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# IT-ENABLED IDEA CROWDSOURCING – A MEAN TO PROMOTE GENDER EQUITY IN IT RESEARCH INSTITUTIONS

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# IT-ENABLED IDEA CROWDSOURCING – A MEAN TO PROMOTE GENDER EQUITY IN IT RESEARCH INSTITUTIONS

*Research paper*

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## Abstract

*The paper is aimed at enhancing understanding of how under-representation of women in IT (Information Technology) research institutions, as well as other challenges related to gender equity, can be addressed with the help of IT-enabled idea crowdsourcing. A systematic literature review was conducted to understand how the topic of gender equity promotion via collaboratively used IT artefacts has been addressed in extant research. Insights from the literature review, overview of existing related IT artefacts, and iterative discussions with scholars in the IT field have resulted in a set of requirements to the idea crowdsourcing platform aimed at the promotion of gender equity in IT research institutions. These requirements were analysed further and could be categorised into those specific for the target platform and those relevant also for other idea crowdsourcing platforms (with or without further adaptation). This study addresses a novel and important research topic and might be of value for practitioners.*

*Keywords: Gender Equity, Women in IT, Idea Crowdsourcing, Online Platform, Literature Review.*

## 1 Introduction

Attracting the best researchers with a balanced representation of women and men is crucial to Europe's innovative capacity and global competitiveness (e.g., European Commission, 2009, 2014a). However, *horizontal* and *vertical segregation* afflict research careers (e.g., Robertson et al., 2001): women and men are unequally represented in academic senior positions (*vertically*) and across the disciplines (*horizontally*).

In terms of vertical segregation, women remain a minority among academic leaders. Although in Europe in 2014 between 40% and 60% of doctoral degrees were awarded to female students, women made only 20.9% of full professors, 20% of higher education institution heads, and 22% of scientific and administrative board leaders. This pattern of gender imbalance has improved slightly over the last years, but still the numbers remain low. (European Commission, 2015)

As for horizontal segregation, women are particularly poorly represented in the Science, Technology, Engineering, and Mathematics (STEM) fields (e.g., Rees, 1998; Xie and Shauman, 2003). This challenge holds true in Europe, as well as in the United States of America, Canada, Australia, and most of the industrialised world, where it has been the subject of considerable concern over the past thirty years (e.g., Faulkner and Arnold, 1985; Hewlett et al., 2008). As it is widely recognised that research and innovation are the main drivers of a prosperous economy and all potential talent needs to be utilised as fully as possible, action is required here.

Within the STEM disciplines, one of the areas, where the widening gender imbalance is particularly acute, is Information Technology (IT) (e.g., von Hellens et al., 2012). The ubiquitous nature of IT has

resulted in a constantly increasing demand for IT professionals worldwide. In Europe alone a gap of over 1.3 million of IT professionals is forecasted to occur by 2020 (European Commission, 2014b). Therefore, the under-representation of women in the IT field and, in particular, in IT research institutions (including bachelor and master students of IT-related study programmes), aside from its implications for gender equity in career progression, also has far-reaching negative consequences for satisfying the demand for IT professionals (Trauth, 2011).

IT transforms economies and societies for prosperity, social development, and stability (e.g., Andal-Ancion et al., 2003; Tapscott, 2012; Venkatraman, 1994). Moreover, it is now widely recognised that IT can play a major role in solving complex global challenges (e.g., vom Brocke et al., 2015). One promising way how IT can support addressing a challenge is by facilitating the ideation process via IT-enabled idea crowdsourcing (Greene, 2002). Ideation refers to the generation of ideas (Dreiling and Recker, 2013; Flynn et al., 2003), while idea crowdsourcing means the involvement of a large and diverse group of individuals (e.g., users or consumers) to generate novel ideas. Studies show that people with diverse backgrounds and roles are likely to create synergies while they brainstorm and discuss ideas, and the solutions identified during this process have a high potential to be successful once implemented (Cui et al., 2015; Hargadon and Sutton, 1997; Salomon and Schork, 2003; Wang and Ramiller, 2009; Whelan et al., 2013). The idea crowdsourcing process can be supported by online platforms, called idea crowdsourcing platforms (Görzen and Kundisch, 2016; Johannsson et al., 2015; Kosonen et al., 2013, 2014; Nguyen, 2014).

According to the United Nations, the “strategic challenge today is to ensure not only that both women and men benefit from the opportunities presented by new ITs, but also that new ITs are used to support greater socioeconomic, scientific and political equity” (UNESCO, 2007, p. 31). The goal of this study is, thus, to explore the potential of IT-enabled idea crowdsourcing in contributing to the promotion of gender balance in IT research institutions. The first step of this explorative study is to understand how this topic, if at all, has been addressed in extant academic literature. The second step is to investigate the peculiarities of an idea crowdsourcing platform aimed at the promotion of gender equity in IT research institutions, as compared to other idea crowdsourcing platforms. These objectives lead to the following research questions (RQs):

**RQ1:** What is the state of the published research on the promotion of gender equity via IT-enabled idea crowdsourcing?

**RQ2:** What should be the specific requirements to the idea crowdsourcing platform aimed at the promotion of gender equity in IT research institutions (the Platform)?

In order to address RQ1, a systematic literature review was conducted and its process and results are reported on in this paper. The results of the literature review demonstrated that the topic of IT-enabled idea crowdsourcing has not been discussed extensively in the literature on the promotion of gender equity. Nevertheless several interesting insights could be revealed from the literature, which informed the requirements to the Platform, thus, contributing to RQ2. As we could not identify any relevant Platform already implemented in practice, in order to further address RQ2 the final set of requirements was specified through iterative discussions with 13 academics from eight IT research institutions in Europe. These requirements are presented in this paper, comparing their characteristic features with the features of other commonly used idea crowdsourcing platforms.

This study is in line with the first two steps of the design science process, namely problem identification and definition of the objectives for a solution (Peffer et al., 2007). The Platform addressing the identified requirements is currently being developed and the results of its evaluation will be reported on in the future.

The paper starts with explaining the concept of crowdsourcing and providing some background information about idea crowdsourcing platforms. The methods used to analyse the existing literature and to determine the Platform requirements are described afterwards, followed by the presentation of attained results. The paper is concluded by discussing the study outcomes, contribution, limitations, and suggestions for future research.

## 2 Background

In the past, it was widely thought that the principle remedy to address the gender imbalance in IT research institutions was a numerical one – to simply seek to attract more women through awareness campaigns and other measures aimed at incentivising individual women. Nowadays, however, increasing attention among policy-makers is being paid to cultural, structural, and institutional remedies that should be developed to improve equity in research careers for both women and men (European Commission, 2012; genSET). This study is part of a larger project, known as EQUAL-IST (“Gender Equality Plans for Information Sciences and Technology Research Institutions”), which is aimed at introducing structural changes for promoting gender equity and diversity in IT research institutions in Europe. The changes are implemented by combining the so-called “top-down” and “bottom-up” approaches. The “top-down” approach refers to the interventions initiated by management and brought forward to employees. The “bottom-up” approach, just the opposite, involves the interventions proposed by employees and communicated to management. Within the EQUAL-IST project, the “bottom-up” approach implies involvement of a wider audience of staff members (both academic and non-academic) and students into (a) identification of the challenges related to gender equity that exist at each participating research institution and (b) generation and selection of ideas that could address the identified challenges. An idea crowdsourcing platform offers a great potential to support these participatory processes.

The concept of *crowdsourcing*, which was first introduced by Howe in 2006, means the involvement of an undefined large group of internal and external individuals in the process of accomplishing a specific task or in innovation efforts (Howe, 2006a, 2006b). The specific type of crowdsourcing when novel ideas need to be generated by internal and external contributors is called *idea crowdsourcing* (Görzen and Kundisch, 2016; Kosonen et al., 2013, 2014). One common way to enable idea crowdsourcing is via Internet-based tools for crowdsourcing and idea management systems (Aitamurto et al., 2011; Bansemir and Neyer, 2009; Görzen and Kundisch, 2016; Greene, 2002). Using idea crowdsourcing for the idea generation process can bring an organisation a number of benefits. First, it brings together a diverse set of people with different knowledge and skills, which facilitates the collection of diverse thoughts and experiences and, as a consequence, the generation of the most innovative ideas (Aitamurto et al., 2011; Cui et al., 2015; Hargadon and Sutton, 1997; Hopkins, 2011; Kosonen et al., 2014; Wang and Ramiller, 2009; Whelan et al., 2013). Second, idea crowdsourcing allows the collection of a high number of ideas in a cost-efficient way (Johannsson et al., 2015; Nguyen, 2014; Schweitzer et al., 2012). Third, the involvement of a ‘crowd’ can increase the public visibility of an organisation and its support (Johannsson et al., 2015).

Although there is a lack of research on IT-supported idea generation (Masseti, 1996; Müller-Wienbergen et al., 2011; Nagasundaram and Bostrom, 1994; Nunamaker et al., 1987; Santanen et al., 2004; Wierenga and van Bruggen, 1998), there are several idea crowdsourcing platforms in practice. These platforms range from free community platforms to commercial platforms to hybrid platforms. Community platforms, like OpenIDEO, deal with socially important challenges and do not request payment from their users. Commercial platforms link companies seeking for innovative solutions and contributors, for instance, researchers, designers, or customers, who might offer such solutions. According to Kosonen et al. (2014), companies can be connected with researchers via research and development platforms, like InnoCentive; with designers via marketing and design platforms, like crowdSPRING; and with customers (to integrate them, for instance, in product development) via platforms owned by companies, like IdeaStorm (Dell Inc.). Hybrid idea crowdsourcing platforms, like IdeaScale, combine community and commercial platforms into a single system with community areas and private areas (that can be rented by companies). None of the identified idea crowdsourcing platforms focused on the promotion of gender equity nor did they consider the specifics of research institutions.

### 3 Method

In order to address the first study research question and to support the problem identification step of the design science process (Peppers et al., 2007), a systematic literature review was performed. The review was carried out in an iterative way following the process proposed by Bandara et al. (2015). It was quickly discovered that there were no studies specifically dealing with the promotion of gender equity via idea crowdsourcing. Therefore, it was decided to extend the scope and reveal any articles discussing how the promotion of gender equity is being supported by any IT artefacts that enable collaborative work, idea management, and contribution. Under IT artefact instances, Hevner et al. (2004) understand all readily implemented or prototyped information systems.

Three world leading research databases, namely EBSCOhost, Scopus, and ScienceDirect, as well as the Association for Information Systems Electronic Library (AISEL), which is the “central repository for research papers and journal articles relevant to the information systems academic community”, were selected for literature search. In the Scopus research database, the “Medicine” and “Agricultural and Biological Sciences” subject areas, which were not relevant for this study, were excluded to keep the number of returned results manageable. It was decided to search within all database articles, without any publication time limitations. Thus, all articles included in the databases up to November 2016 were considered. Several iterations of searches using different combinations of search terms were performed, until a final set was defined. This set of search terms was discussed and deemed appropriate by several scholars in the IT field. In line with the updated review scope, the search terms could be grouped into those related to (1) gender, (2) equity, (3) collaboration, and (4) IT artefact. The systematic search was performed within the paper abstracts, returning the articles containing at least one search term from each of these four search groups. For the sake of brevity, specific details of literature selection and evaluation are provided in Table 1.

Search outlets	All articles included in the following research databases (no limitation on publication year): EBSCOhost, Scopus, ScienceDirect, and AISEL			
Search terms	Gender-related search terms	Equity-related search terms	Collaboration-related search terms	IT artefact-related search terms
	<i>sex, gender</i>	<i>equity, equal<sup>a</sup>, equation, equilibrium, egalitarianism, divers*, variety, balance, fair*, discriminat*, justice, parity</i>	<i>crowd*, idea*, “joint work”, group*, “peer production”, co-creat*, “co creat*”, cocreat*, collaborat*, cooperat*, co-operat*</i>	<i>portal, web*, network, system, database, “data base”, prototyp*, platform</i>
Search string	Any of the <i>gender-related</i> search terms in abstract AND any of the <i>equity-related</i> search terms in abstract AND any of the <i>collaboration-related</i> search terms in abstract AND any of the <i>IT artefact-related</i> search terms in abstract			
<sup>a</sup> - The wildcard asterisk (*) can be substituted with any number of characters				

Table 1. Details of the Search, Selection, and Initial Analysis of Articles.

The returned 3992 results were extracted into the BibTex format, imported to a .csv file, and then to Excel. After removal of 343 duplicating entries, a macro in Excel that highlights with a different colour the keywords belonging to each of the four search groups was implemented and applied to the remaining 3649 abstracts to facilitate the subsequent screening process.

During the screening of paper abstracts, several exclusion criteria were applied. First, the studies not dealing with an IT artefact were removed. The search term “system” has led to the largest number of irrelevant results, as often not an IT system was meant, but, for instance, “education system”, “legal system”, “social system” and so on. The studies on the gender digital divide were not considered further as well, because they dealt with the gap in opportunities to access IT and Internet between men in women (e.g., Liff et al., 2004), rather than how technology can support the promotion of gender equity. Several

studies related to the promotion of gender equity stated that some software or web surveys were used to support data collection and analysis. It was decided to not consider such articles further, as it can be assumed that data collection and analysis with the help of IT was the case for the absolute majority of returned articles, just that not all of them stated it explicitly in their abstracts. Second, the studies, where the promotion of gender equity was not the goal, were excluded. Here, for instance, the search term “equation” was often used in a phrase “structural equation modelling”, which is not related to gender equation. Furthermore, many studies investigated the differences between men and women in IT adoption and use, which was also not relevant for our study. Third, only research articles were considered, excluding, for instance, magazine articles or editorials. As a result, only 26 potentially relevant articles were pre-selected for further analysis and their full texts were screened.

In line with the updated review scope, out of 26 potentially relevant articles in 10 research papers it was discussed how the promotion of gender equity is being supported by collaboratively used IT artefacts. These papers were included in the final dataset and their full texts were analysed in detail (Table 2). In several potentially relevant articles, which were not included into the final dataset, the described IT artefacts had informational (unidirectional) role and did not cover the “collaborative” aspect. In the study by Irving and English (2010) the websites for feminist organisations and women’s resource centres were analysed. Singh and Point (2006) argued that gender equity could be promoted by presenting diversity statements on company websites. Mendick and Moreau (2013) discussed how gender stereotypical images of women and men in the STEM fields were reproduced online. Several studies introduced databases, where information related to gender equity could be collected (Alonso et al., 2016; Campbell, 2006; Golderman and Connolly, 2004; Holter, 2014; Kremer et al., 1996). Finally, a stream of research on consideration of gender in the design of an IT artefact could be revealed (Boiano et al., 2006; Cyr et al., 2009; Fan and Macredie, 2006; Gopal et al., 1997; Olbrich et al., 2013; Zorn et al., 2007). One interesting non-academic magazine article by Casserly (2012) was also identified during the literature review. This article, among others, introduced the Catapult crowdfunding platform aimed at raising funds “for projects to advance gender equity”.

The process of the final dataset formation, highlighting the number of papers returned at each step, is presented in Figure 1. The analysis results of the selected 10 studies are presented in the “Results” section.

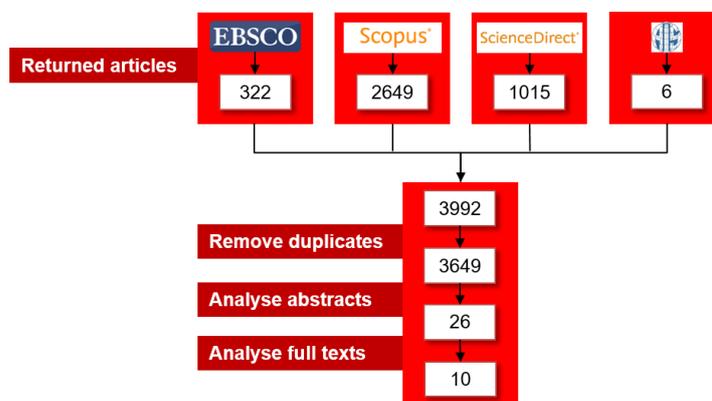


Figure 1. The Process of the Final Dataset Formation.

As discussed in detail in the “Results” section, within the performed systematic literature review, only one study, namely by Trauth and Jessup (2000), dealt with the promotion of gender equity via IT-enabled ideation. This study is particularly valuable for addressing the second research question also because it was conducted in a university. Insights from the study were used to formulate the initial requirements to the Platform. In addition to that, existing IT artefacts aimed at the promotion of gender equity and diversity were considered, including sophisticated websites of the projects funded by the European Commission (e.g., FESTA, GENERA, LIBRA, Plotina, Trigger), as well as the HeForShe and Catapult crowdsourcing platforms. It has to be mentioned though that these websites focused on the provision of

information, rather than supported collaborative work, and the related crowdsourcing platforms were neither idea crowdsourcing platforms nor did they consider the specifics of research institutions.

In order to address the study second research question, expert feedback to the initial requirements to the Platform was collected. Identification of the final list of requirements or, in other words, the objectives for the designed Platform is in line with the second step of the design science process (Peppers et al., 2007). A focus group involving 13 representatives from eight European IT research institutions participating in the EQUAL-IST project was gathered (see the “Background” section for the project details). The participating academics involved nine female and four male professors and postdoctoral researchers from Germany, Liechtenstein, Finland, Italy (two research institutions), Portugal, Lithuania, and Ukraine. The initial requirements were presented to them and were then discussed, refined, and extended. The results of this brainstorming were documented, structured, and shared with the same group of IT scholars via a collaborative online document. The scholars could add new requirements, as well as comment on, adjust, or criticise any of the existing requirements. The requirements, where contradicting opinions were expressed, were put on the vote (via online polls), so that all scholars could express their opinions and the decision was made based on the majority of votes. After incorporating all feedback and the results of voting, a final list of requirements was formulated and shared with the scholars for a final check; no further objections were raised (see Appendix for the list of final requirements). Analysis and discussion of these requirements and their peculiarities as compared to other idea crowdsourcing platforms are presented in the “Results” section.

## 4 Results

### 4.1 Extant research on the promotion of gender equity via collaboratively used IT artefacts

Based on the performed systematic literature review, 10 studies discussing how the promotion of gender equity was supported by collaboratively used IT artefacts could be revealed. The main aspects from each study are summarised in Table 2, highlighting the respective IT artefact with *course*. The analysed studies can be roughly classified into two main categories. The first category includes the papers about specific collaborative platforms and online communities promoting gender equity (Bentow et al., 2007; Fischer, 2016; Headlam-Wells et al., 2006; Öner et al., 2012; Rodriguez et al., 2011; Trauth and Jessup, 2000). The second category includes the studies dealing with the phenomenon that web in general provides features facilitating elimination of gender bias (Armentor-Cota, 2011; Crocco et al., 2008; Klein et al., 2003; Otterbacher, 2013).

Although no studies specifically discussed the promotion of gender equity in research institutions via IT-enabled idea crowdsourcing, the study by Trauth and Jessup (2000) provided valuable insights for the identification of initial requirements to the Platform. A group support system (GSS) “to support employee discussions about gender equity in a university” (p. 43) was introduced in the study. The relevant features and advantages provided by the GSS were discussed and the processes of identification of challenges related to gender equity, as well as the solutions addressing these challenges, were presented.

The GSS sessions, where feedback from the university staff members was collected, had the following goals, which also correspond with the Platform goals: (1) “raising awareness about gender equity issues”, (2) “bringing people from various parts of the University together”, and (3) “generating alternatives for managing gender equity” (p. 65). Opportunities for secure anonymous content submission, voting, and discussions were highlighted as advantages when dealing with such an “emotionally charged” topic as gender equity and, therefore, were also included in the list of Platform requirements (p. 45).

Another requirement indicated in the study by Trauth and Jessup (2000), which was considered to be important for the Platform too, was the distinction between two sequential phases. During the first

brainstorming phase users had an opportunity to submit challenges and ideas addressing them. Challenges could be submitted anytime throughout the phase, meaning that the challenge identification and the idea generation processes took place in parallel. The second phase included user voting for the best ideas from a list compiled by the session moderators upon the completion of the first phase.

The discussed GSS, however, did not cover such aspects, which were deemed to be important for the Platform, as the system availability for an unlimited number of research institutions and the opportunity to collect additional feedback from the users not belonging to a research institution. Therefore, the list of Platform requirements needed to be extended further, which is discussed in the following sub-section.

Study	Details
Studies on the collaborative platforms and online communities promoting gender equity.	
Trauth and Jessup (2000)	The study introduced a <i>group support system (GSS)</i> that supported the identification of challenges related to gender equity in a university, as well as the discussion of ideas addressing these challenges.
Bentow et al. (2007)	The study discussed how a <i>Virtual Support Network (VSN)</i> was used within a project aimed at the integration of gender equity principles into existing programs of engineering associations. VSN was used mostly as a dissemination tool, but its ultimate goal was to create a “successful online community [...] which specifically focuses on interweaving gender equity, engineering education, and project management knowledge” (p. 5).
Headlam-Wells et al. (2006)	The study focused on the promotion of gender equity via e-mentoring and discussed, among others, the design of the applied <i>e-mentoring system</i> . The system functionality supported provision of “personalised matching for each mentee, [...] chatrooms (or online meetings), and discussion areas” (p. 483).
Öner et al. (2012)	The study discussed a global diversity management programme implemented at a commercial company. This programme, among others, included the promotion of gender equity. The formation of <i>e-teams and network groups on the intranet</i> were highlighted as important parts of this programme.
Fischer (2016)	The study described an important role that <i>social media</i> had played in defending the rights of one African-American transgender woman.
Rodriguez et al. (2011)	The study discussed the implementation of a <i>content management system</i> at a non-profit organisation, which dealt with, among others, the promotion of gender equity. The content management system was implemented as a tool for knowledge management and supported the knowledge sharing process.
Studies discussing the web features that support elimination of gender bias.	
Klein et al. (2003)	The study discussed the consequences of anonymity-featured GSS, specifically the phenomenon of “equalization of male-female participation” (p. 355). The authors argued that because all GSS members had an option to stay anonymous, gender was not anymore a factor that could influence discussions.
Crocco et al. (2008)	The study discussed the participatory culture of <i>Web 2.0</i> , arguing that “a shift to web-based computing eliminates some gender gaps” (p. 19).
Otterbacher (2013)	The study introduced an <i>online database</i> of movies, television programs and video games, where users could leave reviews. In order to provide a balanced view on “what others think about an item”, a gender filter was introduced that “displays an equal number of reviews authored by men and women” (p. 1).
Armentor-Cota (2011)	The study discussed behavioural patterns of users in online interactions, for instance, on <i>social networks</i> , and introduced gender fluidity as one of such patterns. The author stated that gender fluidity was, among others, expressed by challenging “male dominance and hegemonic masculinity” and building solidarity by women to gain the gender balance in online interactions. (pp. 32-33)

Table 2. Research papers addressing the topic of gender equity promotion via collaboratively used IT artefacts.

## 4.2 Requirements to the idea crowdsourcing platform aimed at the promotion of gender equity in IT research institutions

Based on the conducted focus group and iterative discussions with IT scholars (see the “Method” section), as well as the insights from the systematic literature review (see the previous sub-section), a final list of requirements to the Platform could be derived (see Appendix). The requirements could be grouped into several categories, and for each requirement it was possible to define, whether it was specific for the Platform or generic for idea crowdsourcing platforms (with or without further adaptation).

Some of the functionalities relevant for both the Platform and other established idea crowdsourcing platforms include the submission, overview, and detailed presentation of ideas, submission of feedback via comments, registration and login, user profiling, subscription to the notifications, user ranking and statistics etc. If an idea crowdsourcing platform supports submission of not only ideas, but also challenges (as it is the case for the Platform), these challenges typically go through different life cycle phases. In spite of these similarities, no idea crowdsourcing platform that would meet all the requirements to the Platform could be identified. The following functionalities distinguish the Platform from other established idea crowdsourcing platforms.

Each challenge submitted to the Platform goes through a specific life cycle consisting of five phases (Figure 2). During Phase 1, it is important to identify, what challenges a research institution (RI) faces, while Phase 2 is aimed at the collection of ideas addressing these challenges. The collected ideas are being reviewed in Phase 3 and the most promising of them, which are also feasible to be implemented, enter Phase 4 to be voted on. During Phase 5, which takes place outside the Platform (marked with grey in Figure 2), the best ideas, i.e. those that received the highest number of up-votes and the lowest number of down-votes, need to be operationalised and implemented in practice.

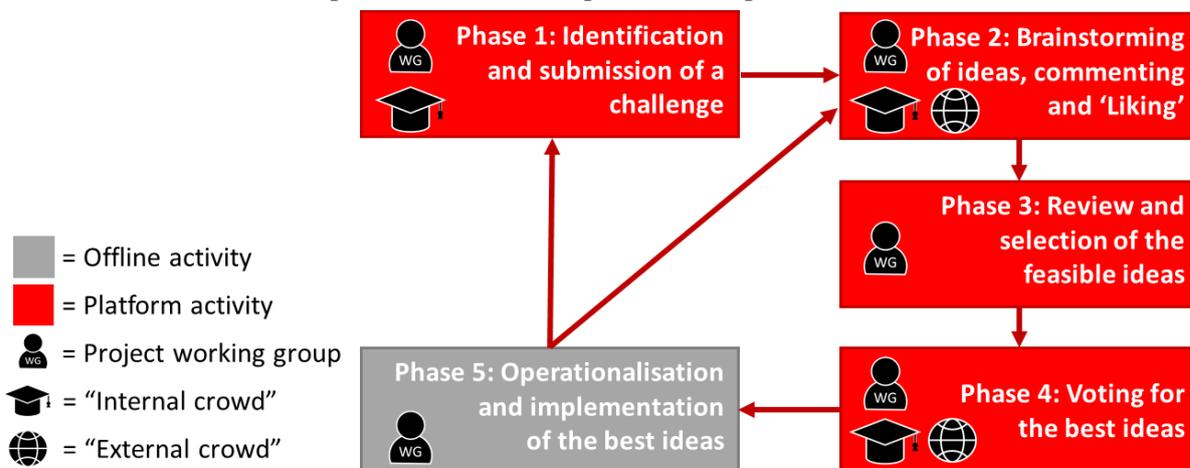


Figure 2. The Challenge Life Cycle.

In order to reveal initial challenges, as well as first ideas addressing them, within the EQUAL-IST project (see the “Background” section for the project details), an internal gender audit is planned to be performed at each of the participating RIs. The gender audit includes the collection of gender-disaggregated statistics, as well as the conduction of a survey, interviews, and workshops with RI members. RI members include its staff members (both academic and non-academic) and students who together form the so-called RI “internal crowd”. The outcomes of the internal gender audit will then be analysed by the working group of people involved in the EQUAL-IST project at each RI (WG). Based on this analysis, initial challenges, as well as first ideas addressing them, should be identified and submitted to the Platform. In this case, a WG member who will make this submission should have an option to flag it as a “group submission”, meaning that a challenge or an idea was discussed and agreed upon by a group of people. Submission of challenges and ideas can also be done by any member

of the RI “internal crowd”. Here the contributor should be asked to select the “individual submission” check-box.

During Phase 1, it is important to ensure that every individual voice is heard, which is different to other idea crowdsourcing platforms, like OpenIDEO, where a challenge needs to go through a centralised approval process before it appears online. Phase 2, quite the contrary, is similar across all idea crowdsourcing platforms and pursues the involvement into the idea generation process the largest possible audience. The Platform enables all registered users to leave comments on challenges and ideas. Here contributors can also be outside the participating RIs, thus, belonging to the so-called “external crowd”. When submitting a comment to the Platform, a user is additionally asked to specify its type (agreement, critique, or further aspects to be considered). Moreover, during Phase 2 initial evaluation of ideas with ‘Likes’ takes place. ‘Likes’, just like comments, can be left by all registered users. This evaluation with ‘Likes’ should support the WG members during the analysis and pre-selection of the promising and feasible ideas in Phase 3. The pre-selected ideas can then be up-voted or down-voted by all registered users in Phase 4. This phase is similar to the final feedback phase on OpenIDEO. The opportunity to down-vote is aimed at revealing unfair or biased ideas. The ultimate goal is to implement the best ideas in practice during Phase 5. The knowledge generated during the implementation can initiate or inform new challenges and ideas, thus, looping the challenge life cycle.

Next important aspect specific to the Platform is the sensitivity of the considered challenges, which are related to gender inequalities existing at RIs. Therefore, there is a need to combine the “wisdom of crowds” with the non-disclosure of sensitive information. For that, the Platform should have both the so-called private area for each RI, which is accessible only to the RI “internal crowd”, and the shared area, which is accessible to the “external crowd”. Before information about challenges and ideas submitted to the private area of the Platform appears on the shared area for an open public discussion, it needs to be anonymised by removing all author-, country-, and RI-identifying information. Moreover, each contributor can decide, whether his/her authorship should be revealed to the other members of the RI “internal crowd” or anonymity should be kept also in the RI-specific private area of the Platform. This selective anonymization should encourage contributors to not be afraid to express their honest opinions. Furthermore, each contributor from the RI “internal crowd” can decide, whether the submitted content should appear on the shared area of the Platform at all. The RI-specific private area of the Platform should contain only those challenges and ideas that belong to this RI. The RI “internal crowd” should see the information appearing in the private areas of other RIs in the same anonymised way as the “external crowd”. In order to differentiate between the RI “internal crowd” and the “external crowd”, a thorough consideration of user roles, access rights, and security is required. A user is assigned to the “internal crowd” if during registration (s)he provides an email address with the domain included in the list of email domains of participating RIs.

It might happen that a specific challenge is relevant for more than one RIs. In this case, it still needs to be submitted for each RI separately, because addressing this challenge might require different actions at each RI. The ideas addressing a challenge are supposed to consider context, national regulations, local specifics etc. In order to keep order in the shared area of the Platform, where all challenges and ideas appear as a single list, a contributor should have an opportunity to assign each challenge to one of the gender equity areas (e.g., lack of awareness, work-life balance issues, gender stereotypes etc.). Ideas addressing a challenge should automatically inherit its area. The list of these areas needs to be flexible and opened for extension. Then, in the overview pages of challenges and ideas, both in the private and the shared areas of the Platform, the grouping and filtering of entries based on the assigned gender equity area should be done.

The Platform development should follow the principles of Inclusive Information System (IS) Design. The British Standards Institution (2005) defines inclusive design as “the design of mainstream products and/or services that are accessible to, and usable by, people with the widest range of abilities within the widest range of situations without the need for special adaptation or design”. In other words, Inclusive IS Design facilitates the creation of a flexible and adjustable product, which guarantees the best

accessibility in a specific target market. We argue that the Platform aimed at the promotion of equity and diversity needs to be designed in a way that it is accessible and easy to use by all user groups. According to Olbrich et al. (2015), until now the guidelines for Inclusive IS Design focused mostly on the inclusion of users with physical disabilities, while the social inclusion of various user groups has not yet been addressed in extant research. Therefore, during the Platform design and implementation, it is intended to follow the Inclusive IS Design principles formulated, for instance, in the Microsoft Inclusive Design Toolkit (Microsoft, 2013). It is important to recognise potential excluded groups and consider them in the Platform design. After the Platform starts its operation, the continuous improvement of its design can be supported, among others, by a feedback module.

## 5 Discussion and Conclusion

This study was motivated by two striking phenomena: (1) existence of horizontal and vertical gender segregation in research careers and, in particular, gender imbalance in IT research institutions (e.g., von Hellens et al., 2012) and (2) the constantly increasing potential of IT and, in particular, IT-enabled idea crowdsourcing, to solve complex global challenges (e.g., vom Brocke et al., 2015; Greene, 2002). A systematic literature review was conducted to enhance the understanding of how (if at all) extant research investigated the potential of collaboratively used IT artefacts to tackle the challenges related to gender equity. The results, although provided valuable insights, indicated a general lack of examination of the topic. This research gap is addressed in the study and further inspection of the role of IT artefacts in promoting gender equity, diversity, and social inclusion could be done in future research.

The performed literature review was followed by the overview of existing related IT artefacts, including, on the one hand, prominent idea crowdsourcing platforms (e.g., OpenIDEO, InnoCentive, IdeaScale) and, on the other hand, existing IT artefacts aimed at the promotion of gender equity and diversity (e.g., the HeForShe and Catapult crowdsourcing platforms). This analysis has resulted in the initial set of requirements to the idea crowdsourcing platform aimed at the promotion of gender equity in IT research institutions (the Platform). The initial requirements were then reworked within the focus group and iterative discussions with 13 academics from eight IT research institutions in Europe. As a result, a final list of requirements to the Platform could be developed (see Appendix). The final requirements could be grouped into several categories and were then compared with the features of other idea crowdsourcing platforms. For each requirement it was possible to define, whether it was specific for the Platform or generic for idea crowdsourcing platforms (with or without further adaptation).

As we could not identify a functioning platform addressing all the identified requirements, the Platform is currently being developed, which constitutes the third step of the design science research methodology that we follow (Peppers et al., 2007). The first two steps, namely problem identification and definition of the objectives for a solution, were described in the paper. In future work we intend to report on the remaining steps of the design science process, including demonstration, evaluation, and communication.

Although the study was motivated by the challenge of under-representation of women in IT research institutions, we believe that the Platform, once it is implemented, might be used by different organisations and in many contexts. On the one hand, the Platform functionality can be easily adjusted, so that it considers the issues related not only to gender equity, but to any dimension of diversity (race, religion, age, etc.) or to human capital in general. On the other hand, the Platform can be used not only by IT research institutions, but by any organisation. It has to be noted though that the analysis and revision of the Platform requirements might be needed in order to make them applicable to other contexts. For instance, experts from research institutions outside the IT field or outside Europe could be asked, what they would change or extend in the current list of Platform requirements.

The Platform requirements combine two contradicting aspects, namely the “wisdom of crowds” and the non-disclosure of sensitive information. The “wisdom of crowds” is an inherent aspect of idea crowdsourcing, while the sensitive information, which should not be disclosed, is related to gender inequalities existing at an organisation. The study insights, thus, might be of value not only to research

institutions, but also to companies and other organisations that face the need to address sensitive challenges.

## 6 Appendix

Requirement Category and Description	Requirement Type <sup>a</sup>
<b>Challenges and ideas</b>	
<i>Submission</i> - Submission of challenges – specific issues related to gender equity and diversity identified in IT research institutions (RIs). - Submission of ideas – possible solutions addressing each of the submitted challenges.	<i>Adapted</i>
<i>Categorisation</i> - Assignment of each challenge and related ideas to one of the gender equity areas, which are flexible and opened for extension.	<i>Adapted</i>
<i>Visualisation</i> - Usage of both texts and visuals during the challenge/idea submission. - Submission of information about a challenge/idea in a structured way, including such fields as (a) title, short text, long text, option to add files; (b) characterising picture; and, if applicable, (c) information about a similar challenge existing elsewhere and/or an earlier successful implementation of a similar idea. - Indication, whether a challenge/idea was discussed and agreed upon by a group of people (“group submission”) or not (“individual submission”).	<i>Adapted</i>
<i>Discussion</i> - Collection of feedback (via comments) on challenges, ideas, and other comments.	<i>Generic</i>
<i>Search and filters</i> - Search for any Platform content with the opportunity to sort the returned results by (a) relevance and (b) date. - Filtering of the challenges/ideas by gender equity area. - Display of the RI-specific challenges/ideas for the RI “internal crowd”.	<i>Adapted</i>
<b>Challenge life cycle phases</b>	
<i>Phase 1: Identification and submission of a challenge</i> - Submission of a challenge by (a) RI working group members (WG) based on the performed internal “as-is” analysis, (b) RI “internal crowd”, or (c) RI external contributors (see the “User roles” requirement category).	<i>Adapted</i>
<i>Phase 2: Brainstorming of ideas, commenting and ‘Liking’</i> - Submission of ideas by WG, “internal crowd”, and external contributors. - Commenting on all challenges/ideas/comments by all registered users who include contributors also outside the participating RIs (“external crowd”). - Rating of ideas with ‘Likes’ by all registered users.	<i>Adapted</i>
<i>Phase 3: Review and selection of the feasible ideas</i> - Pre-selection of the ideas by WG for voting in Phase 4. The Platform recommends ideas in descending order based on the number of ‘Likes’.	<i>Adapted</i>
<i>Phase 4: Voting for the best ideas</i> - Up- / down-voting of the pre-selected ideas by all registered users.	<i>Specific</i>
<i>Phase 5: Operationalisation and implementation of the best ideas</i> - Operationalisation and implementation in practice by WG of the best ideas (those that received the highest number of up-votes and the lowest number of down-votes). Note: The phase takes place outside the Platform.	<i>Generic</i>
<b>Opinion expression</b>	
<i>‘Liking’ ideas and comments during Phase 2</i> - A respective notification (upon subscription) can be sent to the contributor of the ‘Liked’ content.	<i>Generic</i>
<i>Up- / down-voting during Phase 4 of the pre-selected ideas to reveal the best ideas to be implemented in practice.</i>	<i>Specific</i>

<b>User-related</b>	
<p><i>Registration</i></p> <ul style="list-style-type: none"> <li>- Prominent option to register / log in.</li> <li>- Obligation to read and accept the “Terms and Conditions” document in order to complete the registration process.</li> <li>- Completion of the registration process upon following a confirmation link sent to the provided email address.</li> <li>- Assignment of a user role based on the provided email address. Notification to all RI to use university email addresses during the registration. Creation of a taxonomy of all valid university email domains (@sample_uni.com) to check if the domain of the provided email address is listed in the taxonomy.</li> </ul>	<i>Adapted</i>
<p><i>Profiling</i></p> <ul style="list-style-type: none"> <li>- Creation of a profile for each registered user with a possibility for a user to further change/update his/her profile information, as well as to delete the whole account.</li> <li>- Presentation in the user profiles of the information stated during registration, including occupation, gender, age, country of origin/activity, and a picture.</li> </ul>	<i>Generic</i>
<p><i>Rewarding</i></p> <ul style="list-style-type: none"> <li>- Provision of non-monetary rewards to the Platform contributors via, for instance, gamification features (avatars, badges, etc.), alerts (with an option to switch them off), and praising the most active contributors.</li> </ul>	<i>Generic</i>
<b>Research institution related</b>	
<p><i>Platform areas</i></p> <ul style="list-style-type: none"> <li>- The <i>shared area</i> of the Platform is accessible to all users. All challenges/ideas are presented there in an anonymised way. Only the comments submitted by “external crowd” are displayed.</li> <li>- The <i>private area</i> of the Platform is accessible to RI “internal crowd” and external contributors. RI-specific content (challenges/ideas/comments) is presented in a non-anonymised way. Only the comments submitted by RI “internal crowd” and external contributors are displayed (to reduce the noise from “external crowd”). When submitting challenges/ideas, on top of public information that will also appear in the <i>shared area</i>, RI “internal crowd” and external contributors can provide further internal information visible only in the respective RI <i>private area</i>. The content specific for the other RIs is displayed in an anonymised way, just like in the <i>shared area</i>.</li> </ul>	<i>Specific</i>
<b>User roles</b>	
<p><i>Administrator</i></p> <ul style="list-style-type: none"> <li>- A person responsible that the Platform works smooth.</li> <li>- The Administrator has the highest level of user permissions to: (1) view and contribute to all content of all Platform areas, (2) manually assign and restrict access of specific users to specific Platform areas, (3) track the actions and feedback from users, (4) restrict users behaving in an appropriate way, (5) extract and analyse all data collected on the Platform.</li> </ul>	<i>Generic</i>
<p><i>Working group members (WG)</i></p> <ul style="list-style-type: none"> <li>- RI members forming the EQUAL-IST project consortium (see the “Background” section for the project details).</li> <li>- WG members are allowed to: (1) view and contribute to all content of all Platform areas, (2) send requests to the Administrator to provide additional permissions to external contributors (see below).</li> </ul>	<i>Specific</i>
<p><i>“Internal crowd”</i></p> <ul style="list-style-type: none"> <li>- RI students, academic and non-academic staff members.</li> <li>- The main target audience of the Platform.</li> <li>- RI “internal crowd” are allowed to view and contribute to all content in the RI-specific <i>internal area</i>, but have the same rights as “external crowd” to the content relater to other RIs.</li> </ul>	<i>Specific</i>
<p><i>External contributors</i></p> <ul style="list-style-type: none"> <li>- External partners who have sufficient knowledge of the RI-specific challenges and can provide valuable feedback.</li> <li>- RI external contributors receive the same rights as RI “internal crowd” manually upon request by WG to the Administrator.</li> </ul>	<i>Specific</i>
<p><i>“External crowd”</i></p> <ul style="list-style-type: none"> <li>- External users who neither belong to any RI nor are external contributors.</li> <li>- “External crowd” are allowed to (1) view and comment on all Platform content which is publicly visible (in an anonymised way), but are not allowed to submit challenges/ideas, (2) ‘Like’ any content (during Phase 2), and (3) up-vote or down-vote pre-selected ideas (during Phase 4).</li> </ul>	<i>Adapted</i>

Not logged-in users can view all Platform content which is publicly visible (in an anonymised way), but are not allowed to contribute.	<i>Generic</i>
<b>Data privacy and security</b>	
<p><i>“Terms and Conditions”</i></p> <ul style="list-style-type: none"> <li>- Prominent presentation of the Platform <i>“Terms and Conditions”</i>, which include the definition of inappropriate behaviour, description of the restriction strategy, clarifications on the storage and usage of personal data etc.</li> </ul>	<i>Adapted</i>
<p><i>Anonymization</i></p> <ul style="list-style-type: none"> <li>- Anonymization means that all author-, country-, and RI-identifying information is not displayed.</li> <li>- Anonymization of all information displayed in the <i>shared area</i>, except for the comments submitted by “external crowd”.</li> <li>- Option to anonymize author-identifying information also for “internal crowd” (in order to motivate people to not be afraid to express their honest opinions).</li> </ul>	<i>Specific</i>
<b>Content promotion and dissemination</b>	
<p><i>Most recent contribution</i></p> <ul style="list-style-type: none"> <li>- News panel on the Platform home page, which shows the recently submitted content.</li> </ul>	<i>Generic</i>
<p><i>Subscription</i></p> <ul style="list-style-type: none"> <li>- Option for a user to subscribe to notifications if his/her submitted content received a comment or ‘Like’.</li> </ul>	<i>Generic</i>
<p><i>Social media</i></p> <ul style="list-style-type: none"> <li>- Option to share the content from the <i>shared area</i> via social media.</li> </ul>	<i>Generic</i>
<b>Analytics</b>	
<p><i>Extraction and analysis of data</i></p> <ul style="list-style-type: none"> <li>- Option available to the Administrator</li> <li>- Extraction and analysis of the data related to user profiles, user activity, submitted content, and popularity of the Platform (based on numbers of visits, registrations, subscriptions etc.) with an opportunity to visualise the analysis results in tables and charts.</li> </ul>	<i>Adapted</i>
<b>Other requirements</b>	
<p><i>Maintainability</i></p> <ul style="list-style-type: none"> <li>- Conceptualisation of the Platform in a way that it is scalable and can be easily adapted to changing requirements, as well as easy to maintain and administer.</li> </ul>	<i>Generic</i>
<p><i>Usability</i></p> <ul style="list-style-type: none"> <li>- Compliance of the Platform design (user interfaces, functionalities etc.) with the principles of Inclusive Information System Design.</li> </ul>	<i>Generic</i>
<p><i>Platform feedback</i></p> <ul style="list-style-type: none"> <li>- Option available for each user to send suggestions to the Administrator about the Platform improvement, report on the identified bugs etc.</li> </ul>	<i>Generic</i>
<p><i>Mobile device support</i></p> <ul style="list-style-type: none"> <li>- User-friendliness of the Platform interface when accessing it from a mobile device (tablet, smartphone).</li> </ul>	<i>Generic</i>
<p><sup>a</sup> – <i>Generic</i>: A requirement is relevant for other idea crowdsourcing platforms; <i>Adapted</i>: A requirement is relevant for other idea crowdsourcing platforms, but adaptation for the Platform is required; <i>Specific</i>: A requirement is peculiar for the Platform.</p>	

Table 3. Requirements to the Idea Crowdsourcing Platform at the Promotion of Gender Equity in IT Research Institutions.

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