüneburg Declaration(Lüneburg Declaration, 2001), which promotes the inclusion of up-to-date sustainability knowledge in learning materials, a focus on sustainable development in teacher education, adopting sustainable policies and practices, and networking with other institutions to ensure environmentally friendly practices.

(Bekessy et al., 2003) Assert that universities have responsibilities beyond education or research, and these responsibilities include sustainable campuses as well. Additionally, a strategy for sustainability must contain not solely reactive measures but preempt potential environmental issues before they happen.

(Bekessy et al., 2003) Also analysed current sustainable developments, discovering that the key strengths are education programs, institutional operations (trans-disciplinary approaches to sustainability), and commitment of university members. While weaknesses were a lack of funding and policy, and sometimes a lack of executive commitment. They define the path to achieving sustainability at universities as separate phases ranging from 'rejection' to full commitment to implement sustainable strategies.

1. Rejection;

2. Response to and compliance with government regulation;

3. Risk assessment: the increasing insurance, business and public image risks associated with poor levels of environmental performance;

4. Recognition of cost savings such as reductions in energy and material use and opportunities for recycling and transforming waste to new products;

5. Growing awareness of the seriousness of global and local environmental trends;

6. Institutional opportunity: the competitive advantage institutions see in cross-institutional leadership in environmental performance;

7. Strategic sustainability: the development of comprehensive social, economic and environmental strategies;

8. Full institutional commitment to the implementation of those strategies.

(Bekessy et al., 2003) University phases in response to the call to achieve environmental sustainability.

Researchers have also begun to address the evolution of the concern for sustainability in higher education (Clugston et al., 1999). In their view, sustainable communities and sustainable efforts at institutions should also address social justice and humane issues, as this is an essential aspect of sustainability. Obviously, sustainability is not one single goal, but a collection of various dimensions that together signify a sustainable institution. Sustainable organisations should provide written statements of their missions and commitments. Sustainability should be included in education as well as research. Sustainability should play a role in hiring and promotion, and the institution itself should be run following sustainable practices and

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should have a clear ecological footprint. Student and institutional services should include and promote sustainable practices. Moreover, the university should work together with other institutions to advance sustainability and assists sustainable communities. Unfortunately, very few institutions are reported to have achieved all of these dimensions, while many focus on just a few dimensions or they concentrate on reaching their definition of sustainability. Most recent work emphasises strong policy and sustainability strategies, as well as awareness building and encouragement of individuals (Ralph and Stubbs, 2013). Moreover, achieving sustainability relies on changes in the economy as well, such as the relative prices of sustainable energy and related tax incentives.

- How are the "champions" of sustainability initiatives perceived by others in the institution?

- Do the initiatives have the endorsement of key administrative leaders at the institution?

- Who benefits from the initiative?

- Does the initiative fit with the institution's ethos, its saga, and its organisational culture?

- Does the initiative elicit the engagement of the college or university community?

- Is the initiative academically legitimate?

- How successful is the initiative in bringing in critical resources (e.g. grants and contracts, state funding, student demand, recognition and support from key stakeholders such as the media or trustees, and state, national and international leaders)? Does the initiative produce cost savings over time (e.g., energy conservation)?

(Clugston et al., 1999) Critical Conditions Determining the Success of Sustainability Initiatives

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2.2 Transitioning towards sustainability

Numerous researchers have identified the importance of the process to attain sustainable universities. In the UN's Decade of Education for Sustainable Development (UN DESD), (Wals, 2014) reported that universities are beginning to implement changes in 'education, research, operations, and community outreach' towards sustainability, although some educational reforms might be unfavourable for these efforts. Nonetheless, some universities go as far as reorganising themselves to achieve a design built on sustainability among their entire system.

Administrators and educators are expected to achieve competence in educating about sustainable development. This includes (Wals, 2014):

- Interdisciplinary work

- Open-mindedness and cooperation with others

- Participation, planning and implementation of sustainability efforts

- Empathy, sympathy, solidarity

- Motivating self and others

- Thinking ahead and dealing with plans and expectations

- Being able to reflect externally on individual and cultural concepts

- Recognising relationships and interconnections

It is not surprising that there is a need to identify the key aspects of the transformation of universities towards sustainability. These aspects include ideal characteristics of the "sustainable university", and the drivers and barriers in the conversion to a sustainable university. (Ferrer-Balas et al., 2008) Take a 'framework-level-actors' approach using these three interacting dimensions of change for achieving sustainable development. There are multiple main barriers identified for sustainable development. Academic freedom can present an issue, as many groups of faculty might

Table 4
UNECE competences in ESD for educators.

	Holistic approach	Envisioning change	Achieving transformation
The educator understands…	The basics of systems thinking	The root causes of unsustainable development	Why there is a need to transform the education systems that support learning
The educator is able to…	Work with different perspectives on dilemmas, issues, tensions and conflicts	Facilitate the evaluation of potential consequences of different decisions and actions	Assess learning outcomes in terms of changes and achievement in relation to SD
The educator works with others in ways that…	Actively engage different groups across generations, cultures, places and disciplines	Encourages notions of alternative futures	Help learners clarify their own and others' worldviews through dialogue and recognize that alternative frameworks exist
The educator is someone who…	Is inclusive of different disciplines, cultures and perspectives, including indigenous knowledge and worldviews.	Is motivated to make a positive contribution to other people and their social and natural environment, locally and globally	Is a crucially reflective practitioner

Source: UNECE, 2011a,b

Figure 1: (Wals, 2014) Competences in ESD for educators, three categories of progress.

resist proposed changes coming from the administration or be less motivated to achieve consensus. An inadequate incentive structure which does not reward participation can be a large barrier in galvanising academic faculty and staff for taking a part in or championing sustainable efforts. Lack of outside pressure, either government or community-driven, can give only limited inspiration and impulse to universities to invest in sustainable transformations.

A conservative administration might not realise the importance of sustainability at universities. The following primary drivers for a sustainable change are recognised by (Ferrer-Balas et al., 2008). 'Connectors', or existing networks of people and research groups can reach a critical mass of individuals to include in sustainable efforts. Coordination units and projects, along with strong leadership can promote cooperation and keep sustainability efforts on track as well as distribute responsibility. External financial support to achieve sustainability can either come from corporations or government. Nonetheless, large universities will still be slower to transform due to their size and inertia. The motivation for sustainability can come from either individual champions who need to be supported by the institution, or by 'peer pressure' from other universities who can give examples of successful change. Most universities analysed by (Ferrer-Balas et al., 2008) are focused on interdisciplinary approaches to sustain-

ability and creating networks of experts and champions.

2.3   Practices at universities

So far, many universities have started working on achieving a sustainable culture. Steps in this direction range from faculty and student meetings to fully funded programs that affect daily operations of the university. A sustainable culture can include recycling programs and environmentally friendly approaches, as well as added course content and individual classes.

University campuses have begun embracing a culture of sustainability (Miller, 2005). The endeavour for sustainability in education has been established for many years: "What if higher education was to take a leadership role, as it did in the space race and the war on cancer, in preparing students and providing the information and knowledge to achieve a just and sustainable society?" (Second Nature, 2004). Sustainable projects are now part of campus culture and influence curriculum, operation and building plans. While there are contributors from both students and faculty, they still require campus-wide coordination and cooperation (Miller, 2005).

For many universities, a vital part of a sustainable culture is setting up a publicly available, up-to-date sustainability policy (Ralph and Stubbs, 2014). A public policy shows the university's efforts and also helps to keep it accountable and focused on its sustainability programs. Each department may also create their own written policy to demonstrate their commitment (Nejati and Nejati, 2013). Sustainability programs on campuses can have a broad impact (Miller, 2005). They promote the values of the university; they demonstrate leadership towards the community. Environmental programs can result in significant economic savings and also attract students and faculty who seek sustainable values.

2.3.1 Teaching and Research

Miller stresses the importance of involving students and staff in sustainability. One way of staff and student inclusion is to integrate sustainability into university courses, creating a 'hidden curriculum' (Bartlett and Chase, 2004) where faculty members from all disciplines are empowered to include sustainability as part of their course content. This approach has the added benefit of promoting critical reasoning and discussion (Chase and Rowland, 2004). Faculty members also gain from the opportunities of working together and seeing themselves as advocates of a larger sustainable project. Many universities have created committees for integrating environmental sustainability into the curriculum and publish policies for the integration (Ralph and Stubbs, 2014). Staff are trained in sustainability and encouraged to become champions to promote sustainability.

Education and community outreach is a critical part of all sustainable developments. Students at several universities have voted to pay contributions ranging from \$2 to \$20 per year to support sustainable initiatives (Sofer and Pottern, 2008). Green courses either focus on sustainability or include relevant topics in their agenda. Green chemistry labs concentrate on using less toxic chemicals and to educate students about the environmental costs of chemical processes. First-year students are presented with education materials and courses to promote energy savings and awareness of sustainability, as well as field trips to recycling plants or green buildings.

Research efforts commonly include setting up sustainability research groups within universities and creating a strategic policy for integrating sustainability into academic studies. (Ralph and Stubbs, 2014).

2.3.2 Campus and Community

Not surprisingly, so far we have seen a multitude of practical campus sustainability efforts (Sofer and Pottern, 2008), primarily focusing on energy and climate change, and also including other topics that have an ecological impact. Small-scale energy efficiency programs are low-cost upgrades

that involve students and communities, as well as increase awareness or change energy usage behaviours (Sofer and Pottern, 2008). Even a simple program to replace light bulbs with energy efficient ones can reduce power consumption by 75%. Dormitories can implement energy efficient laundry rooms, such as air drying the clothes instead of tumble drying, and add low-flow showerheads to save on water usage. Universities heating policies can reduce energy usage by requiring less heating or air conditioning outside business hours. Energy saving stickers on or near light switches can also propel students to conserve energy.

Motivation to pursue sustainability can be fostered by creating sustainability awards for students, and running awareness-raising campaigns. (Ralph and Stubbs, 2014). The 'Go Cold Turkey' competition (Sofer and Pottern, 2008) challenged students to turn off all heating and electric devices in the dormitories before leaving for Thanksgiving. Campus-wide energy conservation programs included turning off lighting in all buildings for 30 minutes to promote awareness, as well as programming campus computers to automatically shut down when they are not used to save energy. In another university, the EZ GPO software was installed on computers to reduce monitor energy usage and reduce costs as well as emissions. 'Vending Misers' turned off vending machines when not in use.

University cafeterias can also participate in sustainable initiatives. Locally-grown seasonal food is not only less taxing on the environment, but it is also often cheaper as well. Community gardens for the university support a way for students to grow organic food and to raise awareness of sustainable food practices. Food waste can also be composted and sent to local pig farms so it does not need to be thrown out.

Recycling is also a worthwhile avenue as universities can prefer recycled paper for coursework and documents, and utilise reusable bottles and food boxes. These recycling efforts can significantly reduce greenhouse emissions. Instead of recycling paper, universities can also opt to use email to communicate with students, saving costs as well. For students, reusing and reducing campus waste is also a high priority (Nejati and Nejati, 2013), which requires associated support services such as recy-

cling bins and green transport options within the campus.

Community outreach programs are valued highly by students (Nejati and Nejati, 2013). These programs include sustainability efforts to benefit the local environment, community centres, and partnerships with government and industry to work towards sustainability.

Many universities provide sustainability newsletters, blogs, and websites. As reported by (Sofer and Pottern, 2008), the university of New Hampshire created a blog "Discover(ing) Sustainability", sharing the university's commitment to building a sustainable community. These include a "green cuisine" dinner and research related to climate change and clean water. The university of Texas produces a monthly newsletter, "Synergies," that promotes sustainability projects on campus and builds awareness regarding sustainability. The Duke University sustainability website at http://sustainability.duke.edu/ supplies news and events related to sustainability, also contains pledges and challenges aimed at students, as well as information e-books for sustainable practices, promotes student groups and campus initiatives, and invites students to take action and share their story about advancing sustainability.

2.3.3 Operations

Large-scale energy efficiency programs represent a greater upfront investment but can return this over time with economic savings as well as promote sustainability. Universities set sustainability targets in transport, emissions, construction, and energy consumption. (Ralph and Stubbs, 2014).

Sustainability for universities today includes land use and building planning (Nejati and Nejati, 2013). Several options to reduce environmental impact have been commonplace at universities (Sofer and Pottern, 2008). Building metering can encourage competition between dorms and might also find areas with energy inefficiencies. Cogeneration is the generation of both heat and electricity at the same time, instead of using other heating methods. Green building design includes energy efficient building

materials to reduce heating and cooling requirements, as well as large windows to allow additional natural light in the buildings. Green roofs focus on increasing insulation as well as reducing water runoff and being environmentally friendly and aesthetically pleasing. Performance contracts are a financial instrument where an institution can borrow money for large scale energy saving projects, and then use the realised energy savings to pay off the loan. Revolving loan funds are a similar choice within a university, where a 'green loan fund' provides capital for reducing environmental impact and saving on energy costs, building back the initial fund within a few years and enabling further projects and improvements.

It is now becoming common for universities to generate their own renewable energy on-site (Ralph and Stubbs, 2014). Using renewable and safe energy sources for university operations is also noteworthy for students concerned about sustainability (Nejati and Nejati, 2013). There are various options for using renewable energy sources, for instance geothermal, wind or solar power, biomass heating and solar heating. If these are not available, universities can buy renewable electricity or carbon offsets to promote their commitment to sustainability through a carbon management plan. Sustainable transportation programs mentioned in (Sofer and Pottern, 2008) include bike-share programs or free bicycles to first-year students. A 'bike commuter park pass' can offer free car parking for rainy days. Carpooling and shuttle buses also share costs and spare the environment.

2.4   Comparison and overview of sustainability approaches

There are multiple discussed ways of approaching and achieving sustainability at universities. While these are all able to provide results, long-term transformation towards sustainability encompasses many of these together.

2.4.1 Institutional transformation ('top-down')

The most common approach is focusing on the whole university as an institution and adopting overarching policies for progressing towards environmental sustainability. Both the Talloires and the Lüneburg declarations focus on this approach, creating frameworks that define the university's approach to sustainability. This top-down approach encompasses the daily and long-term operations of the university, and planning of university projects and policies. Universities taking this approach may focus on reducing energy use or utilising reusable energy sources. They can also take up partnerships with other institutions or government entities. This approach has the highest potential for change, but also commits to higher initial investment costs.

2.4.2 Individual commitment and champions ('bottom-up')

An alternative approach focuses on empowering individual contributions to sustainability. Champions are either students or university employees who are passionate regarding sustainability and participate in organising efforts and spreading information. Student programs and competitions focus on individual commitment with low to moderate degrees of institutional support required. Student committees can also work on solving sustainability issues and creating sustainable policies with low investment costs. Popular issues to tackle are energy consumption, recycling, and raising awareness.

2.4.3 Campus programs ('take action')

Campus programs focus on taking concrete steps towards sustainability. These include both individual and institutional efforts. A popular program is recycling, ranging from a small scale (bottles) to large scale (recycled printing paper, recycling food waste). Transportation programs include bike-to-work and bike sharing as well as encouraging the use of public transport. Community programs can include outreach to the neighbourhood or city around the university, or public promotions to raise

awareness. In many cases, the results or impact are directly measurable, such as 'energy saved' or 'water usage reduced'. These campus programs are built on inclusion and participation and require active organisation either from students or staff and faculty.

2.4.4 Education programs ('learn more')

Finally, an approach to sustainability at a university can not omit education and research. Education programs encompass setting up sustainability research groups and policy, as well as including sustainability into the curriculum through existing and new courses. Public sustainability websites can add to the available information. Newsletters can also build a community around sustainability efforts in addition to providing up-to-date details about sustainability at the institution. These programs are built on providing information and promoting sustainability through education touching on current issues and possible solutions.

2.4.5 Combined approach

An integrated approach, such as creating a sustainability group can achieve both institutional and individual commitment. Time and effort are required from all levels of the university as well as students to achieve a sustainable transformation. Campus programs, events, and outreach display the commitment of the university and enable the local community to commit to sustainable practices as well. Policies and organisational frameworks can ensure long-term commitment to sustainability.

2.5 ICT4S

ICT for Sustainability(ICT4S) is an emerging research field focusing on the use of Information and Communication Technology to advance sustainable consumption and production (SCP) (Hilty and Aebischer, 2015). ICT4S harnesses the transformational potential of ICT. It is focused both on reducing ICT-related resource use and footprint, as well as utilizing ICT to achieve reductions elsewhere.

The Master Thesis can be placed in the ICT4S field as an effort to achieve Sustainability by ICT, defined as "design and application of ICT systems to support transitions to sustainable development" (Hilty and Aebischer, 2015). Technology in the form of a collaborative platform is used to contribute to the societal transformation towards sustainability. This platform has the potential to impact both individual views and actions, as well as promote awareness among the UZH community.

3 Methodology

The Master Thesis contains four phases of research to arrive at the design for a collaborative platform for supporting the transition to sustainability at UZH. First, a questionnaire among faculty, staff, and students established the current situation and requirements for such a platform. Based on the result, several wireframes are created to arrive at the proposed system wireframe. After a focus group study, the system design is refined and implemented as a functional prototype that demonstrates the main features of the proposed system.

3.1 Questionnaire

3.1.1 Goal of the questionnaire

The goal of the questionnaire is to reveal how activities for sustainability at UZH can be supported by Internet-based platforms. The survey results should help to understand the current situation and requirements regarding such platforms. Questions are asked to determine what people think regarding sustainability in their life and at UZH. The survey also contains questions on what people at UZH consider concerning current sustainability efforts at the university. The questionnaire intends to find out which efforts do they rate as important, and what should be the highest priority for the university. The questionnaire also gathers information on which platforms the respondents know about, what is their opinion on them, and which ones they use most. Finally, people are asked which platform is useful for spreading awareness on the subject of sustainability.

3.1.2 Approach

The mixed ended questionnaire contained multiple questions about sustainability graded on a Likert scale, as well as some free form questions. Questions are written based on the state and desired transition path towards sustainability at UZH. The initial version of the questionnaire was

written in Google Forms. Since not all types of questions for a questionnaire are supported by Google Forms, the final questionnaire was hosted on SurveyMonkey. SurveyMonkey was able to run all question types. All responses were recorded in SurveyMonkey by anonymising response data, to preserve privacy.

Faculty, staff, as well as students were invited to participate through the UZH mailing lists through the one month running time of the questionnaire. A total of 221 responses were recorded, with 162 complete surveys, giving a 73% completion rate. The questionnaire contained multiple choice questions and Likert scale ratings to assess the relationship to sustainability and open questions to record additional information and opinions. The survey consisted of both voluntary and compulsory questions. Open questions were voluntary as they might not be applicable for everyone. Responses were received from a mixed demography, from the ages of 22-27 to over 52 years of age, including 35 responses from faculty members, 130 responses from other staff, and 56 responses from students. Detailed results are available in the Appendix, and the questionnaire answers are analysed in the 4.1 Discussion section.

3.2 Wireframes

3.2.1 Goal of the wireframes

The wireframes were designed to show the 'look-and-feel' of the proposed platform. They enhanced a guided tour of the platform, which can be used to present and evaluate its presentation and functionality. The wireframes are based on answers from the questionnaire as well as on the previously drafted ideas to create a platform that is appropriate for the needs of people at UZH. Multiple wireframes are created and evaluated to discover the best choice that is suitable for both potential users and the university. Wireframes aid and simplify to present how a platform built on the survey results and original ideas looks like, and to ensure that the final design could also be supported by the university.

In computer software, there is a gap between user needs and user re-

quirements (Kujala et al., 2001). Therefore, a reason for designing wire-frames before presenting a final prototype is to gauge users' needs and eliminate this gap between needs and requirements by bringing users closer to the final version of the platform. Wireframes are able to elicit user reactions. By studying these, it can be decided how appropriate and useful the design and ideas are for the platform.

3.2.2 Approach

The wireframes were created in a combination of HTML and Balsamiq Mockups, as well as custom designed in the GIMP photo editing software. Existing HTML pages to be extended are also rewritten locally to change their look, for instance by adding additional sections and menu items. They were integrated into a Google Slides presentation which supports online viewing and navigation using image components (to support 'button clicking' behaviour). The wireframes can also be shared from Google Slides for the focus group study. The wireframes present a clean, demonstrable view of the proposed platforms. As they are presented in a typical use case sequence, the wireframes support some level of immersion and a feeling of actually 'using' the system. Finally, the wireframes are supplemented with an instruction list or walkthrough to guide users through each wireframe and which features they can use to progress to the next steps.

3.3 Focus group study

3.3.1 Goal of the focus group study

A focus group study was set up to evaluate the wireframe across multiple potential users at the same time. Feedback and reactions are noted by a note taker and the focus group moderator. An advantage of the live focus group study is the potential for free speech and voicing opinions, as well as instant feedback. Problems, issues, missing features can be discussed on the spot. The focus group study also looks at how straightforward and

appropriate the design for the platform is. Participants could report on the usability of the platform, what are the positive or negative values for them, and how they would use it if the platform were already available.

3.3.2 Approach

The focus group study was run as a summative two-way focus group. Initial questions addressed relations to sustainability and knowledge of sustainability issues, as well as sustainable efforts that were followed among the participants.

The chosen wireframe was presented on various devices to the participants (Android tablet, Linux and Windows laptops, and a Macbook, both with mouse and touchscreen controls). The participants used one device independently or in teams of two. To make sure that everyone is included in the study and can solve the tasks in the instruction list, all teams had at least one person who felt experienced in the use of internet platforms. An office meeting room was booked to ensure safety from interruptions and a quiet atmosphere to run the focus group study.

All tasks were executed together by the focus group, step by step. For example, when instructed to view additional comments on the current post, they would click on the 'More comments...' hyperlink. A total of seven participants followed the steps as part of the focus group. One additional observer or note taker wrote down comments and feedback from the participants, as well as any issues they possibly faced when following the instructions. The observer also noted their impression of the other participants' walkthrough of the wireframes. The participants were also asked for their feedback on the usability, usefulness and design of the platform. All participants were former or present UZH members representing different age ranges.

3.4 System prototype

3.4.1 Goal of the system prototype

The goal of the system prototype was to demonstrate the functionality and design of the platform, incorporating results from all previous research phases. The functional prototype demonstrates all main functionalities in the system. These encompass creating a post, adding images, commenting, browsing, and searching, and changing the logged in user. It is presented as an integral part of the sustainability website. The system prototype could be used for the evaluation and further development of the platform.

3.4.2 Approach

The functional prototype needed to be able to demonstrate all functionalities of the platform without a running web server or database backend. Therefore, the choice was made to use the 'local storage' and 'session storage' HTML5 features to save data on the platform and enable running it as a self-contained unit, without the need for deployment. These features are available by default in the widely used Chrome browser. The prototype used JavaScript for user interaction and data processing, as well as to display the dynamic components of the platform. Using these technical solutions made it possible to demonstrate and evaluate the full functionality of the system, while running it in a local browser. The prototype code contained clear entry points for possible interaction with other systems (such as database access or login functions) which can be used for future integration into a live system.

3.5 Summary

The discussed phases build on each other to arrive at an understanding of how a collaborative platform supporting sustainability could look at UZH. A vital part of the Master Thesis was to include results in each next phase to refine the design and functionality of the platform. While the

questionnaire phase started with a generic and exploratory approach, it provided concrete results which could be used to create the wireframes for the planned platform. Multiple versions of wireframes were evaluated and refined, and then demonstrated along with user stories for the focus group study. The focus group study provided concrete feedback for both design and functionality, leading to the final design of the functional prototype.

4 Discussion

In the following sections, the results of each phase are discussed together with their effect on the research process. From these results was the platform developed for the transition towards sustainability at UZH.

4.1 Questionnaire

4.1.1 Results of the questionnaire

Responses were recorded from a large age range from students to staff and faculty. The median age of respondents was 39 years. In total, the questionnaire received 221 total responses, with 162 complete surveys, representing all age groups between 22 to 52+ with at least 10% of replies. The fill rate ranged from 63% to 83% depending on the age of respondents.

There was a large age gap between knowledge and usage of the UZH sustainability website. For respondents below 39 years old, only eight percent visited the university's sustainability website, while for respondents above this age range, the rate was 32%. This latter age group also corresponds mostly to technical and administrative staff.

Relatively few responses were received from faculty members, so professors and other teaching and research staff are analysed together, as this gives 35 responses for the 'faculty' group. Most responses were received from technical and administrative staff with 130 responses altogether. A total of 56 UZH students filled out the questionnaire.

The UZH sustainability website contains information related to sustainability efforts at UZH. Campus programs and events are included, as well as current teaching and research. According to the questionnaire responses, 7% of students and 7% of faculty has visited the sustainability website. Among administrative and technical staff, the ratio of visitors is 30%. Altogether around 19% of respondents have visited the sustainability website, which is a relatively low ratio.

On the question of whether people received recommendations to look into the topic of sustainability, 37% of those who received recommenda-
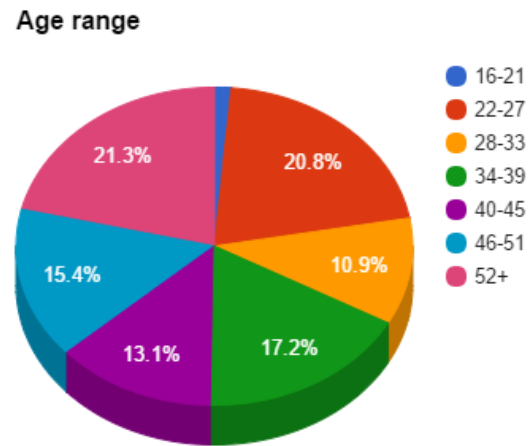
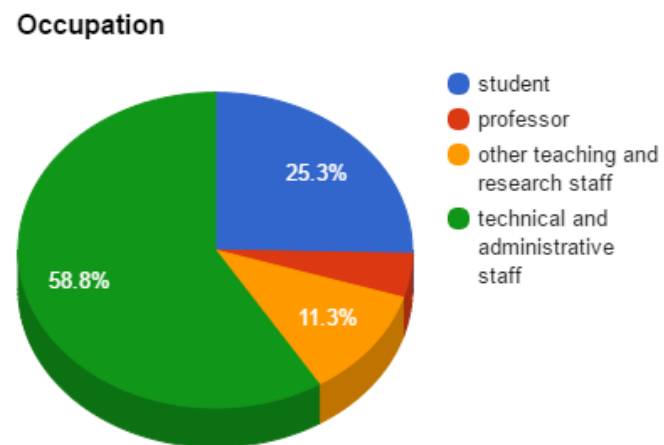Figure 2: Age range of questionnaire respondents

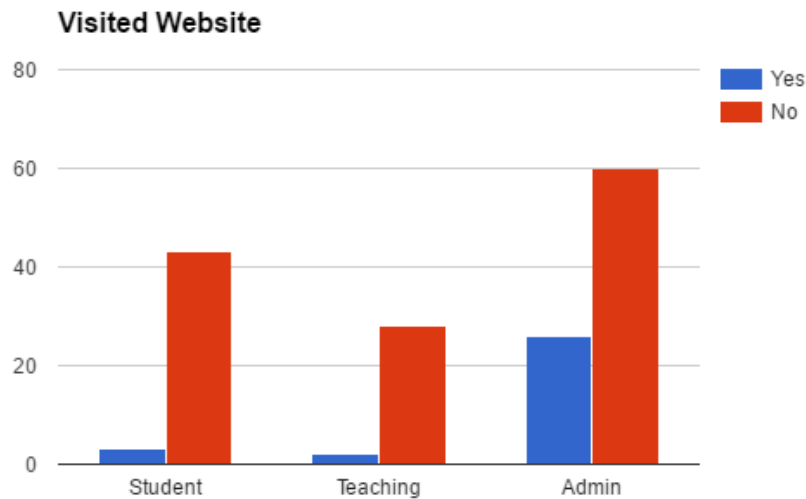
Figure 3: Occupation of questionnaire respondents

Figure 4: Ratio of sustainability website visitors among questionnaire groups: Students, Teaching Faculty, Administrative and Technical Staff

tions visited the website, and solely 15% visited otherwise. Even though 24% of students received recommendations, their overall visiting ratio is still low at 7%.

The university runs sustainability-related courses every semester, and there are also specialised courses that discuss sustainability within specific fields. On the question of whether sustainability was integrated into their studies at UZH, more than half of students reported that they studied sustainability or some aspect of sustainability was mentioned during classes UZH. In total, 40% of students covered some aspect of sustainability in their curriculum, and an additional 11% took courses related to sustainability. 31% of respondents reported that sustainability was not mentioned in their studies.

Many sustainable practices were reported at the university. Although 40% of responses did not mention any practices, the other respondents provided a wide range of these.

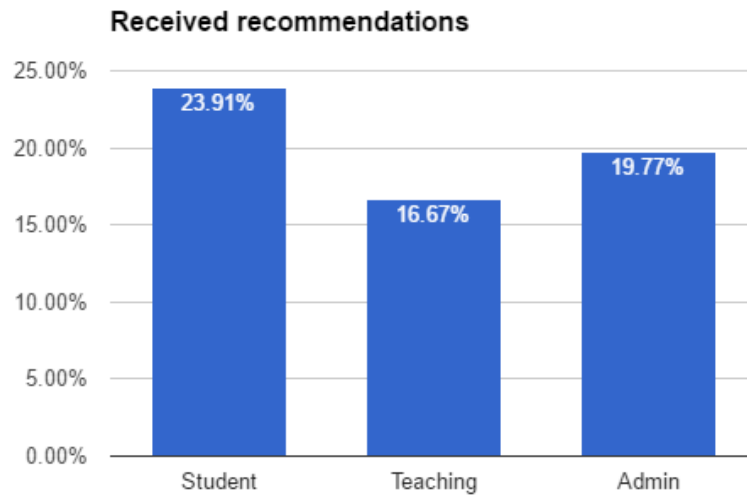The following categories were mentioned:

Figure 5: Ratio of those who received recommendations to look into the topic of sustainability
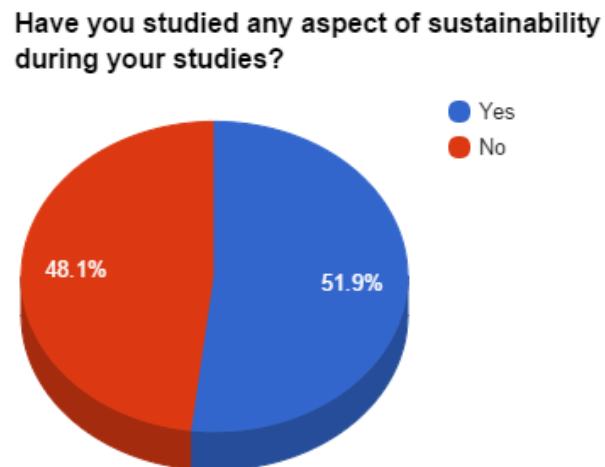

Figure 6: Ratio of student respondents who studied some aspect of sustainability at UZH
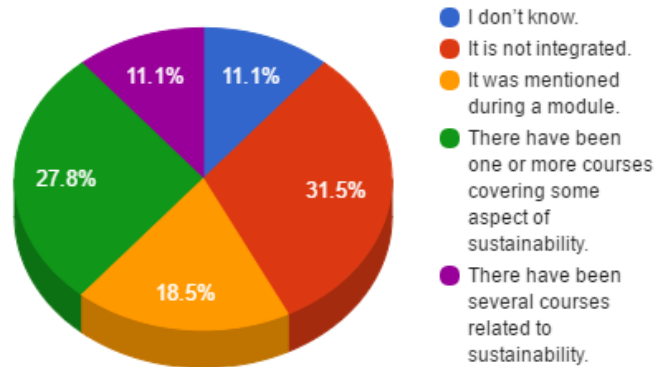
Figure 7: Integration of sustainability to studies at UZH

- Printing: using double sided printing, or printing on recycled paper, or avoiding altogether

- Recycle: recycling plastic bottles, and paper

- Commute: using a bicycle or public transport to commute to the university

- Energy: using less energy, turning off lights and machines when they are not in use

- Food: buying local, eating vegetarian and sustainable food

- Organisational: the respondent's actual work area or projects they are working on are related to sustainability, or they are organising sustainability efforts

- Education: learning about sustainability

The next category of the questionnaire was sustainability efforts at UZH. People were asked what sustainability areas the university should focus
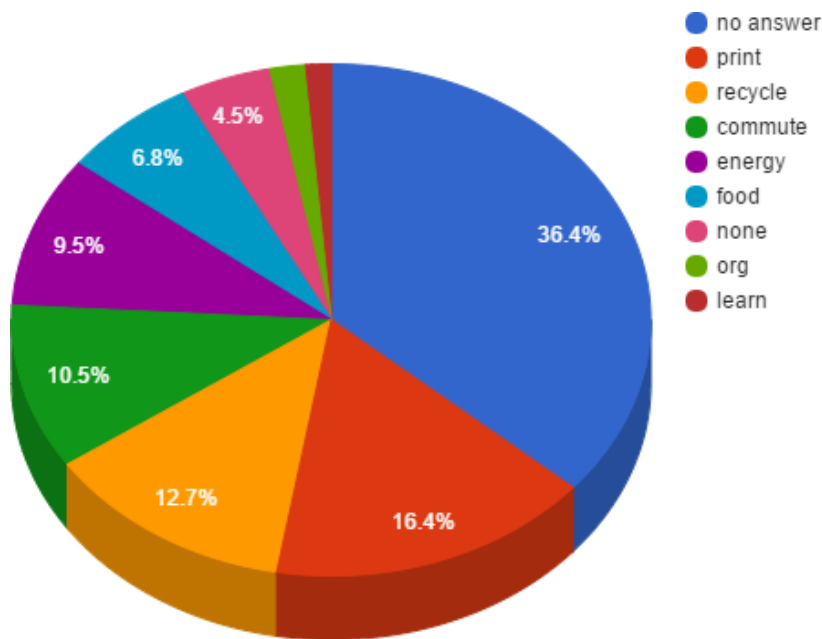
Figure 8: Sustainable practices followed by questionnaire respondents at UZH

on. The highest rated categories for staff and student groups were: energy efficiency, recycling and waste management, using renewable energy, and green buildings (62%, 57%, 50%, and 43% strongly agree, respectively). For faculty members, the highest priorities were: recycling and waste management, energy efficiency, research concerning sustainability, improving public transport and the situation for cyclists (67%, 57%, 43%, and 43% strongly agree). There were also many open comments received supporting the categories of food, printing, commute, and sustainability projects.

Existing projects mentioned at the university were:

- Bike to work

- "ELLT (further education program)"

- "Workshop on teaching sustainability"

- "Project related to sustainability impact. "

- "Conference and workshop related to regenerative sustainability"

- Nachhaltigkeitswoche (Sustainability week)

- Sustainability in planning

People at the university reported diverse ambitions to join these projects. The highest rated were awareness and interest, as well as the time required and support from UZH. Awareness includes knowing about projects and gaining information as well as advertisement of sustainability efforts. Many reports mentioned that their participation in sustainability efforts would be conditional on having enough spare time to partake in these, outside of working and study hours. Personal interest in the topic was also mentioned, as people will contribute to efforts that are interesting for them or presented in an interesting way. Connected to this is the feeling of participation, including team spirit and a 'fun factor', or possibly the inclusion of child programs so that relatives and families can also attend the event. University support was also reported to be a salient factor. The conviction and focus of UZH play a significant role in people's decisions and views of what they view as useful contributions and helpful projects. Finally, some responses recorded looked at the direct benefits of contribution, alike gaining ECTS credits for projects or professional career recognition.

Interest in online platforms for sustainability was very diverse across the different groups of respondents. Most interest came from students and staff, where greater than 15% responded that they would be interested in using such a platform. Those who visited the sustainability website were also more likely to be interested. In total, 73.5% responded 'Yes' or 'Maybe'. The main reasons for 'No' responses were a lack of time (55%) and a lack of interest (12.5%).

The main online platforms used by staff and student respondents are web pages, email, wiki and social networks. Moreover, for university faculty, the first four popular platforms tend to be email, web, wiki, social networks.

When asked about the effectiveness of exchanging information regarding volunteer work and engagement activities, only 'personal meetings'
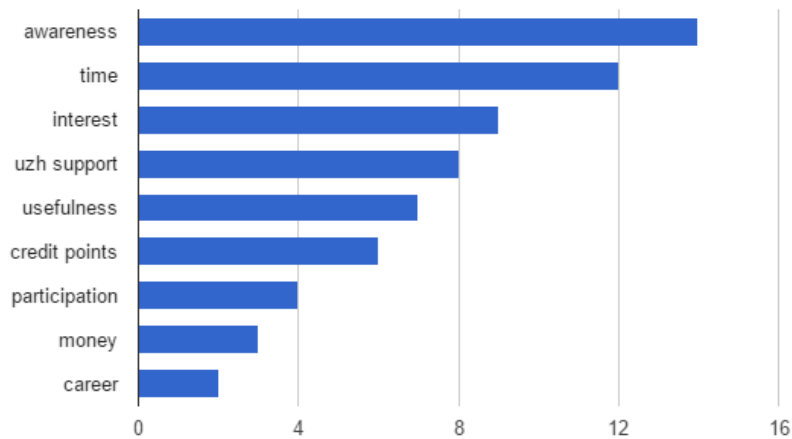
Figure 9: Motivation to join sustainability projects

Table 1: Questionnaire: Most effective methods of exchanging information

Top 4 effectiveness	Student	Teaching	Admin
Personal meet.	Personal meet.	Personal meet.	Personal meet.
Web pages	Social network	Wiki	Web pages
Social network	Web pages	Web pages	Social network
Wiki	Wiki	Email	Wiki

were rated extremely effective by more than 10% of respondents. Many respondents rated wiki, social network, and web pages among the most effective.

The last question looked at reasons why a platform can be thought of as effective. These advantages translate to perceived effectiveness in the given platform. The following categories were mentioned as the key advantages. *Informative* platforms have the ability to convey large amounts of information. *Personal* or personalised platforms can provide a personal experience, meta-communication, or another way of 'simulating' personal meetings. *Direct* platforms provide the ability for one-to-one communication. *Interactive* platforms facilitate to ask questions and get immediate
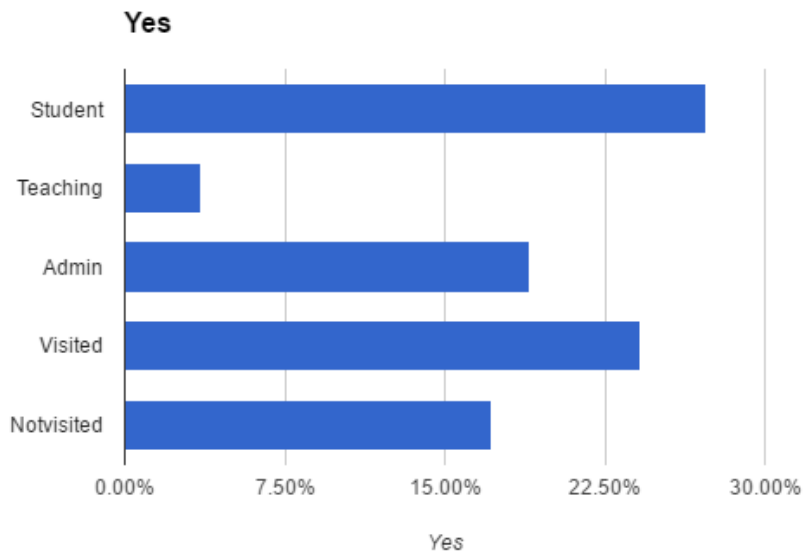
38

Yes

Figure 10: Responding 'Yes' to whether they would use an online platform related to sustainability. 'Visited' are those who have visited the UZH Sustainability Website in the past

feedback and responses, providing two-way communication channels. A platform is *convincing* if it has the ability to convince someone concerning sustainability or related topics.

Further responses were related to the structure of the platforms. While some of these can be controlled by design, others are dependent on the audience. *Reach* correlates to the size of the audience that can be reached on the platform, a widespread platform used by many people can allow a broad audience. *Speed* is the ability to convey information in a short time, which this related directly to the previous response that people would only use such a platform if they have enough time for it. Inclusive platforms encourage audience *participation*. Finally, simplicity is always an important aspect of computer software as the platform should be easy to use without additional instructions or reading the manual.

The questionnaire results showed that many people are interested in sustainability at the university. Members of staff consider many areas of

Use of online platforms
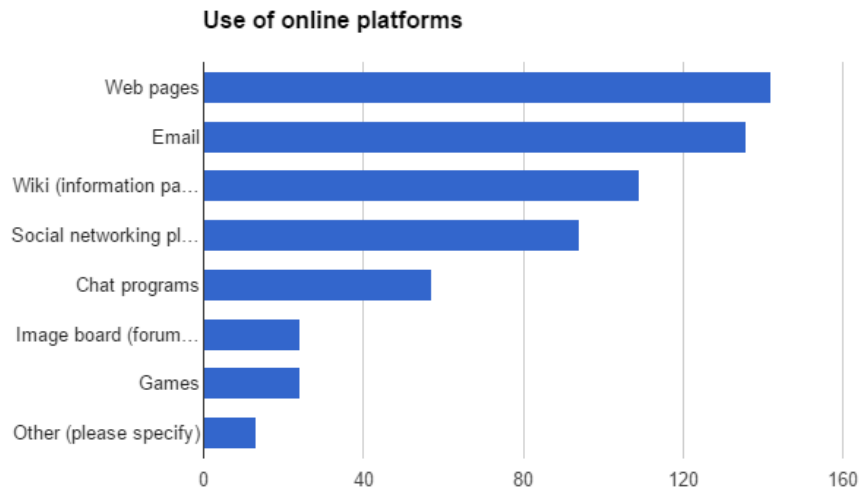

Figure 11: Use of online platforms among questionnaire respondents
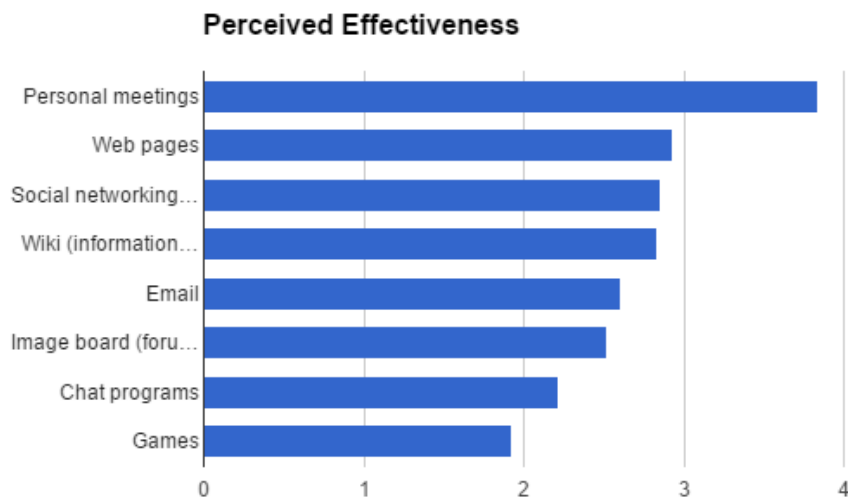
Perceived Effectiveness

Figure 12: Perceived effectiveness of exchanging information about sustainability on online platforms among questionnaire respondents

Figure 13: Main advantages that respondents would prefer in a platform to discuss sustainability

sustainability as candidates for improvement.

Further result diagrams and the data spreadsheet are available in Appendix A.

4.1.2 How we can use this result

The questionnaire results were taken into consideration when designing the wireframes. They showed the participants' relationship to sustainability, and that advertising of any resulting platform is a primary prerequisite to achieving widespread use. Respondents rated personal meetings and interactions highly. Thus it became also necessary to focus on social aspect when designing the platform. Multiple versions of wireframes were created as a result.

4.2 Wireframes

4.2.1 Results of the wireframes

In the next phase, a set of wireframes were created to demonstrate multiple versions of the proposed platform. Alternatives which were not used for the focus group study are attached in Appendix X, while the final wireframe is attached in Appendix B.

The focus of the wireframes is Sustainability Photos. Users can upload photographs related to sustainability topics, or pictures of sustainability issues at the university. Keywords and a description can also be added to the photos, as well as the clear location in case of sustainability issues. This platform is proposed to address concerns with images: energy efficiency, recycling and waste management, using renewable energy, green buildings, research about sustainability, improving public transport and the situation for cyclists, food, printing, sustainability projects, as well as other categories. Issues posted on the Sustainability Photos web page would be rated by relevance to the university, which would show the interest of people at the university and serve as a basis for further discussions. Social interactions are supported in various ways, e.g. by adding a comment section below each photograph and description, where users can interact with each other and discuss the photograph and the topic.

The wireframes consist of multiple screens that guide through the usage of the system. The main screen for users shows photographs with descriptions, either some issue, e.g. something unsustainable or something where sustainability had a positive impact (e.g. energy efficient light bulbs/recycling station). There is availability to search the uploaded content by locations, topics, or keywords. Comments from the people are shown below the photographs, and additional comments can be added as well. When uploading a picture, users can choose a topic, add keywords, and write a short description as well as the location of the photo. The uploader can describe what they consider unsustainable, or they can voice their opinion concerning a particular topic.

The following steps are part of the wireframe walkthrough:
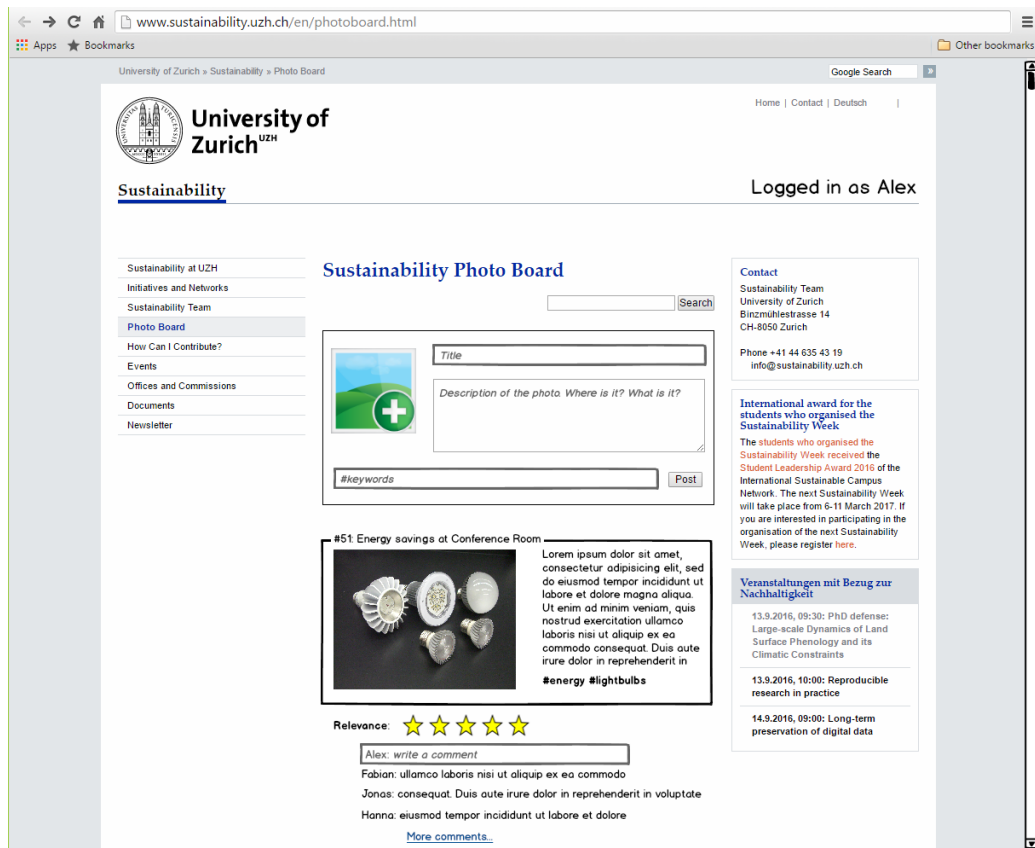
Figure 14: Wireframes - main screen

- Find more topics by scrolling down the page.

- Enlarge a picture.

- Read all the comments for a particular photograph.

- Write a comment.

- Create a post by uploading a photograph and adding a title, location, keywords, and a short description.

- Search for content with the keyword 'recycling'

Figure 15: Wireframes - creating a new post

4.2.2 How we can use this result

These wireframes present a bird's-eye view of the platform and demonstrate the available features. The wireframes can be employed in the focus group study to gather feedback on usability, usefulness and the design of the proposed platform. The wireframes make it possible to evaluate the platforms given UZH's priorities and questionnaire results.

This wireframe and the proposed platform has several advantages that relate to the questionnaire. The format of the platform drives involvement and action, by focusing on issues and how they could be solved. Photographs are direct and personal since they are the user's pictures that they took and shared. The platform does not force a direction but emphasises issues and topics that users think are critical. There are no barriers to

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contribution since only a photograph is needed to create a new topic or a short comment to add to the discussion. If the system is used within the format of university websites, then the platform is already familiar and used regularly. Photographic updates of previous topics and issues can also demonstrate visible change. The system does have features stemming from to social networking, but it is restrained to the topics of sustainability. This restriction crafts an easier way to moderate conversations. The direction of discussions is set by creating new topics, which is possible by adding photographs. The platform also requires moderation to ensure that images and comments are relevant and appropriate. This feature is included in the proposed wireframes, by a delay to show posts solely after approval by a moderator. After the post is visible, users are encouraged to rate its relevance. There are also a few potential drawbacks of this version. Since the platform contains discussions between users, registration or authentication is required, though this can be achieved by the university's 'AAI login' system. User-submitted photographs might also have lower information content than a website or wiki page. This is alleviated by the topic descriptions where users can elaborate on their thoughts or add additional information to the topic. The proposed platform, as well as the current website, would need to be advertised. In this fashion, people will be aware of its existence and could start using it.

4.3 Focus group study

4.3.1 Results of the focus group study

In addition to evaluating the wireframes, the focus group study also looked at current practices and knowledge about sustainability among the participants.

4.3.1.1 Practices

The most prevalent current practice among the participants was recycling. Many sustainable habits were reported to be commonplace in Switzerland,

such as separating and recycling waste, sustainable transportation, turning off the lights, or using natural lights. Sustainable furniture reusability is also a priority, as participants reported that it is relatively easy to find and trade used furniture in Switzerland. One participant pointed out that "People should be sustainable without even realising they are" so that sustainability is part of daily habits and lifestyle choices. Although it was also opposed because of the extent of initial effort and budgets, and the continuous time investment, in the long term sustainability was regarded as being the economically more viable option. Sustainable commuting options were supported by the reported favourable quality and reliability of public transportation in Switzerland. Reasons for sustainable practices included conscious decisions, continuation of childhood habits and peer pressure. There are also sometimes economic reasons - to avoid having to pay a fine, household waste has to be disposed of separately for each category of waste. Participants reported that sustainability-related lectures helped them with making informed decisions concerning sustainability.

Few barriers to sustainability were also mentioned. Participants were reluctant to reduce their water usage, even with public warnings and announcements to do this, as they place a high priority on personal water use. Another barrier is politics; on areas such as energy use, participants thought that there is a too little political support for renewable and locally generated sustainable energy sources. Lack of information is another barrier, as it was not clear how to contribute to some sustainability efforts.

4.3.1.2 Knowledge

Participants were motivated to learn more about sustainability and to gain knowledge regarding sustainability-related topics. They use forums, Facebook news feed, content aggregation sites such as "Reddit" and "Hacker News", and word-of-mouth to stay informed. Participants were aware of the natural energy infrastructures in Switzerland, for instance, the Grande Dixence dam, and the importing renewable energy from Germany and nuclear energy from France. Some shared that sustainability is a core princi-

ple of the Swiss education system from a very early age. Sustainability was regarded as vital knowledge for daily life as well as being relevant for political discussions. The credibility of websites was deemed essential when participants seek to enhance their sustainability knowledge, as well as visible sponsorship information to ensure that sponsors are trustworthy and the information is not biased, as an average person would not have time to fact check all of the information. Although participants were not sure which information source they should trust, for sources such as Wikipedia, they tended to believe or agree with the information. They preferred small facts or 'information bites' that they could assume to be correct or even reason about themselves. There were also websites mentioned (for instance http://www.sustainablecitizen.org/) that focus on awareness.

UZH was regarded as a trustworthy and credible source of information. A reported barrier to usefulness to information sourced from UZH was the occasional conflict between different university websites or research at various universities. Options mentioned within UZH to gain insight and information were the Minor in Environmental Sciences for BSc and MSc (http://www.ieu.uzh.ch/en/teaching/envsci/bachelor.html), as well as the lecture 'Introduction to the basics of Sustainability'.

4.3.1.3 Usability and Design

Participants understood the basic design elements of the platform, such as search engine, relevance ratings, scrolling, enlarging pictures and clicking through additional content. They had no issues using the platform. There were two notes from participants regarding feedback of actions on the platform. Fresh comments were displayed no differently from others, which causes them to be less noticeable. Relevance ratings should look different if already rated by the user, as they were not sure whether they already rated a post or not. Participants also mentioned that there could be a need for a manual or introduction that would tell new users how to use the system. The overall opinion considered the platform as easy to use, with a simple, plain, user-friendly design. The content was regarded

as informative.

Participants mentioned that they could imagine the platform being used to share sustainability tips, and knowledge. It was considered to be a social sustainability platform, where they could browse posts organised and sorted by topics, relevance, or popularity. Ideas would come from any person using the system, or even the moderators themselves. The focus group also mentioned that the website could contain posts about how to practice being sustainable, or other everyday topics, not just issues or general information relating to sustainability.

When asked about the structure of the platform, participants thought that the pages already look quite structured, but the right bar could be replaced with further information related to the platform, for instance, related posts or popular posts, similar to the website "Stack Overflow".

Finally, participants were asked to describe what other features could improve the design of the platform to be more usable and appropriate to the topic of sustainability. They mentioned that it could stand out more from the common UZH website design, to give a different feeling that relates to the atmosphere of sustainability. The look and feel of the sustainability platform also received feedback, as a sustainability-focused website, participants envisioned a more interesting and enticing design for such a social platform, which is in conflict with the clean design of UZH websites. Although UZH websites and design are appropriate for gathering information respecting study concerns, participants felt that it does not drive people to see it as a social platform. Regarding awareness, they mentioned that the platform could have a news feed relevant to ongoing topics, such as a banner on the top of the page, which could even mention events in Switzerland outside the university. University event pages could also contain links to the platform to promote sustainability. The focus group mentioned that usability could be improved by adding a topic cloud on the platform with the most popular keywords and topics to filter the posts that are displayed and to make searching easier. Some users could also have a verified profile handle, to show that they are well-versed in an area such as 'energy'. Participants would be happy to visit the web-

site more frequently if it was integrated with a social network, without the need to log on separately. Another requirement mentioned was the nature of updates to the website, which could automatically notify users on Facebook, or Twitter via an account that could be followed.

4.3.1.4 Usefulness

The platform was regarded as useful to discuss small tips and facts. It avoids the burden of having long papers to read but focuses instead on further discussion between participants. The relevance rating was also regarded on users 'voting' on each other in a way, to signify trust or knowledge regarding the topics. They would place a higher trust on users with high ratings, especially in subjects such as energy or transportation.

The focus group associated the system to 'policemen at UZH', as they can report problems and concerns. Participants also thought that this platform could be part of a larger effort including news about UZH, pictures of concerns and news in sustainability, and also containing user submitted content. They reported that joining the platform with other useful information would raise awareness. An integrated platform would be easier to reach for students looking up other types of information.

Participants reported that they would be reluctant to use a stand-alone web page dedicated to sustainability. The reasons for this were that they would not be informed of updates, and would not have an incentive to check it every day, unlike Twitter of Facebook where users can 'follow' others to get updates. They would value more incentives in the platform, such as levelling up and celebrating contributions. As an example, if the university reaches a sustainability goal, there would be a party to celebrate it, which would also build group collaboration. The intended use of the platform was interpreted as a way to add ideas, complaints, suggestions, and news related to sustainability at UZH. The comment section was regarded as potentially versatile, as it could contain suggestions, praise, other relevant information, or even in-depth discussions around the issues.

When asked whether they would frequently visit and post on the platform, participants reported that they would not perceive a reason for frequent use as the content itself would probably not be updated frequently. Participants mentioned that they feel that a stand-alone, dedicated web page makes the platform less integrated into everyday student life and would instead feel like a chore. They also emphasised the need for RSS feeds, Facebook groups or similar to receive notifications when there are updates on the platform. Alternatively, people would use the site as a way to report issues whenever they notice them, so they could view it as a complaint board where people could argue concerning issues in the comment section.

4.3.1.5 Importance

Focus group participants thought that the platform in the presented form would probably not be used by many, as people will not meet in person to discuss or work towards sustainability. Therefore it is not directly useful. They reported that people at UZH would probably get together to solve specific problems, especially if this is encouraged by the platform, and these success stories would be an inspiring force for further use. They would not actively visit and seek out new content on the platform, but they would instead respond to notifications when they receive them.

Participants praised that other users of the system could validate the responses for each other, giving additional confidence to everyone contributing to the discussions. They would see the platform as part of a wider effort to promote sustainability, such as a UZH Energy Club, run by students, that could even gain sponsorship from energy companies to advance their efforts and promote sustainability. The focus group agreed that employees could use the platform as well as students, and many people would care in the matter of sustainability issues, but for students especially, they might not have the time for these during their studies. Therefore the focus group would prefer a platform that is open to everyone who is passionate about environmentalism and sustainability, not only current

UZH members. They regarded a public platform as potentially more popular and impactful.

4.3.2 How we can use this result

Feedback from the focus group study was used in creating the prototype for the platform. The design for the wireframes was modified and updated to address the focus group's comments and concerns. Possible improvements and additional features were gathered to prepare the design to be more useful. These include:

- enhanced feedback for user actions (comments, ratings)

- related and popular posts in the right bar

- newsfeed about ongoing topics at UZH and in Switzerland

- topic cloud with the most popular keywords

- verified profiles icons (e.g. 'energy', 'recycling')

- update notifications (RSS or social networks)

- login (AAI or social network login)

4.4 System prototype

4.4.1 Results of the system prototype

The system prototype 'Sustainability Photo Board' was created as a combination of HTML5 and JavaScript, using local storage to save data. Screenshots of the prototype are available in Appendix C. The style of the prototype conforms to the style of the UZH sustainability website, and the platform integrates into the sustainability website seamlessly. The platform prototype has been tested in Google Chrome and Firefox browsers on the Windows operating system.

The prototype contains the following functions.

4.4.1.1 Login, User handling

The prototype can handle different users and stores the currently logged in user name. The login system can be extended to use external authentication. After authentication, the prototype stores the logged in user locally, so there is no need to log in again when navigating the platform. Interactions such as commenting and rating use the user's name. When a new post is added, the author is also visible. Therefore, all user-submitted data is connected to a user name.

4.4.1.2 Posting

Photos can be chosen from the local pictures directory, and will be displayed along with topic, keywords, and description. Since no database is available to store the images (and local storage does not support storing binary data), a predefined directory can be used to store and add pictures. The relative paths of the pictures are stored in the local database, and are subsequently displayed in the list of photos. In a live version of the platform, the binary picture data could be stored on the server with minimal modification to the code of the platform. Posts are displayed three at a time, and can be clicked through at the bottom of the page to load more without reloading the page. The latest content is displayed on the top of the page, as this is typically what the users will be looking for, according to the focus group study. Posts are dynamically loaded and displayed on the website, and the expanding link is also automatically generated to start loading more content continuing from the following post.

4.4.1.3 Search

The prototype supports search in the keywords, topic, and description of posts, and shows a 'filtered' view that contains all posts that match the search term. More content can be loaded at the bottom of the page similarly to the main interface. The search functionality uses the same dynamical loading as the normal post listing, with an added filter to only load

matching posts.

4.4.1.4 Rating

Relevance of posts can be rated by each user. The average rating of the post is displayed. As a feedback to show already rated posts, the rating added by the current user is visible as well. To avoid duplicate ratings, all ratings are stored as metadata added to the posts, and an average is displayed to users.

4.4.1.5 Commenting

Comments and discussion are displayed below each post, starting with the latest comments. Older comments can be loaded dynamically by clicking on the corresponding link. If the user writes a new comment, they receive instant feedback as the platform emphasizes their text with a bold font weight. User names are automatically added to comments, using the currently logged in user's name.

4.4.1.6 Database operations

A separate page contains functions to save and load the data in local storage, containing picture links, posts, ratings, and comments. Therefore content can be migrated from one computer to another. The prototype also contains a bootstrap function to add a few sample posts and comments to the page when it is started for the first time. Since local storage in HTML5 is only able to store string data types, the local database is stored by first converting all data to JSON, and then storing the resulting string in a local storage key-value pair.

One of the challenges of the prototype implementation was the fully dynamic nature of the platform. Posts and comments are loaded on-demand, without cluttering the initially shown web page. Creating comments or rating other posts can also be achieved without the need to reload or recreate any other element of the displayed page. Even though utilizing a

dynamic platform makes the user flow simpler and avoids page reloading, it presents two bottlenecks which had to be solved. Dynamic content has to use the same look and feel as static content. The content therefore used common style sheets for both dynamic and static content, which defined the display properties of each element on the web page. Dynamic content also has to present the same features for posting and browsing (adding comments, loading more content). This was solved by creating callback functions dynamically, that would call static functions with predefined (such as the ID of the current post, or the last comment that was displayed). Since JavaScript uses lazy evaluation, dynamic parameters in these functions were encased in JavaScript closures, to force early evaluation of the locally scoped parameters. By using callback functions instead of HTML form controls, reloading can also be avoided, reducing network traffic in a live implementation.

To integrate the platform into a live server, the following additional features would be necessary. These are not required for a prototype implementation, since it runs locally with a 'trusted' user and no user impact in case of data loss.

4.4.1.7 Login, Logout

By integrating the photo board platform into a system such as AAI, UZH identifiers (such as the Display Name attribute) could be used to display names for posts and comments. When commenting as a logged in user, the platform requires only a function to return and store the name of the current user. The AAI system is able to handle authentication and user verification, as well as to provide user metadata. (SwitchAAI, 2016)

4.4.1.8 Storage

Since the platform uses local storage, saved data would need to be also sent to the server for a live implementation. Any modification in the local database has to be synchronized by a remote procedure call to the server as well. This could be implemented by an AJAX request sending all mod-

ifications to the server as JSON values. When loading or refreshing the web page, the platform would also have to contact the server to update the locally stored data.

4.4.1.9 Control panel

Online systems can gather a large amount of data. Therefore, a separate database control panel is required to manage posts, images, comments. Some database systems might provide this functionality already, so additional implementation work might not be required. For example, this feature is implemented in the MySQL Visual SQL Editor and Oracle's SQL Developer.

4.4.1.10 Logging

To prevent abuse or misuse, all operations should be logged and backed up by the web server. This can usually be achieved by configuration file changes, and by mirroring the database, as well as periodically creating offline backups. After an implementation of a backup and logging system, all operations would automatically be saved. Administrators would be able to create queries for actions such as login, logout, data changes on the platform, and even actions by other administrators, thereby helping to fix possible glitches in the system.

4.4.2 How we can use this result

The platform prototype encompasses the results of all research phases in an integrated package. It can be extended and hosted online to create a fully functional system. The prototype could also be modified to try and test out different versions of the platform. It is easy to test functions, to try out the system, and to examine usage scenarios and user stories. Therefore, the prototype is both useful for further evaluation of the design ideas and platform created as part of the Master Thesis, and serves as basis for further development, research, and deployment.
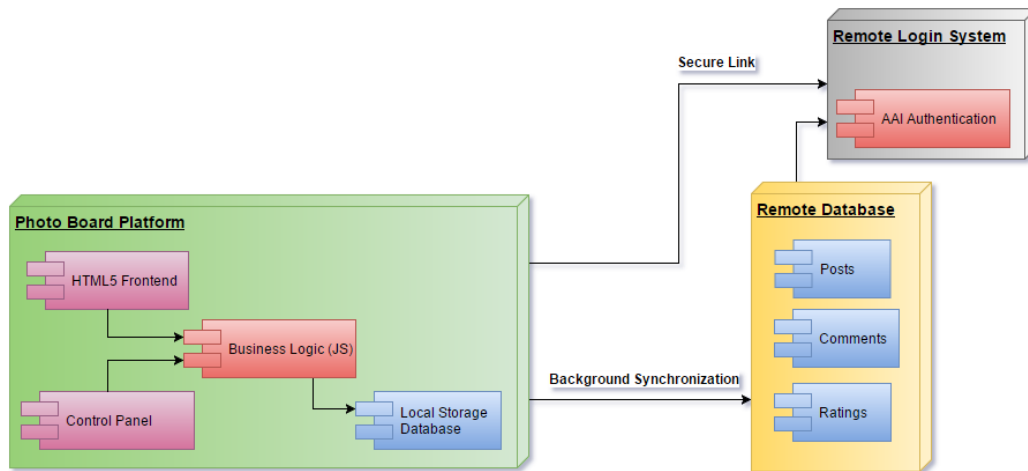
Figure 16: Proposed architecture of the photo board platform. The local database contains the latest available data, and is synchronized with the remote server. Login operations and Remote database operations both access the Remote Login System (SwitchAAI) to verify user credentials.

4.5 Summary

Each phase in the Master Thesis contributed to the final design of the platform and aided in achieving the aim of creating a system that helps in communication, sharing of ideas, and collaboration on these ideas.

The questionnaire was created to gauge interest in sustainability topics, and gather thoughts on online platforms and their effectiveness. The questionnaire shed light on critical aspects of an effective platform, such as personal interaction, informativeness, interactiveness, feedback, and reach. The wireframes built on this information create an outline of the intended platform, together with user stories that correspond to typical user interactions. As a result, the wireframe for the 'Sustainability Photo Board' was created. In this design, photo posts and embedded comment threads are supported to discuss sustainability topics. The focus group study gathered valuable information regarding the platform. These included feedback for user actions, integration into already known systems, and a requirement for a simple and unified login system. Finally, a functional prototype was created which can run on a local machine to demonstrate all impor-

tant functions of the proposed system: creating photo posts, commenting, browsing, rating, and searching.

The prototype still kept in mind the most important requirements from the questionnaire in the initial phase:

Personal interaction

Interaction between users is possible across the comment section in each post, where users can discuss the topic, their opinions, or arrange further collaboration.

Informative

Photographs, descriptions, and keywords add to the information content of each topic. Additional information can be discussed in the comments.

Interactive

Users can perform near real time communication across the comments. They can ask questions related to the topic and get answers from the topic creator or each other.

Feedback

Feedback for each post is provided by the relevance rating system. Textual feedback can also be left in the comments.

Timeliness and relevance

Relevant posts are clearly visible by the rating system on the platform. Furthermore, comments and posts show the latest information first. Earlier information is still available by browsing the website, but does not clutter the main starting screen.

Reach

Reach of the platform is enhanced by integrating into the already existing sustainability website at UZH. This also represents institutional support by the university. The new platform is integrated into the well-known layout of UZH web pages. Furthermore, adoption could be further increased by advertising the sustainability website and the platform itself to UZH students, staff, and faculty.

The design for this platform presents an opportunity for bottom-up collaboration between people at UZH (like mentioned in Subsection 2.4.2). Sustainability champions and interested people can become empowered to present, rate and discuss topics and issues related to sustainability in an easy to use and simple interface. The platform presents the possibility to spread awareness, to discuss, to show commitment, and to educate about sustainability. It can also support the discussion of related practices, and aid in group efforts by enabling users to interact with each other.

5 Conclusion

This Master Thesis focused on a user friendly way to engage all people at UZH in sustainability related topics. It is difficult to design a system for people with different ages, from 17 up to 50 or more. They have a different experience with the Internet, as well as different habits. These age groups also know and use different platforms in their day to day lives. Known across all age groups is the medium of personal discussions, which is the most efficient way of information transfer. It is a difficult task to unequivocally replicate this experience on an internet-based platform. On the other hand, people prefer simple tools that they already know and use.

Moreover, they are highly interested in sustainability, and they want to take action for sustainability. Many people at UZH already follow some sustainable practices, and they would like to do and learn about more. Many people are knowledgeable in one or more sustainability topics, but they do not share their knowledge frequently without a platform that would enable this.

Unfortunately, time is a big constraint for everyone. Thus people are reluctant to take on extra responsibility when using a platform that supports sustainability. A platform design that has low barriers to entry and multiple modes of contribution (comments, photos) alleviates this. People do require such a platform, but it still needs to be advertised, as awareness is vital regardless of the final implementation choices.

It is not always clear where to find truthful and credible information about sustainability. UZH can help students, faculty and staff members to gain valuable information, as UZH and its faculty have a high credibility. Many people prefer short tips and notes in connection with sustainability that are easy to process, instead of reading and evaluating lengthy scientific papers. They would also prefer this information to have the support of UZH and the knowledge of people at UZH contributing to it.

Many people reported that they would be happy to report sustainability issues and concerns. They would prefer an approach integrated with social platforms in their free time, as sustainability is also a topic that they

are happy to integrate into their free time as well. Sustainability seems to be not a job or assignment for them, but a hobby and passion.

The proposed platform addresses concerns to take action, raise awareness, and to share ideas regarding sustainability. It can be used to learn about sustainability, to report sustainability issues, to work on solving them collaboratively or to organise group efforts. The platform aspires to drive involvement and individual commitment in a sustainable campus life by focusing on sustainability issues and on solving them. It is collaborative in nature, as people can discuss issues, rate their relevance, and can even coordinate efforts to address them together. The platform brings personal discussions concerning sustainability online and supports the daily discourse of UZH faculty, staff, and students. The platform supports the idea of sustainability champions by the concept of verified profiles and serves as a starting point for education and gathering information concerning sustainability. The platform also has a chance of attracting external sponsors such as energy companies committed to the idea of sustainability. As a UZH-integrated platform, it also serves as a display of commitment to the transition towards sustainability at UZH. Future options for the platform might include closer integration with social networks, a sustainability-specific custom website style, and additional media formats such as short video clips. Hopefully, sustainability continues to be an important focus of the university life.

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A   Appendix (on CD)

A.1   Appendix A: Results of Questionnaire

A.2   Appendix B: System Wireframes

A.3   Appendix C: System Prototype

A.4   Appendix X: Other Wireframes