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### Author

Gorbacheva, Elena, Beekhuyzen, Jenine, vom Brocke, Jan, Becker, Joerg

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## Directions for research on gender imbalance in the IT profession

Elena Gorbacheva<sup>a</sup>, Jenine Beekhuyzen<sup>b</sup>, Jan vom Brocke<sup>c</sup> and Jörg Becker<sup>a</sup>

<sup>a</sup>European Research Center for Information Systems, University of Muenster, Muenster, Germany; <sup>b</sup>Institute for Integrated and Intelligent Systems, Griffith University, Nathan, Queensland, Australia; <sup>c</sup>Institute of Information Systems, University of Liechtenstein, Vaduz, Liechtenstein

### ABSTRACT

There is a significant shortage of expert Information Technology (IT) personnel in Europe and elsewhere and a marked under-representation of women in the field. This paper identifies important gaps in research on gender imbalance in the IT profession and motivates future Information Systems research to address each of them. First among these gaps is the lack of research on the far-reaching consequences of gender imbalance in the IT profession. Second, despite a considerable body of research, there is the lack of coherent explanation for this imbalance. Third, although many intervention programmes have been implemented in this area, gender diversity in practice has not improved significantly. This research field also requires theorisation based on the cumulative research efforts in the field, comparative studies in various contexts, and longitudinal studies. We point to opportunities to investigate each of these issues and recommend directions for future research and actionable research questions.

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### Rationale and method

Over the past 20 years, the number of jobs in the Information Technology (IT) field has increased rapidly, increasing demand for qualified IT professionals. According to the European Commission (2017), the gap between supply and demand of IT-skilled labour is likely to reach 500,000 by 2020. This challenge has been discussed in the academic Information Systems (IS) literature, which highlights consistently low numbers of IT/IS graduates (e.g., Downey, Bartczak, Young, & England, 2016; McLachlan, Craig, & Coldwell-Neilson, 2016; von Hellens, Trauth, & Fisher, 2012). At the same time, although women are 51% of the population in Europe and 47% of the workforce (Eurostat, 2016), they represent only around 16.7% of employed IT specialists (Eurostat Press Office, 2017). Therefore, women are a promising group to be encouraged to join the IT profession. Achievement of this objective is facilitated by the advancement of new kinds of work enabled by IT, such as teleworking, which provide opportunities for both women and men to balance work and family life (e.g., Boell, Campbell, Cecez-Kecmanovic, & Cheng, 2013; Greenhill & Wilson, 2006). For more than 20 years, many countries have undertaken interventions aimed at increasing gender diversity in IT education, academia, and the workforce (“interventions” hereafter), yet little progress has been made (e.g., Craig, 2015; Loiacono, Iyer, Armstrong, Beekhuyzen, & Craig, 2016; Trauth, 2017). We

believe that IS research has an opportunity to contribute to addressing the challenge of gender imbalance in the IT profession by explaining its causes and consequences and identifying effective interventions. In so doing, research would demonstrate the IS discipline’s usefulness in solving important societal and economic challenges. This “Issues and Opinion” article proposes six directions for research on gender imbalance in the IT profession, each accompanied by actionable research questions, to guide future research efforts in the field.

Our argumentation is based on a review of the extant literature and our own practical experience from several research projects in this field and involvement in related interventions. (Details are provided in Appendix A, Tables A-1 and A-2.) The literature review follows Rowe’s (2014, p. 246) call to reach a “good or reasonable coverage [of literature] rather than a comprehensive one that would make a review process at best ephemeral if not unachievable.” As a starting point, we investigated how the topic was considered in the “core” IS outlets – the Senior Scholars’ *Basket of Journals* (“the *Basket of Journals*” hereafter (AIS Senior Scholar Consortium, 2011)). We conducted the collection and analysis of the literature systematically based on Bandara and colleagues (2015), beginning with the *Basket of Journals* based on Hirschheim and Klein’s (2012, pp. 216–217) argument that it recognises the “diversity inherent in IS research [through] (1) the rigorosity of the review process, (2) the composition of the editorial board (members must be widely respected and recognised), and (3) the existence

of an international readership and contribution.” The papers published in the *Basket of Journals* also reflect the core research interests of the IS discipline.

This review identified 16 studies on gender imbalance in the IT profession (Appendix A, Table A-3). Although not the focus of this study, additional studies covering other topics related to gender and IS research (Appendix A, Tables A-4 and A-5) were also identified in the *Basket of Journals*. Next, we searched specialised outlets that address gender imbalance in the IT profession outside the *Basket of Journals* (Appendix A, Table A-1). We also used *Google Scholar* (<http://scholar.google.com>) to perform a forward search for all of the identified relevant studies to reveal the most recent research efforts in the field. This iterative approach to reviewing the literature provided a comprehensive view of the state of the research field, current issues in the field, and suggested directions for future research.

The remainder of the paper first provides a brief theoretical background on the topic. We then identify and discuss the issues in research on gender imbalance in the IT profession, for which we propose directions for future research. Finally, we discuss these directions and summarise the key ideas, contributions, and limitations of the paper.

### Theoretical background

IS research considers the topic of gender primarily from two opposing perspectives: that of IT users’ acceptance and IT-related behaviour or that of diversity and social inclusion in the IT workforce (Craig, 2015; Loiacono et al., 2016; Ridley & Young, 2012). The former focuses on gender as an influence on IS design, use, and impact, while the latter focuses on human capital, IT personnel, and the wider workforce. This paper addresses the latter area, particularly the gender composition of the IT workforce. The main theoretical approaches followed in the areas of gender and IS research include gender essentialism, the social construction of gender, and gender intersectionality (in order of their emergence).

The gender essentialist approach considers the concepts of gender and sex to be synonymous, and men and women to be fundamentally different because of their biological and psychological attributes. According to essentialist research, these fundamental differences result in, for instance, differences in how men and women use technology and differences in the professions men and women choose. Gender essentialism was the dominant approach to studying gender in IS until recently (e.g., Kvasny, Greenhill, & Trauth, 2005). The

earliest papers on gender imbalance in the IT profession stem from this perspective (e.g., Baroudi & Igarria, 1995; Igarria & Baroudi, 1995; Truman & Baroudi, 1994) and take the view of western trends at a time when society expected men to be the sole breadwinners (e.g., Baskerville, 2007). These studies often present the outcomes of quantitative studies and are usually limited to collecting and reporting on descriptive statistics (e.g., the percentage of women involved in the IT industry) but do not apply or generate any gender theory (Trauth, 2013). The essentialist approach to studying gender and IS is rightfully criticised as untenable and simplistic and as reinforcing inaccurate gender stereotypes (e.g., Howcroft & Trauth, 2008; Ridley & Young, 2012).

Theories of social construction reject essentialist views in favour of explaining the many human-capital-related issues in IS and how IT work is organised. The social construction of gender perspective considers gender to be a socially formed construct, as opposed to a matter of biology, and addresses the socially constructed differences between men and women. These theories posit that an individual’s actions are products of the culture in which he or she was born and raised (Berger & Luckmann, 1966) and that people are socialised to adhere to society’s norms. The turn of the millennium saw a move to these theories to explain women’s lack of participation in the IT workforce, when a string of studies presenting this perspective appeared in the IS research (e.g., Ahuja, 2002; Robertson, Newell, Swan, Mathiassen, & Bjercknes, 2001). As women are often socialised towards the teaching and nursing professions, and men are often socialised towards more technical careers, such as the IT profession, the IT industry is largely constructed socially as a male domain (von Hellens & Nielsen, 2001). At the same time anything constructed by society can also be changed (Wilson, 2004).

Social construction of gender is criticised for its lack of critical attention to the differences within, not just between, genders, which is necessary to understand individual experiences. As a result, the gender intersectionality approach emerged to develop the Individual Differences Theory of Gender and IT (e.g., Quesenberry & Trauth, 2012; Trauth, 2002; Trauth, Quesenberry, & Huang, 2009). Development of this approach was triggered by the new technologies and new kinds of work (such as teleworking) that have facilitated changes in how work is operationalised in the IT context (e.g., Greenhill & Wilson, 2006). Insights into gender intersectionality are surfacing but have not yet been explored in depth (Direction 2.1).

## Identified issues

Based on the literature review and our practical experience, we identified three issues in the research on gender imbalance in the IT profession to which we believe the IS discipline has an opportunity to contribute.

*Issue 1: Lack of research on the consequences of gender imbalance in the IT profession*

In and beyond the IS community lies a perception that the current gender distribution in the IT workforce is “normal” and that no effort is required to change it, which is discussed by, for instance, Villa and Ayoub (2016) and Kirton and Robertson (2018) and evidenced anecdotally. This view is also reflected in the paltry 16 articles published in the *Basket of Journals* on gender imbalance in the IT profession, which is less than 0.25% of more than seven thousand studies published there. What’s more, none of these studies investigate the consequences of this imbalance (Appendix A, Table A-3). As Loiacono et al. (2016, p. 797) point out, “If we do not acknowledge that a problem exists, we cannot ever hope to solve it.” Therefore, we propose that future research investigate the consequences of gender imbalance in the IT profession.

*Issue 2: Lack of coherent explanation for gender imbalance in the IT profession*

The literature review shows that, while many studies published since the early 1980s address why so few women study or work in IT (e.g., von Hellens et al., 2012), there is still no consensus on these factors. Some suggest that the challenge is too complex and context-dependent (e.g., Ridley & Young, 2012; Trauth & Quesenberry, 2006), while others propose their own frameworks of factors instead of building on each other’s work and contributing to a wider body of knowledge (e.g., Khalil, Nayab, Naeed, Khan, & Khalil, 2015; Kindsiko & Türk, 2017; Nelson & Veltri, 2011). Therefore, future research should seek to identify and come to some consensus on the factors that cause gender imbalance in the IT profession as a prerequisite for developing successful interventions to address this challenge.

*Issue 3: Lack of impact of interventions that address gender imbalance in the IT profession*

Despite many countries’ efforts to solve the problem of gender imbalance in the IT industry over the past 20 years, all of which required considerable human and financial resources, the number of women working in IT or enrolling in IT programmes at universities remains low (e.g., Annabi & Lebovitz, 2018; Eurostat Press Office, 2017). The share of women in IT at each next career stage continues to decrease (the “shrinking pipeline” phenomenon (Camp, 1997)) and women also continue to leave the IT workforce at a high rate (e.g., Annabi & Lebovitz,

2018; Armstrong, Riemenschneider, & Giddens 2018; NCWIT, 2015; Trauth, 2017). While the number of women in IT could have been even lower in the absence of these interventions, there is a need for further investigation into why they have not changed the situation and what alternative interventions could be more effective.

In summary, the three issues related to gaps in the research deal with the *consequences* of gender imbalance in the IT profession (Issue 1), the factors that *cause* it (Issue 2), and *solutions* to address it (Issue 3). Among the studies published in the *Basket of Journals* (Appendix A, Table A-3), none address Issue 1, while 10 address Issue 2 (Ahuja, 2002; Armstrong et al., 2018; Baroudi & Igarria, 1995; Igarria & Baroudi, 1995; Kirton & Robertson, 2018; Panteli, Stack, Atkinson, & Ramsay, 1999; Reid, Allen, Armstrong & Riemenschneider, 2010; Robertson et al., 2001; Trauth et al., 2009; Truman & Baroudi, 1994), and six address Issue 3 (Annabi & Lebovitz, 2018; Clayton, Beekhuyzen, & Nielsen, 2012; Craig, 2015; Panteli, 2012; Quesenberry & Trauth, 2012; Ridley & Young, 2012).

## Directions for future research

The directions for future research on gender imbalance in the IT profession and suggested research questions to address each of the identified issues are summarised in Table 1.

### **Directions to address Issue 1: Lack of research on the consequences of gender imbalance in the IT profession**

#### **Direction 1.1. Collect, analyse, and disseminate comprehensive statistics and data on gender distribution in the IT profession**

The discourse on gender imbalance in the IT profession must be based on facts. Therefore, comprehensive worldwide statistics on gender distribution in the IT profession must be collected, analysed, and disseminated to enhance the awareness and understanding of the issue. Fragmentary statistics show that this challenge might be less acute or even irrelevant for some countries. For instance, while in Western societies women are under-represented in the IT profession (e.g., European Commission, 2016; U.S. Bureau of Labor Statistics, 2013; van Welsum & Montagnier, 2007; VCAA, 2014), the situation differs in other cultural and economic contexts like India (Government of India, 2015; Varma, 2016), post-Communist countries (e.g., Trauth, 2002), and countries with high gender inequality in society (Stoet & Geary, 2018). Some countries’ statistics might not be well-documented and reflected in IS research, so the documentation or even collection of the statistics



**Table 1.** Directions for future research on gender imbalance in the IT profession and suggested research questions.

Directions for future research	Suggested research questions
<p>Issue 1: Lack of research on the consequences of gender imbalance in the IT profession.</p> <p>1.1. Collect, analyse, and disseminate comprehensive statistics and data on gender distribution in the IT profession.</p> <p>1.2. Investigate the implications of gender imbalance in the IT profession.</p>	<ul style="list-style-type: none"> <li>- What is the worldwide gender distribution in the IT profession, in particular job categories in the IT profession, and in the fields adjacent to IT? To what extent does gender distribution in the IT profession differ from that in non-IT professions?</li> <li>- What is the gender distribution in the IS research field (AIS members, editors of leading IS journals, authors of top-tier IS publications, keynote speakers at IS conferences, etc.)?</li> <li>- How do indicators of career success (salary, job level, promotability, etc.) differ between male and female IT professionals? How do these differences vary by country?</li> <li>- How does gender diversity in IT teams affect teams' innovativeness and problem-solving capacity?</li> <li>- How does gender diversity in IT design teams affect the IT artefacts they create?</li> <li>- How does gender diversity in managerial positions affect IT organisations' financial performance?</li> <li>- To what extent do IT professionals value employing organisations' support of gender equality, diversity, and work-family balance?</li> <li>- What are the consequences of gender diversity in IT teams in combination with other forms of diversity (e.g., ethnicity, cultural background, age)?</li> <li>- To what extent does (implicit) gender discrimination remain in the IT field?</li> <li>- How can the awareness of the importance of gender balance in the IT profession be raised?</li> </ul>
<p>Issue 2: Lack of coherent explanation for gender imbalance in the IT profession.</p> <p>2.1. Examine the Individual Differences Theory of Gender and IT (IDT).</p> <p>2.2. Conduct a comparative analysis of existing models of the factors that cause gender imbalance in the IT profession.</p>	<ul style="list-style-type: none"> <li>- What is the state of the published research on operationalisation and testing of different factors of IDT? What are the respective research gaps?</li> <li>- What are the appropriate measurement instruments for the not yet operationalised factors of IDT?</li> <li>- What IDT factors have the highest impact on women's IT career intentions, choices, persistence, and advancement in different contexts?</li> <li>- How do existing models of the factors that cause gender imbalance in the IT profession overlap, and how do they differ?</li> <li>- How do the barriers that women in IT face in different contexts develop over their careers?</li> <li>- What is the state of the published research on the study programmes and occupations that women evaluate and select as alternatives to IT? What are the research gaps? What are the benefits of these alternatives for women that are lacking in IT study and work?</li> <li>- What are the differences between the factors that influence women to stay in the IT workforce and those that influence them to leave?</li> </ul>
<p>Issue 3: Lack of impact of interventions that address gender imbalance in the IT profession.</p> <p>3.1. Investigate the reasons behind interventions' lack of impact.</p> <p>3.2. Investigate promising interventions based on target groups.</p>	<ul style="list-style-type: none"> <li>- What interventions have been implemented? What specific problems do these interventions intend to solve?</li> <li>- Why have the interventions been ineffective? How does the presence of intervention evaluations affect their effectiveness?</li> <li>- What are the success factors of interventions in various contexts? How can their effectiveness be maximised? Which unsuccessful interventions should be avoided?</li> <li>- How should future interventions and their evaluations be designed considering: <ul style="list-style-type: none"> <li>• within-gender variation of target groups?</li> <li>• sustainability of the implementation?</li> </ul> </li> <li>- How can the practical implementation of recommendations for interventions be encouraged?</li> <li>- How can the following interventions be encouraged, designed, and (longitudinally) evaluated? <ul style="list-style-type: none"> <li>• those that seek to change the public image of IT and address existing IT stereotypes</li> <li>• those that encourage women that they can be good at IT</li> <li>• those that address the barriers that women in IT face over their careers</li> <li>• those that reveal and address gender-related conscious and unconscious biases</li> <li>• those that target girls, young women in school, men in the IT workplace, and decision-makers</li> <li>• those that encourage scholarly research on gender imbalance in the IT profession</li> </ul> </li> <li>- What is the impact of gender equality policies in IT organisations?</li> <li>- How can IT artefacts be used to promote gender balance in the IT profession?</li> </ul>

might be required as a first step. If only high-level statistics are available – for instance, in China IT is part of the engineering and technology category, in the US it is part of computer and mathematical occupations, in Australia and New Zealand it is part of business faculty, and in some European countries

it is aggregated with the natural sciences – it is necessary to single out the statistics about the IT field in specific. The next step is to collect and analyse detailed statistics for the various job areas in the IT profession in order ensure contributions are directed and specific. Comprehensive statistics on gender

distribution must also be collected for fields adjacent to IT, such as business process management (Gorbacheva, Stein, Schmiedel, & Müller, 2016) or geographic IS (Betancourt Mazur, 2015). According to Frehill and McGrath-Cohoon (2015), another potential challenge is that the overlap and similarities among the IT, IS, Information and Communications Technology (ICT), computing, and computer science disciplines frequently cause confusion, so what the IT profession constitutes must be defined before conducting a comparative analysis across countries. Then, these authors suggest, these statistics must be compared to the gender distribution in non-IT professions. Subsequent comparative analysis of the collected data in various contexts must be done with caution to avoid comparing statistics for countries where women still lack basic human rights and have limited access to education and technology with statistics for countries that have overcome these challenges.

Within the IS community itself, gender-disaggregated statistics regarding members of IS's peak body, the Association for Information Systems (AIS), editors of leading IS journals, authors of top-tier IS publications, keynote speakers at IS conferences, and so on remain to be captured systematically (Loiacono et al., 2016). Finally, comprehensive gender-disaggregated statistics on indicators of career success (salary, job level, promotability, etc.) must also be collected, analysed, and disseminated. In 1995, Baroudi and Igbaria (p. 181) showed that female IT professionals tended to "be employed at lower levels of the organisation, make less money, and have greater intentions to leave the organisation" than men, even when controlling for the differences in education, work experience, and other characteristics. Collecting these statistics would help to determine whether the situation has improved since then and how these differences vary by country.

### **Direction 1.2. Investigate the implications of gender imbalance in the IT profession**

Increased awareness of the practical importance of gender balance in the IT workforce may also increase attention to this topic and motivate IS researchers to study how this challenge can be addressed and practitioners to implement effective interventions. Therefore, in addition to the collection and analysis of comprehensive statistics (Direction 1.1), researchers should provide empirical evidence for each of the following arguments for the value of gender diversity in the IT workforce (Trauth, 2011a, pp. 561–562).

- (1) The *demographic argument* contends that qualified IT professionals are in great demand but are in short supply at all stages of the pipeline, at least in Western societies (e.g., European

Commission, 2017; Kirton & Robertson, 2018). This argument is confirmed by statistics, but awareness about it (as well as about the other arguments) must be raised before the issue can be resolved.

- (2) The *innovation economy argument* posits that innovation is fuelled by brainpower and creativity and that "the 'best brains' can come in a variety of bodies" (Trauth, 2011a, p. 562). The argument that involving more women would lead to gaining access to more talent is self-evident and relevant to every industry. Another aspect of this argument that is yet to be researched is that diversity positively impacts teams' innovativeness and problem-solving ability (e.g., EIGE, 2016; Kirton & Robertson, 2018; NCWIT, 2015). Olbrich, Trauth, Niedermann, and Gregor (2015) highlight that, while the benefits of diversity have been explored in social science (e.g., van Knippenberg & Schippers, 2007; Yu, 2002) and management science (e.g., Foldy, 2004; Saloman & Schork, 2003), few empirical studies research the value of gender diversity in IT teams. Panteli et al. (1999, p. 180) propose to conduct a "longitudinal study of an IT organisation with initially a male-dominated workforce and which is moving towards gender equality" to explore the value of gender diversity in IT, but either the study has not been conducted yet or its results have not been widely disseminated. Nelson (2014) reports on inconsistency in the findings of studies on the value of diversity in teams. For instance, Woolley, Chabris, Pentland, Hashmi, Malone (2010) find that gender diverse teams are both high-scoring and low-scoring in terms of the overall assessment, and Choi (2015, p. 832) reports that, although the coding output of mixed-gender pairs did not differ significantly from that of same-gender pairs, same-gender pairs showed "higher levels of compatibility and communication." Such contradictory findings indicate that further rigorous investigation is required. Further research on the consequences of gender diversity in IT teams, in combination with other forms of diversity (e.g., ethnicity, cultural background, age), is also needed (Direction 2.1).
- (3) As addressed by the Anita Borg Institute for Women and Technology (2004) and Adya and Kaiser (2005), the *consumer argument* focuses on diversity in IT design teams and argues that members of technology-development teams should represent the differing needs of the entire consumer base. These authors point out that, at least in Western societies, women are half of consumers

of technologies, but few participate in the development of these technologies, so bringing women into technology-development teams would improve developers' understanding of consumers' needs and result in the creation of IT artefacts that do a better job of satisfying those needs, thereby benefitting society and the economy. However, we found no empirical research supporting this argument. According to Olbrich et al. (2015, p. 774), "a gender balanced design team does not guarantee that the ultimate product or service will be more accessible," so the authors call for investigation of "the mechanics of how such diversity of design team would influence outcomes."

- (4) Based on the research of Reid et al. (2010) and Trauth, Cain, Joshi, Kvasny, and Booth (2012), among others, the *equality argument* criticises existing world power structures, where men occupy most of the top positions in the IT field and elsewhere. As these authors point out, IT jobs are amongst the best-paid jobs in the world, which is not surprising since professions in which women are under-represented (science, technology, engineering, and mathematics, the STEM fields) are predominantly prestigious and well-paid, while professions in which men are under-represented (teaching, nursing, etc.) are not. The authors suggest that addressing gender imbalance in IT would contribute to the empowerment of women in social and economic life, which would help to solve the grand challenge of social inclusion. This argument requires investigation in order to determine to what extent gender discrimination remains in the IT field, as reported in earlier studies (e.g., Robertson et al., 2001; Truman & Baroudi, 1994). Many companies and universities have introduced equal opportunity policies to curb direct discrimination, yet recent studies report that indirect and often deep-rooted gender discrimination persists in the IT profession such that women in IT may perceive themselves as unwelcome (e.g., Armstrong & Zaza, 2016) and be excluded from informal networks ("the old boys' club" phenomenon (e.g., Kirton & Robertson, 2018)). Women might also still experience gender pay gap (e.g., Joseph, Ang, & Slaughter, 2015) and invisible structural barriers that prevent them from advancing (the "glass ceiling" phenomenon (e.g., Armstrong et al., 2018)). Investigation of the degree of (implicit) gender discrimination in IT is required to address these issues.
- (5) The *employment brand argument* proposes that organisations that demonstrate their

support of gender equality, diversity, and work-family balance are more appealing for potential employees than are those that do not, which helps them to attract and retain employees (e.g., Annabi & Pels, 2016). Future research should investigate the validity of this argument as it applies to the IT industry by investigating to what extent IT professionals, independent of gender, value such support.

- (6) The *financial benefits argument* is based on the positive correlation studies show between female representation in an organisation's senior positions and its financial performance (e.g., Loiacono et al., 2016). Research is required to establish the validity of this relationship for the IT field (Nelson, 2014). Therefore, empirical investigation of the economic and social consequences of gender diversity not only in IT teams in general and in the teams of IT artefact designers, but also among managers of IT organisations would be of value.

### **Directions to address Issue 2: Lack of coherent explanation for gender imbalance in the IT profession**

#### **Direction 2.1. Examine the individual differences theory of gender and IT**

According to Ridley and Young (2012), among others, the Individual Differences Theory of Gender and IT (IDT), developed by Eileen Trauth (Trauth, 2002, 2006), is the most recent framework of the factors that could help to "(1) explain the under-representation of women in the IT field; and (2) account for those women who overcame barriers and entered the IT field" (Trauth, Cain, Joshi, Kvasny, and Booth, 2016, p. 15). It would be beneficial to explore, build upon, test, and extend this theory because IDT is "a gender theory anchored in the information systems field" (Joshi, Trauth, Kvasny, & McPherson, 2013, p. 2) that supports the gender intersectionality approach to investigating the under-representation of women in IT. The theory "accounts for both gender group-level influences and within-gender variation" (Trauth et al., 2016, p. 15), such that, "while all females in a particular society may be exposed to the same messages about gender roles and IT careers, both the interpretation of these messages and the response to them will vary as a result of individual factors" (Joshi et al., 2013, p. 5). The theory recognises the concepts of *exposure* ("the amount of gender bias which a particular woman actually encounters"), *experience* ("a woman's consciousness of bias and the extent to which she notices and internalises it") and *response* ("coping mechanisms") (Trauth, 2011b, p. 3). Thus, IDT avoids both seeing women in IT as "completely free agents" and embracing social determinism of gender roles (Joshi et al.,



2013, p. 2). IDT, which emerged from qualitative studies that are based on interviews, argues for the need to consider the intersection of gender with such constructs as *individual identity*, *individual influences*, and *environmental influences*. Each theory construct contains elements that encompass a variety of factors that explain the under-representation of women in IT (e.g., Joshi et al., 2013; Quesenberry & Trauth, 2012; Trauth et al., 2016). According to Trauth (2017), only *individual influences* can be changed by interventions, while *individual identity* and *environmental influences* cannot. Taken together, the three constructs “can explain within-gender variation in participation in the IT profession” (Trauth et al., 2016, p. 16).

Trauth (2017), Trauth et al. (2016), Joshi et al. (2013), and Trauth et al. (2012) mention some of the research efforts to investigate the influences of various combinations of IDT’s elements on the experiences of women in IT (Appendix B, Table B-1). These studies focus on the intersections of gender with personal demographics (the *individual identity* construct), gender with personal characteristics and personal influences (the *individual influences* construct), and gender with cultural, economic, and infrastructure influences (the *environmental influences* construct). However, most of these studies call for more nuanced examinations of their findings. Moreover, a comprehensive overview of research on operationalisation and testing of different factors of IDT could not be found. Such study could reveal existing gaps in research on the causes of gender imbalance in the IT profession. According to Ridley and Young (2012), most empirical studies that apply IDT are largely interpretive in nature and tend to employ qualitative methods. The first steps in testing some IDT elements using quantitative methods are reported in Trauth et al. (2016) and Joshi et al. (2013). However, appropriate measurement instruments for the IDT factors that have not yet been operationalised remain to be developed and tested using quantitative methods. All such studies should be conducted in various contexts and by different groups of researchers to achieve triangulation and reliability.

### **Direction 2.2. Conduct a comparative analysis of existing models of the factors that cause gender imbalance in the IT profession**

In addition to IDT (Direction 2.1), several other theoretical models of the factors that influence IT career intentions, choice, persistence, and advancement among women have been defined (e.g., Adya & Kaiser, 2005; Ahuja, 2002; Armstrong et al., 2018; Clayton et al., 2012). All of these models are related, but no overview or a comparative analysis of how these models overlap and differ has been performed. Ahuja (2002) finds that women who work or intend to work in IT face social and structural barriers that can affect their IT career intentions, choice, persistence, and advancement. Thus, this research follows

the social construction of gender approach. Armstrong and Riemenschneider (2014, p. 85) in the follow-up study include among the social barriers (“the social and cultural views/biases held by society in general”) social expectations and work-family conflict and include among the structural barriers (“the structure/hierarchy of the institution”) occupational culture, institutional structures, lack of role models, lack of mentors, and lack of informal networks. They propose a revised version of Ahuja’s model and call future research “to further explore Ahuja’s model moving from a more exploratory perspective to a more explanatory one” (p. 93). A high-level comparison of Ahuja’s (2002) model with IDT shows that IDT extends Ahuja’s (2002) model by adding the *individual* dimension to it, although a more detailed comparative analysis is required.

Researchers argue that the central reason for gender imbalance in IT is the number of women who choose IT to study and work, rather than the number of women who leave IT (LeRouge, Wiley, & Maertz, 2013; McKinney, Wilson, Brooks, O’Leary-Kelly, & Hardgrave, 2008). Therefore, research on the factors that influence women to choose IT as a career can help to address the gender gap. As career choice is preceded by career intentions, a focus is also needed on the factors that influence IT career intentions among female students who are in the process of initial decision-making about their careers (Cohen & Parsotam, 2010; Quesenberry & Trauth, 2012; von Hellens et al., 2012). One prominent model of such factors is conceptualised by Adya and Kaiser (2005) and reworked and extended by Clayton (2007). Both models incorporate the individual attributes from IDT but retain the terminology of social and structural factors from the Ahuja’s (2002) model, detailing and adapting these factors for girls and young women in school. Future research should investigate the differences between these models and IDT and whether they add value.

Another area for future research is to examine why women choose certain study programmes and occupations as alternatives to IT, the aspects of IT study and work women dislike (as compared to the programmes and professions they choose), and the benefits of these alternatives that IT lacks (e.g., LeRouge et al., 2013). Joshi et al. (2013) make the first step in applying IDT to an investigation of the influence of its constructs on young women in school who decide to study IT as opposed to those who choose a non-IT major. LeRouge et al. (2013, p. 52) is another study to pursue this course, by evaluating “satisfaction differences between women in IT jobs and women in multiple non-IT jobs.” Furthermore, studies of women’s IT career persistence and advancement should compare the factors that influence their decision to stay in the IT field with those that cause them to leave, as these factors are not necessarily direct

opposites. Armstrong and Riemenschneider (2014) call also for information about the characteristics of women who leave the field. Armstrong and Zaza (2016, p. 1) summarise the research issue in this area, arguing that “even though the topic has been a focus of study for years, researchers are still grappling with the antecedents of turnover for women in technology-related fields.”

### **Directions to address Issue 3: Lack of impact of interventions that address gender imbalance in the IT profession**

#### **Direction 3.1. Investigate the reasons behind interventions’ lack of impact**

According to Trauth (2017, p. 13), the goal of research on the factors that cause gender imbalance in the IT profession is to develop theoretically informed interventions that can be “deployed to address, and ideally overcome, the barriers to participation in the IT field.” Several studies propose explanations for the interventions’ long-run failure to be as effective as hoped (e.g., Craig, 2015; Trauth et al., 2009; von Hellens et al., 2012). However, no comprehensive overview and analysis of these explanations has been performed.

One argument, reported by such researchers as Trauth et al. (2009), Panteli (2012), and Trauth et al. (2016), is that many early interventions focused on women as a homogenous group; however, just as not all women in IT face the same barriers (e.g., Olbrich et al., 2015), one intervention might not have the same effect on all women. Therefore, interventions’ planning and framing should be nuanced. In addition, sustainability plans are missing from many interventions, so any intervention that depends on one key individual who lacks stable funding and an implementation structure has little chance to persist long enough to make an impact (e.g., von Hellens et al., 2012). Sustainable and systematic intervention programmes are likely to be more successful than a one-time endeavour, as participants cannot be expected to enter an IT career after exposure to a single intervention event (e.g., Klawe, Whitney, & Simard, 2009; Trauth, 2002). Therefore, future research should provide comprehensive recommendations for how intervention design and evaluation should deal with within-gender variations (Direction 2.1) and sustainability (e.g., Panteli et al., 1999; Quesenberry & Trauth, 2012).

According to such researchers as Quesenberry and Trauth (2012), Craig (2015), and Annabi and Pels (2016), interventions may be ineffective if they are not evaluated so they can be improved. Intervention evaluations usually include surveys that ask participants about their attitude towards and level of satisfaction with the intervention (e.g., Clayton et al.,

2012; Fisher, Lang, Craig, & Forgasz, 2015; Trauth, 2012). However, as these authors point out, those who organise the interventions often lack the necessary expertise or face time or funding limitations that preclude in-depth evaluations and revisions. This situation could be changed if intervention sponsors/decision-makers request the implementation of theory-informed evaluations and provide the required resources. The authors suggest that, in the best case, an evaluation would involve all intervention stakeholders, such as participants, organisers, and sponsors/decision-makers, and would be performed by professional evaluators at several points in time. Longitudinal evaluations have almost never taken place, although they are crucial in revealing the long-term impact, which is not possible with immediate post-intervention evaluations. What’s more, the results of evaluations, especially those that are unsuccessful, are rarely published academically. Craig (2015) introduces a gender and computing evaluation framework to assist intervention organisers in the evaluation process and advance the theorisation of the research on interventions. Future research could test this framework in various contexts and adjust and extend it if necessary. The next challenge is to motivate intervention organisers to adopt and apply this framework.

While all the interventions are ultimately aimed at getting more women into IT, each intervention programme or event has a more specific problem it intends to solve. Future research should summarise these specific problems and derive respective success (and failure) factors (e.g., Annabi & Lebovitz, 2018; Craig, 2015; Trauth, 2017). For each type of interventions a database could be developed that collects links to relevant materials and information about such interventions so researchers can determine why some interventions are more successful than others and how future interventions can replicate success. The context in which an intervention took place (country, culture, environment) should be considered so recommendations can be derived concerning how future interventions should be adjusted to fit their context. The impact of the presence of intervention evaluations on their effectiveness needs to be investigated as well. A critical examination of existing interventions, focusing on their mistakes and achievements, should result in a set of propositions for the design of future interventions.

That interventions have been ineffective suggests that the recommendations proposed in the gender and IT intervention research are staying on paper and not reaching practice (DuBow & Ashcraft, 2016), perhaps because the information reported in scholarly publications is often difficult for a busy layperson to comprehend fully (Trauth, Keifer-Boyd, & Trauth, 2016). Therefore, future research should

explore the mechanisms that would foster the practical implementation of recommendations. According to Trauth (2017, pp. 9–10), research on gender imbalance in the IT profession should be action-oriented in such a way that the ideas from research are translated into “actionable behaviours that can make a difference” and that the “real lives of real people” permeate the research.

### **Direction 3.2. Investigate promising interventions based on target groups**

Interventions that seek to increase gender diversity in IT can target society overall, women in IT at various stages of their careers, men in IT, IS scholars, and decision-makers. None of these target groups, as highlighted in Direction 3.1, is homogenous, so the interventions that target them must account for the within-gender variations in their members. Participants in interventions are also likely to have their own gender-related conscious and unconscious biases that affect their behaviour and decision-making. Therefore, future research must determine whether interventions can address such biases and, if so, how (e.g., Annabi & Pels, 2016; Serenko & Turel, 2016; Trauth et al., 2010).

*Society overall* is arguably the most promising target group for the interventions, although it is also the most difficult group to reach and influence. Numerous studies (e.g., Gürer & Camp, 2002; Ridley & Young, 2012; Trauth et al., 2016) call for interventions that can change IT’s public image, arguing that existing perceptions of IT being for men only still permeate society and affect all of its members and spheres, including schools, workplaces, governments, and mass media. The difficulty in reframing such gender stereotypes is that doing so requires a change in culture, which cannot be achieved in the short term. Still, societal interventions can counteract existing IT stereotypes by making positive female role models in IT more visible and raising the confidence of women that they can be successful in IT, as well as by communicating that IT is an interdisciplinary and diverse field where not only technical but also problem-solving, managerial, social, and other competences are required (e.g., Bandias & Warne, 2009; Robertson et al., 2001; Todd, McKeen, & Gallupe, 1995). The intervention language and communication channels must be chosen for their ability to reach a wide audience. Examples include the theory-informed play *iDream* ([www.idreamtheplay.com](http://www.idreamtheplay.com)), which addresses the barriers women in the STEM fields face, or book *Tech Girls Are Superheroes* ([www.techgirlsaresuperheroes.org](http://www.techgirlsaresuperheroes.org)), which is aimed at raising girls’ interest in IT and challenging existing stereotypes. Both examples use novel communication channels and language that

everyone can understand, but their long-term impact remains for future research to analyse.

Future research should also investigate how IT artefacts can be used to promote gender balance in the IT profession, as 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 equality” (UNESCO, 2007, p. 31). Such IT artefacts could include online mass media (Ridley & Young, 2012), social networks (Fischer, 2016), group support systems (Trauth & Jessup, 2000), crowdsourcing platforms (Gorbacheva & Barann, 2017), and intranets (Öner, Kaya, Surgevil, & Ozbilgin, 2012).

*Women in IT* at various stages of their careers include students in school whose career preferences are still unformed (career intentions), students who have selected an IT-related study programme (career choice), and IT professionals and academic staff members who are working in IT departments (career persistence and advancement). Gürer and Camp (2002) show that many women believe that they cannot be good at IT, so they never consider, much less enter, the profession. This phenomenon must be addressed in all interventions targeted to women, whether these interventions are in the educational arena (dealing with the career-intentions and career-choice stages) or in the workplace (which deal with the career-persistence and career-advancement stages).

Interventions in the educational arena that target female students are of particular importance (Direction 2.2), as they can communicate comprehensive and correct information about what constitutes the modern IT profession, how it can help people and improve the world, what benefits it brings to those in the profession, what IT professionals do, what competences they need, and so on. Such interventions may include new or improved IT curricula, assurance of a positive and inclusive learning environment during IT classes, training of IT teachers, and guided parental involvement (e.g., Adya & Kaiser, 2005; Alvarado, Dodds, & Libeskind-Hadas, 2012; Fisher et al., 2015). Studies show that children begin to form their career aspirations and define gender stereotypes at a young age (e.g., Chambers, Kashefpakdel, & Rehill, 2018), so interventions that shape children’s – especially girls’ – early socialisation can be particularly effective. Furthermore, according to Craig (2015), an educational arena that has even more potential than schools is young women’s and girls’ use of IT in leisure-time activities.

Workplace interventions are aimed at the career persistence and advancement of female IT professionals, but all IT employees, independent of gender, can benefit from many of them (Quesenberry & Trauth, 2012). Such interventions, many of which

have been implemented in organisations in Western societies and discussed in gender and IT intervention research (e.g., Armstrong & Riemenschneider, 2014; Kirton & Robertson, 2018; Trauth et al., 2009), include ensuring equality at a basic level (e.g., equal pay for equal work, equal treatment, equality in organisational processes, and effective promotion procedures), promoting work-family balance (e.g., parental leave, child-care and elder-care services, flexible work schedules, and teleworking), promoting female IT professionals' training and advancement (e.g., creation of networks, mentoring programmes, and career and professional development programmes), and creating positive environments and inclusive workplaces. Annabi and Pels (2016, p. 8) provide a summary of recommendations for interventions that address the career persistence and advancement barriers women in IT face and suggest that future research investigate what barriers tend to persist in spite of the interventions and what interventions are most effective in mitigating or eliminating them. Annabi and Lebovitz (2018, p. 17) in the follow-up study introduce "a theoretical framework that provides a holistic approach to assess the effectiveness of IT workplace interventions." The authors call to test this framework in various contexts and suggest propositions for further investigation.

As for *men in the IT workplace*, it is more than difficult to empower women and girls fully unless men and boys are engaged (e.g., Craig, 2015; Kimmel, 2015; Trauth, 2012). DuBow and Ashcraft (2016, p. 163) explore the factors that prevent men from becoming involved in diversity efforts and provide a set of recommendations for future interventions that seek to engage men, highlighting that little research investigates "the role of male allies in technology workplaces."

*IS scholars*, too, could be more sensitised to gender imbalance in the IT workforce than they are (e.g., Adam et al., 2004; Ridley & Young, 2012; von Hellens et al., 2012). As indicated in Issue 1, the topic of gender imbalance in IT lacks visibility and awareness among those in the IS discipline, and high-quality research that reaches these professionals is needed (e.g., Trauth, 2017).

Finally, *decision-makers*, independent of gender, are a promising target group, as they include policy-makers who are responsible for the national, state, and organisational policies that promote gender equality and diversity. Recommendations for changes in existing policies to address gender imbalance in the IT profession include educational reform and adjustments in the recruitment and advancement practices in the IT industry (e.g., Craig, 2015; DuBow & Ashcraft, 2016; Quesenberry & Trauth, 2012). Future research should provide an overview of the recommendations that have been implemented in practice and evaluate their impact, focusing on

gender policies in IT organisations. According to Callerstig (2017), there is still little research, other than general discussions, on the impact of gender policies.

## Discussion

Three overarching recommendations for advancing the quality of future research on gender imbalance in the IT profession are formulated from our analysis.

### (1) *Advance the theorisation*

Multiple studies point out that research on gender imbalance in the IT profession lacks theorisation (e.g., Ridley & Young, 2012; Trauth, 2017), indicating that many authors have not used gender theories to guide their research's design, the interpretation of their findings, or the development of resulting implications. Therefore, they lack significant contributions to the body of knowledge in this field. Certainly, theorisation is central to the maturation process of any field of research, so, as Trauth (2013, p. 285) argues, the "paucity of cumulative theoretical knowledge about gender in the IS field" is a major obstacle to its maturity. Despite numerous studies on the value of gender diversity, we remain largely in the dark about why women are under-represented in IT and how to develop effective interventions to address this problem. Solid new theoretical foundations and approaches are required. As outlined in Issue 2, that new research often fails to consider the findings of earlier research contributes to the comparatively low levels of theorisation. The more scholars build on each other's work over time, the more theoretical insights we can expect. This lack of cumulative tradition has been criticised in IS research in general, as many authors attempt to build new theories rather than testing or reworking more substantive existing theories (Benbasat & Zmud 1999). Another reason for the under-theorisation of the literature on this topic can be seen in the lack of visibility and awareness of this topic in the IS discipline (e.g., Adam et al., 2004; von Hellens et al., 2012). This research field must be legitimised through awareness so it can reach the high levels of theoretical development that would contribute to increasing its level of maturity.

The development of explanatory theories within existing approaches to gender and IS research (gender essentialism, the social construction of gender, and gender intersectionality) can make a valuable contribution to theorisation in the field, but whether these approaches are theoretically sufficient to investigating the under-representation of women in IT or they need to be revised and extended remains to be determined (Ridley & Young, 2012). Trauth (2017) argues that both the exploration and application of existing theories and the development of alternative theories and frameworks can help to elucidate the phenomenon. Studies that



follow methods that are sometimes considered marginal (e.g., grounded theory, action research, design science methods) may provide new insights into the experiences of women in the IT profession (Howcroft & Trauth, 2008; Reid et al., 2010). As Trauth (2017, p. 15) says, “All methodologies and epistemologies have a place in social inclusion research.”

### (2) *Conduct comparative studies in a variety of contexts*

One common limitation indicated in many studies on gender imbalance in the IT profession is that their findings may not be extensible to other cultural, national/regional, or professional contexts. Comparative statistics on gender distribution in the IT profession and career-success indicators of women and men who work in the IT industry should be collected (Issue 1). Moreover, several studies (e.g., Trauth, 2012; Trauth et al., 2016, 2009) call for examination in various contexts of the intersection of gender with other forms of diversity in IT teams. Future research should also seek to determine in various contexts which factors that influence women’s IT career decisions are most influential (Issue 2) (e.g., Armstrong et al., 2018). Consideration of context is necessary when constructing interventions and planning their evaluations because interventions that were successful in one setting might not be in another (Issue 3) (e.g., Quesenberry & Trauth, 2012; Ridley & Young, 2012). Therefore, investigation and comparative analysis of interventions’ success factors and evaluation strategies in various contexts are promising areas for future research. Any cross-cultural research requires consideration of several aspects, such as achieving cross-cultural equivalence, preventing biases, choosing an appropriate sample, and ensuring correct translation (Karahanna, Evaristo, & Srite, 2004).

### (3) *Conduct longitudinal studies*

Longitudinal studies could provide valuable contributions to research on gender imbalance in the IT profession, but since such studies are difficult to conduct, they rarely take place (e.g., Fisher et al., 2015). We suggest that future research addresses this gap for each of the identified issues in order to explore the value of gender diversity in IT and to track relevant statistics’ development over time (Issue 1). Longitudinal research is also required to identify and evaluate the influences and barriers women in IT face at the individual and societal levels (Issue 2). At the individual level, future research could track the experiences of women in IT throughout the stages of their careers (e.g., Ahuja, 2002), and at the societal level, track the development of the barriers to women in the IT profession in various countries (e.g., Armstrong & Riemenschneider, 2014). Longitudinal research could be valuable for researchers and practitioners in understanding the long-term impacts of their attempted interventions (Issue 3).

## Conclusion and outlook

This “Issues and Opinion” article was motivated by the need to identify how IS research can contribute to addressing the challenge of gender imbalance in the IT profession. We ground our work on an iterative review of high-quality research on this issue, complemented by our own experience from large-scale research projects and interventions. Based on the results of our analysis, we (1) synthesise existing issues in research on gender imbalance in the IT profession, (2) propose directions for future research to address each of the identified issues, and (3) suggest actionable research questions for each of the proposed directions (Table 1). We also call on future research to advance theorisation based on the cumulative research efforts in the field and to conduct both comparative studies in various contexts and longitudinal studies. By presenting important avenues for future research, we hope to spur discussion among IS scholars and support fellow researchers’ efforts to advance this field and make important contributions to it. From an academic perspective, we also address the call for more conceptual studies in the gender and IS research field (Trauth, 2013, 2017; von Hellens et al., 2012). Furthermore, we propose theoretically grounded recommendations for interventions that practitioners can apply (Directions 3.1 and 3.2).

The directions and research questions we propose are not exhaustive, and although we searched for extant studies that address each of our suggested directions for future research, we cannot guarantee that the research we call for has not already been published somewhere outside the outlets we searched. Nevertheless, our study provides a strong base for future research on gender imbalance in the IT profession and might inspire collection and comparison of other relevant publications inside and outside the IS community.

Future work should examine within-gender differences, not only the differences between men and women, and consider the complex relationships among gender, organisations, and society. We do *not* encourage further essentialist research in the field. The variety of social and personality constructs are much more powerful predictors of human behaviour than biological sex is (Loiacono et al., 2016; Trauth, 2017; Trauth et al., 2016). Therefore, future IS research should distinguish between *gender* (social) and *sex* (biological) constructs and move away from drawing conclusions based on biological sex alone. This paper focuses on the challenge of gender diversity in the IT profession, but future research should investigate how to improve overall diversity in the field. According to von Hellens et al. (2012, p. 345), lessons learned from the interventions that help to attract women to the IT workforce “may be



transferable and applied [to other] specific social groups that are also under-represented in IT.” Also outside the scope of this study but important to future research is the persistent challenge in many non-Western societies of gender inequality in access to and use of IT, which is the result of women’s unfavourable employment, education, and income conditions (Hilbert, 2011). Given the omnipresent role of IT in all areas of modern society, people who lack access to technology or the skills to use it will become increasingly disadvantaged. The IS discipline has an opportunity to contribute to addressing the challenge of gender imbalance among both IT professionals and IT users.

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## Appendix A

**Table A-1.** Details of the Literature Review and Practical Experience that Informed the Identification of Issues and Directions for Future Research on Gender Imbalance in the IT Profession.

Literature review	<ul style="list-style-type: none"> <li>- The <i>Basket of Journals</i> (see Table A-2).</li> <li>- Specialised outlets relevant to gender and IS:             <ul style="list-style-type: none"> <li>• Information Technology and People (all issues)</li> <li>• The Data Base for Advances in Information Systems (all issues)</li> <li>• ACM Inroads (2012 and 2002 special issues)</li> <li>• Women, Work and Computerization (2006 special issue)</li> <li>• IEEE Annals of the History of Computing (1996 special issue)</li> </ul> </li> <li>- Further relevant studies published outside the <i>Basket of Journals</i>.</li> <li>- Forward search of all the identified relevant studies.</li> </ul>
Practical experience	<ul style="list-style-type: none"> <li>- Research projects             <ul style="list-style-type: none"> <li>• “Gender Equality Plans for Information Sciences and Technology Research Institutions” (EQUAL-IST, 2016–2019) funded by the European Union (EU) within the Horizon 2020 Framework Programme</li> <li>• “Gender Equality in Digital Entrepreneurship” (2016–2019) funded by the EU Erasmus+ Programme</li> <li>• “Development of an Information Platform for Young Women for Professional and Academic Orientation in IT-related Professions” (Digital Me, 2016–2019) funded by the German Federal Ministry of Education and Research</li> <li>• “Digital Divas” (2009–2011) funded by the Australian Research Council (ARC)</li> <li>• “Women in Information Technology” (WinIT, 1995–2012) funded by the ARC</li> </ul> </li> <li>- Interventions (selected)             <ul style="list-style-type: none"> <li>• “Girls’ Day” (Germany)</li> <li>• “Go Girl, Go for IT” (Australia)</li> <li>• Activities of the “Tech Girls Movement” (international)</li> <li>• Women’s Networking Events organised by the Association for Information Systems (AIS) Women’s Network (international)</li> </ul> </li> </ul>

**Table A-2.** Details of Search and Selection of Papers on Gender Imbalance in the IT Profession Published in the *Basket of Journals*.

Outlets	The <i>Basket of Journals</i> consists of the following eight journals (AIS SENIOR SCHOLAR CONSORTIUM, 2011): <sup>a</sup>		
	<ol style="list-style-type: none"> <li>1. European Journal of Information Systems (EJIS)</li> <li>2. Information Systems Journal (ISJ)</li> <li>3. Information Systems Research (ISR)</li> <li>4. Journal of Association for Information Systems (JAIS)</li> <li>5. Journal of Information Technology (JIT)</li> <li>6. Journal of Management Information Systems (JMIS)</li> <li>7. Journal of Strategic Information Systems (JSIS)</li> <li>8. Management Information Systems Quarterly (MISQ)</li> </ol>		
Research data-bases used <sup>b</sup>	EBSCOhost Business Searching Interface ( <a href="http://search.ebscohost.com">http://search.ebscohost.com</a> )	Scopus ( <a href="http://www.scopus.com">www.scopus.com</a> )	AIS Electronic Library ( <a href="http://aisel.aisnet.org">http://aisel.aisnet.org</a> )
Gender-related search terms	Gender-neutral terms: <i>gender, sex</i>	“Feminine” terms: <i>female, wom?n<sup>c</sup>, girl, femin*<sup>d</sup></i>	“Masculine” terms: <i>male, m?n, boy, masculi*</i>
The <i>Basket of Journals</i> ISSN codes	0960085X (EJIS), 13,501,917 (ISJ), 13,652,575 (ISJ E-ISSN), 10,477,047 (ISR), 15,369,323 (JAIS), 02683962 (JIT), 07421222 (JMIS), 09638687 (JSIS), 02767783 (MISQ)		
Search string	Any of the gender-related search terms in abstract AND Any of the <i>Basket of Journals</i> ISSN codes		
Fields for text analysis	Preliminary analysis: Abstracts. Analysis of the selected studies: Full texts.		
Search time-frame	All articles published in the <i>Basket of Journals</i> up to the year 2018 <sup>b</sup>		
Nr. of papers	Total papers screened: 112 Studies not relevant for gender research: 20	Studies on gender imbalance in IT: 16 (Table A-3)	Other studies, where the topic of gender is at the core of research: 19 (Table A-4)
		Studies, where the topic of gender is one of the factors: 43 (Table A-5)	Review articles or editorials: 14 - the topic of gender is at the core of research: 5 - the topic of gender is one of the factors: 9

<sup>a</sup> Alphabetically.

<sup>b</sup> The 1991–1995 issues of EJIS and the 1991–1993 issues of ISJ were not represented in any of the databases; these volumes were checked manually using the online archives available on the journal websites. No relevant articles were identified during this manual search.

<sup>c</sup> The wildcard question mark (“?”) represents any one character.

<sup>d</sup> The wildcard asterisk (“\*”) can be substituted with any number of characters.



**Table A-3.** Studies on Gender Imbalance in the IT Profession Published in the *Basket of Journals*.

Paper/gender of the authors	Main ideas, research approaches, and addressed issues <sup>a</sup>	Nr. of times cited <sup>b</sup> total/avg. per year
EJIS (1991–2016)/UK <sup>c</sup>		
Panteli et al. (1999)/2 women and 2 men	The study had the following objectives: “first, to map the representation and distribution of women employed in different types of positions in the IT industry; second, to examine gender similarities and differences in attitudes to career in IT; and, finally, to study ways IT organisations structure and define occupations, and to examine the extent to which these contribute to gender segregation and gendered structures in IT workplaces.” (p. 172) Quantitative and qualitative approaches were used to analyse the case study data. [I2]	104/5.20
Ahuja (2002)/woman	Based on the analysis of literature, in this conceptual study “a model of barriers faced by women” in the IT field was introduced. The author suggested that “social and structural factors, as well as their interactions, would result in turnover of women in IT.” (p. 20) [I2]	452/26.59
Trauth et al. (2009)/3 women	The research question motivating this qualitative study, where grounded theory was employed as a method, was: “How do factors in the workplace affect the experience of women in the US information sector?” The authors “chose the individual differences theory of gender and IT [...] as a lens for theorising the experience of women in the IT workplace.” (p. 478, 482) [I2]	141/14.10
Reid et al. (2010)/4 women	The following research question was addressed in this qualitative study, where focus group was employed as a method: “Are there differences in men’s and women’s perceptions about the challenges women face in IS?” The study was informed by “both the critical and feminist research traditions.” (pp. 529, 535) [I2]	17/1.89
ISJ (1991–2016)/UK <sup>c</sup>		
Robertson et al. (2001)/4 women and 1 man	This conceptual study, where analysis of literature was employed as a method, “explored some of the reasons that may underlie the gender segregation and declining levels of woman participation within the field of computing in Europe during the 1990s in both the professional (industrial) and academic spheres.” The authors focused on “the social construction of the computing domain” and investigated the gender segregation using this perspective. (pp. 111, 115) [I2]	53/2.94
Clayton et al. (2012)/3 women	This mixed-method case study presented “a conceptualisation of the influence of middle-school experiences on girls’ IT study and career choices.” The approach followed in the study was positioned as “a middle ground between social construction and essentialism and had similarities to the theory of individual differences proposed by Trauth.” (p. 375) [I3]	42/6.00
Panteli (2012)/woman	“This paper discussed the case of an intervention programme for women returners in IT” by qualitatively analysing case study data. (p. 392) Individual and structural factors were considered in the study for analysing the intervention. [I3]	24/3.43
Quesenberry and Trauth (2012)/both women	The research question addressed in this mixed-method study was “How can an understanding of career anchor variation among women in the IT workforce in the US be used to inform interventions aimed at increasing woman participation in the profession?” (p. 4) Case study data was investigated both qualitatively and quantitatively. The individual differences theory of gender and IT was employed as a theoretical lens. [I3]	45/6.43
Ridley and Young (2012)/both women	This mixed-method study addressed the following research question: “Do theoretical perspectives shape how Australian society understands gender influences on the IT workforce?” (p. 6) The articles published in one national newspaper were analysed both quantitatively and qualitatively, comparing the three gender and IS theories. [I3]	22/3.14
Craig (2015)/woman	This study introduced a framework to evaluate gender and computing interventions. The study involved a review of the literature, analysis of the case study data, and interviews with intervention experts. [I3]	11/2.75
Annabi and Lebovitz (2018)/both women	This study was aimed at gaining a better understanding of “organisational interventions aimed at increasing gender diversity [...] by developing a comprehensive framework.” (p. 1) Case studies of nine organisations were analysed qualitatively and compared with each other. [I3]	1/1
Armstrong et al. (2018)/3 women	“Using Ahuja’s theoretical model as the foundation, this study asked women working in IT what workplace challenges they faced” via focus group interviews. The study suggested “an extended theoretical model that could be used to further explore the challenges women face at various career stages in the IT field.” (p. 1) [I2]	0/0
JMIS (1984–2016)/US <sup>c</sup>		
Baroudi and Igbaria (1995)/both men	The goal of this quantitative study, where survey was employed as a method, was to examine “the role gender played in career success within the IS occupation.” (p. 183) [I2]	175/7.29
JSIS (1991–2016)/Netherlands <sup>c</sup>		
Kirton and Robertson (2018)/both women	In this study, the analysis of “the gender and IS literature and feminist theorising” was used as a basis for fieldwork at an IT department of a company in the UK. Fieldwork included semi-structured interviews, roundtable discussions with female employees, interviews with female board members, and a career development workshop. The study results revealed “how components of organisational inequality regimes [...] combine and interact to produce and maintain gender inequality in the IT workplace.” (pp. 1, 5) [I2]	0/0
MISQ (1977–2016)/US <sup>c</sup>		
Truman and Baroudi (1994)/both men	This quantitative study, where survey was employed as a method, “empirically examined the extent of treatment discrimination in a select group of IS managers by looking at the disparities in salaries and job levels between men and women.” (p. 131) [I2]	122/4.88
Igbaria and Baroudi (1995)/both men	The goal of this quantitative study, where survey was employed as a method, was “to determine similarities and differences between woman and man IS employees on job performance and career advancement prospects.” (p. 114) [I2]	203/8.46

No relevant articles were identified in ISR (US), JAIS (US), and JIT (UK).

<sup>a</sup> Addressed Issues (I) related to gender imbalance in the IT profession:

[I1] Lack of research on the consequences of gender imbalance in the IT profession.

[I2] Lack of coherent explanation for gender imbalance in the IT profession.

[I3] Lack of impact of interventions that address gender imbalance in the IT profession.

<sup>b</sup> Retrieved from Google Scholar (<https://scholar.google.com>) 2018–03–06.

<sup>c</sup> Journal/Years Analysed/Main Country of Origin.

**Table A-4.** Further Studies Considering the Topic of Gender *at the Core of Research* and Published in the *Basket of Journals*.

Journal/years analysed	Paper/gender of the authors	Main ideas, research approaches, and criteria why gender is at the core of research <sup>a</sup>
EJIS (1991–2016)	Adam <i>et al.</i> (2006)/6 women	This qualitative study, where case study was employed as a method, attempted to capture “the question of gender identity [in IT work] and the way that women distance themselves either from claiming to be working centrally in IT or from being women in relation to IT skills” (p. 376). (p. 370) [C1,2]
	Greenhill and Wilson (2006)/both women	The following research question was addressed in this conceptual study: “What are the implications of teleworking at home for women’s ability to improve their disadvantaged situation, especially through collective actions?” Based on the analysis of literature, in particular, Marxist studies, the authors offered “an alternative position for interpreting and describing how approaches concerning gender could be applied to the at-home telework phenomenon.” (p. 380) [C1,2]
	Light (2007)/man	The “area of Masculinity Studies” was introduced to IS research by presenting a qualitative analysis of a case study on an internet-dating website for gay men. The study raised a discussion on men’s gendered experiences of IS. [C1,2]
ISJ (1991–2016)	Harvey (1997)/woman	“The question that was explored in this paper was concerned with the extent to which masculine culture can arguably be found in the formative contexts of IT professionals.” (p. 154) The author qualitatively analysed the data collected during five ethnographic field studies and concluded that IT is socially constructed. [C1,2]
	Howcroft and Trauth (2008)/both women	In this conceptual study, literature was analysed to explore “the nature of the critical agenda and endeavours to advance the critical debate” in gender and IS research. “[A]n argument for the benefits of adopting a critical perspective when studying gender and IS research” was presented and justified in the paper. (p. 185) [C1,2]
ISR (1990–2016)	Duxbury <i>et al.</i> (1992)/2 women and 1 man	The following research question was addressed in this quantitative study, where survey was employed as a method: “What impact does gender have on the relationship between AHT [After-Hours Telecommuting] and work-family conflict?” (p. 174) [C1]
	Joseph <i>et al.</i> (2015)/1 man and 2 women	This study considered several theories “to hypothesise relationships between relative pay gap and patterns of job mobility” of men and women (p. 145). The authors conducted quantitative analysis of work histories of 359 IT professionals. [C1]
JIT (1990–2016)	Adam (2002)/woman	This conceptual study, where analysis of literature was employed as a method, explored the “ways in which theorising gender may be important in forming an understanding of the topic of emancipation, which was central to the new critical IS based on the thinking of Habermas.” (pp. 59, 63) [C1,2]
	Wilson (2004)/woman	This conceptual study, where analysis of literature was employed as a method, was aimed at addressing “the under-theorisation of gender within the IS literature by adopting a critical and feminist approach to the organisational context of IS development and use.” (pp. 81, 90) [C1,2]
	Shen <i>et al.</i> (2010)/3 men and 1 woman	One of the goals of this quantitative study, where survey was employed as a method, was to “examine possible gender differences in engaging in social network-facilitated team collaboration.” (p. 153) [C1]
JMIS (1984–2016)	Zahedi <i>et al.</i> (2006)/1 woman and 2 men	The following research question was addressed in this qualitative study, which employed the grounded theory approach: “What are the signifiers of cultural masculinity and femininity in Web documents?” (pp. 89, 118) [C1,2]
	Awad & Ragowsky (2008)/1 woman and 1 man	The following research question was addressed in this quantitative study, where survey was employed as a method: “Do men and women differ in their evaluation of online trust, online WOM [Word-Of-Mouth], and e-Commerce?” (p. 102) [C1]
JSIS (1991–2016)	Krasnova <i>et al.</i> (2017)/3 women and 1 man	This quantitative study, where survey was employed as a method, investigated the gender differences in the determinants of intentions to continuously use social networking sites (SNS). The following research question was addressed: “What are the gender differences in the determinants of continuance intentions of SNS users?” (p. 262) [C1]
MISQ (1977–2016)	Gefen & Straub (1997)/both men	The goal of this quantitative study, where survey was employed as a method, was to examine “gender differences in the perception and use of email.” (p. 389) The study also discussed the lack of gender-based work in technology acceptance research. [C1]
	Venkatesh & Morris (2000)/both men	The following research question was addressed in this quantitative study, where survey was employed as a method: “Are men and women different with respect to technology adoption?” (p. 128) [C1]
	Ahuja & Thatcher (2005)/1 woman and 1 man	The goal of this quantitative study, where survey was employed as a method, was to examine “the influence of the work environment and gender on trying to innovate with IT.” One of the addressed research questions was, whether “the relationships of perceived overload and autonomy with IT innovation varied by gender.” (pp. 427, 429) [C1]
	Riedl <i>et al.</i> (2006)/3 men	The following research question was addressed in this quantitative study, where laboratory experiment was employed as a method: “Are there neural gender differences in online trust?” (p. 398) [C1]
	Oreglia & Srinivasan (2016)/both women Venkatesh <i>et al.</i> (2017)/2 women and 2 men	This study was based on an ethnographic fieldwork and explored the role of IT in supporting women in an attempt to “renegotiate existing gendered power structures” (p. 501). [C1,2] One of the objectives of this quantitative study, where survey was employed as a method, was “to develop a model of person–organisation and person–job fit that accounts for gender differences” (p. 527) The study showed evidence that gender was “a moderator of the relationships between valuations of different work outcomes and fit perceptions” (p. 525) [C1]

No relevant papers were found in JAIS (US).

<sup>a</sup> Criteria (C) why the topic of gender is at the core of research:

[C1] Gender is part of the study goal, research question, or hypothesis.

[C2] A detailed analysis of a gender-related topic is provided.

**Table A-5.** Studies Considering the Topic of Gender as One of the Factors and Published in the Basket of Journals.

Journal/years analysed	Paper	Main ideas and rationales why gender is one of the factors
EJIS (1991–2016)	Taylor (2004)	The influence of users' cognitive style and gender on their usage of computer-mediated Knowledge Management Systems (KMS) was investigated. One of the study findings was that "gender significantly affected KMS usage, with males being more likely to use such systems than females" and that there was "a small interaction effect between cognitive style and gender." (p. 52)
	Ranganathan <i>et al.</i> (2006)	The study aimed at understanding "the switching behaviour of mobile users" who had prepaid tariffs, and gender was reported to be one of the influential factors in this context, namely that "a male user was 1.16 times more likely to switch mobile providers than a female user." (p. 274)
	Gallivan & Benbunan-Fich (2007)	Demographics of IS researchers was studied, including their location and gender. A "set of 'most productive researchers'" was identified and women comprised 17.5% of it. (p. 49)
	McCoy <i>et al.</i> (2007)	One of the study findings obtained during the multi-cultural examination of technology acceptance model (TAM) was that "the TAM model appears not to fully hold for people scoring [...] high on masculinity", namely that for such individuals Perceived Ease of Use did not influence Behavioural Intentions to use a technology." (p. 87) Masculinity here was considered as one of the cultural dimensions in accordance with Hofstede (1980).
	Heinze & Hu (2009)	The factors influencing intentions to choose a career in IT were conceptualised and tested. One of the study findings was that "males were more likely to choose [IT as a career] than females." (p. 462)
	Phang <i>et al.</i> (2010)	The effects of gender on the needs of online consumer were investigated alongside with other demographic variables. Findings "did not indicate gender differences in the online context." (p. 355)
	Chen & Sharma (2015)	The study analysed survey data to, among others, explore the differences between male and female Facebook users in their "learning-based attitude formation and the relationship between member attitude and self-disclosure." (p. 93)
	Hoehle <i>et al.</i> (2015)	The study focused on the challenge of developing mobile applications that "satisfy individuals with various cultural backgrounds." A "model examining the impact of mobile social media application usability on continued intention to use" was developed, where, among others, the masculinity/femininity cultural value by Hofstede was incorporated as one of the moderators. (337)
	Foth (2016)	The study analysed survey data to explore "the influences of the attitudes, subjective norms and perceived behavioural control on employees' intentions to comply with data protection regulations" and, among others, investigated the differences between men and women (p. 91).
	ISJ (1991–2016)	Pozzebon <i>et al.</i> (2012)
Venkatesh <i>et al.</i> (2014)		Gender was tested in this study as one of the "predictors of e-Government portal use." (p. 249)
Payton (2016)		The study dealt with the topic of "culturally relevant health information" and collected requirements to an online platform that targeted Black female college students (p. 319).
ISR (1990–2016)	Gattiker & Kelley (1999)	One of the study objectives was to determine if individual differences, including gender, affected people's moral acts when IT was involved. Study findings showed that "women appeared more cautious regarding certain moral and immoral acts of computer users" and "women were more likely to refrain from distributing illegal games." (p. 233)
	Levina & Xin (2007)	The study analysed the factors influencing "IT workers' compensation in labour markets." One of the study findings was that "female IT workers [...] fared worse than their male [...] counterparts as the IT job market slowed down [in the early 2000s]." (p. 193)
	Ragu-Nathan <i>et al.</i> (2008)	The study analysed the factors influencing "the phenomenon of techno stress", which, among others, included gender. One of the study findings, which was contradictory to the authors' expectations, was that "males experienced more techno stress than females." (p. 417)
	Cavusoglu <i>et al.</i> (2016)	The study examined "the role of granular privacy controls on dynamic content-sharing activities and disclosure patterns of Facebook users based on the exogenous policy change in December 2009." One of the study findings was that those users who did not reveal their gender shared "more content openly and less content secretly than before", while those users who revealed their gender shared "less content openly and more content secretly after the change." (p. 848)
JAIS (2000–2016)	Leonard & Cronan (2001)	The study furthered "the development/validation of the IT ethical model" by adding the gender construct to it. Gender was shown to be one of the "significant indicators of ethical behaviour intention" with women having "a greater intention to behave ethically than men." (p. 1)
	Hansen & Walden (2013)	The study investigated "consumers' perceptions of legality and ethicalness of file sharing" and gender here acted as one of the control variables. (p. 521)
	Gallivan & Ahuja (2015)	The study analysed scientific collaboration (co-authorship) in the papers published in five leading IS journals and, among other findings, revealed "significant effects of homophily related to gender" (981).
	Fehrenbacher (2017)	The study analysed "the influence of emotional expressions in faces on knowledge-sharing decisions in a computer-mediated environment." One of the study findings was that the influence of emotional facial expression on knowledge-sharing decisions "held for females but not males."

(Continued)

**Table A-5.** (Continued).

Journal/years analysed	Paper	Main ideas and rationales why gender is one of the factors
JIT (1990–2016)	Iskan & Naktiyok (2005)	The study analysed the factors influencing “individuals’ attitudes towards telecommuting.” One of the study findings was that women had “a more favourable attitude towards telecommuting.” (p. 52)
	Kim & Han (2009)	The study investigated the factors influencing adoption of mobile data services, and gender, alongside with other variables, had a moderating effect on acceptance of mobile data services.
	Škerlavaj <i>et al.</i> (2010)	The study objective was “to determine the patterns and structures that govern the formation of intra-organisational learning networks.” One of the study findings showed evidence of homophily in terms of gender in learning relationships. (p. 2)
JMIS (1984–2016)	Harrison & Rainer Jr. (1992)	The study tested “the relationship between individual differences and computer skill.” One of the study findings was that “the male gender [...] [was one of the] individual difference variables associated with higher computer skill.” (p. 93)
	Smits <i>et al.</i> (1993)	The study described “the job characteristic preferences and self-described personal attributes and work traits [...] of persons entering [IS] careers.” One of the study findings was that “the commonalities among high-achieving females and males vastly overshadowed their differences.” (p. 104)
	Hess <i>et al.</i> (2006)	The study explored “how multimedia vividness and the use of computer-based social cues could influence involvement with technology and decision-making outcomes.” One of the study findings was that “women reported higher levels of involvement with the decision aid.” (p. 15)
	He <i>et al.</i> (2007)	The study examined “how communication activity and team diversity impacted the formation of [team cognition].” One of the study findings was that “[g]ender diversity had a strong and positive effect on the development of team cognition.” (p. 261)
	Brown <i>et al.</i> (2010)	The study aimed at explaining “the adoption and use of collaboration technology.” (p. 10) One of the study findings was that gender moderated the effects of facilitating conditions, performance expectancy, and effort expectancy on the intention to use a collaboration technology.
	Wattal <i>et al.</i> (1992)	The study examined “the role of network externalities on the use of blogs in an organisation.” One of the study findings was that “network effects were stronger for women than for men.” (p. 146)
	Chai <i>et al.</i> (2011)	The study analysed the “factors affecting bloggers’ knowledge sharing” and highlighted the moderating effect of gender. One of the study findings was that “trust, norms of reciprocity, and strength of social ties had a more significant effect on women bloggers’ knowledge-sharing behaviour than on the behaviour of men bloggers.” (p. 332)
	Nunamaker <i>et al.</i> (2011)	One of the study goals was to investigate the interaction between human and “an automated kiosk that used embodied intelligent agents to interview individuals.” One of the study findings was that “instantiations that had the agents embodied as males were perceived as more powerful, while female embodied agents were perceived as more likable.” (p. 18)
	Maruping & Magni (2012)	The study investigated the “factors that affected employees’ propensity to explore a new system’s features.” One of the study findings was that “men and women were affected differently by team climate.” In particular, “for men team empowerment climate had no influence on intention to explore, whereas for women there was a significant negative cross-level effect.” (pp. 79–80)
	Ma <i>et al.</i> (2013)	The study analysed various aspects of how early online reviews biased subsequent reviews and one of the findings was that male reviewers were “more prone to being influenced by prior reviews.” (p. 280)
JSIS (1991–2016)	Gupta <i>et al.</i> (2008)	The study explored the factors affecting “adoption of IT to enhance government-to-employee interactions in a government organisation in a developing country.” (p. 140) The influence of gender was investigated, but no significant moderating effect of gender was found.
MISQ (1977–2016)	Igbaria <i>et al.</i> (1991)	Career orientations of IS employees were investigated and one of the study findings was that “women were more lifestyle oriented and less technically oriented than men.” (p. 151)
	Webster & Martocchio (1992)	The measure of microcomputer playfulness (“degree of cognitive spontaneity in microcomputer interactions”) was investigated. One of the study findings was that this measure “did not relate to gender.” (p. 201)
	Trauth & Jessup (2000)	The study analysed, whether “an interpretive analysis of GSS [Group Support System] uses resulted in a different understanding of the GSS discussions than that provided by a positivist analysis.” (p. 45) Gender equity in a university was chosen as a topic for GSS discussions. The focus of the study was on computer-mediated discussions and on various approaches to data analysis; the topic of gender equity in a university was used to contrast the results of positivist and interpretive analyses.
	Moore & Chang (2006)	The study attempted to better understand software piracy and proposed a model of ethical decision-making. Moderating effect of gender on the ethical decision-making process was tested, but “limited support for gender differences” was found. (p. 175)
	Srite & Karahanna (2006)	“The paper identified espoused national cultural values as an important set of individual difference moderators in technology acceptance.” Masculinity/femininity, as one of such values, was “incorporated into an extended model of technology acceptance” as a moderator. One of the study findings was that “social norms were stronger determinants of intended behaviour for individuals who espouse feminine [...] cultural values.” Another finding was that “espoused masculinity/femininity values did not moderate the relationship between perceived usefulness and behavioural intention, but [...] did moderate the relationship between perceived ease of use and behavioural intention.” (p. 679)
McElroy <i>et al.</i> (2007)	The study tested “the effect of personality and cognitive style on three measures of Internet use” and gender acted as one of the control variables. (p. 809)	

(Continued)

**Table A-5.** (Continued).

Journal/years analysed	Paper	Main ideas and rationales why gender is one of the factors
	Venkatesh <i>et al.</i> (2012)	The study extended “the Unified Theory of Acceptance and Use of Technology (UTAUT) to study acceptance and use of technology in a consumer context” (p. 157). One of the study findings was that gender moderated the effects of hedonic motivation and price value on behavioural intention to use technology. Another finding was that “the strength and activation of habit differed across [...] gender.” (p. 174)
	Godinho de Matos <i>et al.</i> (2014)	The study investigated the “effect of peer influence in the diffusion of the iPhone 3G”, and gender was one of the control variables. (p. 1103)
	Hess <i>et al.</i> (2014)	The study performed a “meta-analysis of reliability coefficients” on TAM constructs. One of the study findings was that “reliability differences were also found for [...] gender composition.” (p. 1)

## Appendix B

**Table B-1.** Studies Considering the Intersection of Gender with Other Items of the Individual Differences Theory of Gender and IT (IDT).

Paper <sup>a</sup>	IDT constructs <sup>b</sup>		
	Individual identity	Individual influences	Environmental influences
Adya & Kaiser (2005)		✓ Personal influences	
Adya (2008)	✓ Personal demographics	✓ Personal influences	✓ Cultural and economic influences
Ahuja (2002)		✓ Personal influences	✓ Cultural and economic influences
Ash <i>et al.</i> (2009)		✓ Personal characteristics	
Cain & Trauth (2013)	✓ Personal demographics		✓ Cultural and economic influences
Cain & Trauth (2015)	✓ Personal demographics		✓ Cultural and economic influences
Cain & Trauth (2017)	✓ Personal demographics		✓ Cultural and economic influences
Clayton <i>et al.</i> (2012)		✓ Personal influences	✓ Cultural and economic influences
Gallivan (2004)		✓ Personal characteristics	
Guzman <i>et al.</i> (2007)			✓ Cultural and economic influences
Howcroft and Trauth (2008)			✓ Cultural and economic influences
Joshi <i>et al.</i> (2013)	✓ Personal demographics	✓ Personal characteristics	
Joshi <i>et al.</i> (2016)	✓ Personal demographics		✓ Cultural and economic influences
Kvasny (2003)	✓ Personal demographics		
Kvasny (2006)			✓ Cultural and economic influences
Kvasny <i>et al.</i> (2009)	✓ Personal demographics		
McGee (2017)	✓ Personal demographics	✓ Personal influences	✓ Cultural and economic influences
Morgan <i>et al.</i> (2004)		✓ Personal influences	
Morgan <i>et al.</i> (2015)	✓ Personal demographics		
Nielsen <i>et al.</i> (1997)			✓ Cultural and economic influences
Nielsen <i>et al.</i> (1998)			✓ Cultural and economic influences
Nielsen <i>et al.</i> (2000)			✓ Cultural and economic influences
Payton & Kvasny (2012)	✓ Personal demographics		
Quesenberry & Trauth (2007)		✓ Personal characteristics	
Quesenberry & Trauth (2008)		✓ Personal characteristics	
Quesenberry and Trauth (2012)		✓ Personal characteristics	
Quesenberry <i>et al.</i> (2006)	✓ Personal demographics		✓ Policy and infrastructure influences
Ridley and Young (2012)			✓ Cultural and economic influences
Serenko and Turel (2016)	✓ Personal demographics		
Trauth (2013)			✓ Cultural and economic influences
Trauth (2017)			✓ Cultural and economic influences
Trauth & Booth (2013)	✓ Personal demographics	✓ Personal characteristics	
Trauth & Howcroft (2006)			✓ Cultural and economic influences
Trauth & Quesenberry (2005)			✓ Policy and infrastructure influences
Trauth and Quesenberry (2006)		✓ Personal characteristics	
Trauth <i>et al.</i> (2006)			✓ Cultural and economic influences
Trauth, Quesenberry & Huang (2008)			✓ Cultural and economic influences
Trauth, Quesenberry & Yeo (2008)			✓ Cultural and economic influences
Trauth <i>et al.</i> (2009)		✓ Personal influences	✓ Cultural and economic influences
Trauth <i>et al.</i> (2012a)	✓ Personal demographics		✓ Cultural and economic influences
Trauth <i>et al.</i> (2012b)	✓ Personal demographics		✓ Cultural and economic influences
Trauth <i>et al.</i> (2014)	✓ Personal demographics		
Trauth <i>et al.</i> (2015)	✓ Personal demographics		
Trauth <i>et al.</i> (2016)	✓ Personal demographics		✓ Cultural and economic influences
Von Hellens and Nielsen (2001)			✓ Cultural and economic influences
Windeler & Riemenschneider (2016)	✓ Personal demographics	✓ Personal influences	

This table is based on the results of the literature reviews presented in the studies by Trauth (2017), Trauth *et al.* (2016), Joshi *et al.* (2013), and Trauth *et al.* (2012a).

<sup>a</sup> Alphabetically.

<sup>b</sup> The constructs and items (in the cells) were introduced by Quesenberry and Trauth (2012).



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