

Digital Inequality and the Use of Information Communication Technology

Dissertation

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Preface

Ever since the inception of the Internet, researchers have been both, enthusiastic and concerned about the social implications of Internet-enabled digitization (DiMaggio, Hargittai, Neuman, & Robinson, 2001). They have been enthusiastic, because they believed that the Internet has the potential “to liberalise access to a whole host of resources and opportunities, to increase social connection [...], to impart knowledge to groups which have tended to be excluded from traditional information sources, to provide new channels of communication, and to open up access to goods and services previously denied or impeded by older technologies or methods of exchange” (Bromley, 2004, p. 73). They have been concerned, because they feared that the Internet could also entail inadvertent negative effects for society such as the infringement of data privacy and security, technostress, or unequal access to digital opportunities (Ayyagari, Grover, & Purvis, 2011; Dhillon & Backhouse, 2000; Hargittai, 2003).

In particular, the latter issue of unequal access to digital opportunities has garnered substantial research attention and has been termed ‘digital inequality’ (Hargittai & Hinnant, 2008; Hsieh, Rai, & Keil, 2008; Kvasny & Keil, 2006; Riggins & Dewan, 2005). Generally, digital inequality refers to the unequal opportunity and ability of individuals to profit from information communication technologies (ICT) (DiMaggio & Hargittai, 2001). The phenomenon of digital inequality has also been at the heart of public debates because in the light of the ongoing digitization using ICT actively is more and more becoming a prerequisite to fully participate in society; as Barack Obama put it very recently: “In this digital age, when you can apply for a job, take a course, pay your bills ... with a tap of your phone, the Internet is not a luxury. It’s a necessity,” (Superville, 2015).

Digital inequality is a complex, societal phenomenon and can be broken down into three stages (Wei et al., 2011). The majority of research has explored the so-called ‘first-order’ digital inequality¹ which refers to differences in ICT access and adoption (e.g., Agarwal et al., 2009; Hsieh et al., 2008; Niehaves & Plattfaut, 2014; Racherla & Mandviwalla, 2013). Fewer studies have focused on ‘second-order digital inequality’ which is concerned with *how* individuals use ICT and to which degree they are capable of using them (e.g., Riggins &

¹ Often also referred to as the digital divide

Dewan, 2005; Hargittai & Hinnant, 2008; Sipior, Ward, & Connolly, 2011; van Deursen & van Dijk, 2014; Venkatesh et al., 2014). The third and least researched level of digital inequality is concerned with the experienced outcomes of ICT use (DiMaggio & Bonikowski, 2008; Venkatesh & Sykes, 2013).

This thesis seeks to expand research on the complex and societally relevant phenomenon of digital inequality. Specifically, I aim to explore the following focal research question:

How do individuals use ICTs and which mechanisms and factors influence individual use and non-use of ICTs in the context of digital inequality?

Advancing our knowledge in this field is particularly relevant for the following reasons. First, while understanding all stages of digital inequality is essential for both, assessing the true severity of the phenomenon and developing measures to bridge it, a large part of research has so far focused on ICT access and adoption. Yet, if digital inequality eventually translates into inequality in ‘real life’ is determined by whether individuals can use ICTs to their advantage and benefit from digital opportunities. This thesis seeks to address this research gap by shifting the attention to the factors and mechanisms that drive individual differences in ICT appropriation as opposed to ICT access and adoption. Second, digital inequality research still stands to profit from a broader methodological foundation. In fact, most of what we know about digital inequality is based on the quantitative analysis of surveys and statistical data and might limit research in exploring and better understanding the more complex and multi-layered forms of digital inequality as evident in ICT appropriation. This thesis aims at strengthening the methodological foundation of digital inequality research and at generating new and rich insights by adopting so far underrepresented research methods, in particular qualitative and internet-enabled data tracking methodology. Third, digital inequality is an interdisciplinary research field and different insights haven been gained in a diverse range of academic disciplines. In this thesis I also seek to lay a sound theoretical foundation for my own research and the research of others by integrating these otherwise separate perspectives on digital inequality. Fourth, better understanding digital inequality and potential means to bridge it is of high societal relevance. Therefore, this thesis also aims at inferring implications not only for academic research but also for practitioners, in particular public policy makers. The thesis comprises four papers that seek to address the points outlined above and that are introduced in the following paragraphs.

The first paper is single-authored and entitled “*Digital inequality: An interdisciplinary literature review and future research agenda*”. This paper lays the theoretical foundation of this thesis. The interdisciplinary literature review informs scholars on the current state of digital inequality research, integrates perspectives from diverse, otherwise separate academic disciplines, and outlines a substantial agenda for future research on digital inequality. The review also critically challenges the current focus of digital inequality research in the light of the rapid development of Internet-enabled consumer technologies of the last two decades. The review follows a systematic search strategy and analysis scheme to ensure the relevance and the replicability of the findings (Leidner & Kayworth, 2006; Webster & Watson, 2002). In total I screened 439 articles of which I eventually coded and analyzed 130 articles. The paper reveals several interesting findings and important implications for digital inequality research. First, the review shows that digital inequality can be studied as a multi-stage concept, although few studies do so in a comprehensive manner. A multi-stage perspective is important, because by focusing only on selected stages scholars risk neglecting relevant antecedents and limit the explanatory power of their findings if those cannot be related outcomes of ICT use. Second, the analysis suggests that research should shift its attention to the less researched fields of ICT appropriation and outcomes of ICT use. This is particularly important in a developed country contexts and researchers should work towards a common measurement and theoretical conceptualization of these constructs. This shift in attention is necessary in order to not jeopardize the validity and the relevance of findings in the field, to ensure the comparability of results, and to allow researchers to build upon the work of others. Third, digital inequality research has not yet integrated recent technological developments such as the implications of Internet-enabled smartphones which limits our understanding to an incomplete set of technologies. Fourth, research methods are dominated by quantitative analysis relying heavily on cross-sectional, official statistic data from developed countries. This narrow scope of methods, data and samples limits the generalizability and validity of findings. Fifth, digital inequality is mostly studied at the individual level, with less research on the country level and almost no research on the organizational level even though it entails important implications for organizations, in particular governmental institutions.

The second paper takes a quantitative empirical approach and is entitled “*Second-order digital inequality: A clickstream analysis of e-commerce use*”. This paper has been written in co-authorship with Katharina Buhtz, Andreas König, Jan Mammen, and Lorenz Graf-Vlachy. It explores how individuals use e-commerce and whether and how digital inequality can be

observed among individuals from different socio-economic backgrounds in the realm of e-commerce. As such, this study addresses one of the findings of the literature review, namely the fact that we already know much about *whether* individuals use the Internet but we know little about *how* individuals can use the Internet and its applications to their own advantage. This study also addresses the fact that, although research has acknowledged the importance of e-commerce in the context of digital inequality and its potential benefits particularly for less privileged shoppers, it has dedicated almost no scholarly attention to the topic (Riggins & Dewan, 2005). This study addresses this research gap by extending digital inequality research to the realm of e-commerce and by introducing a novel perspective on effective – potentially economically beneficial – e-commerce use. This perspective encompasses two dimensions: (1) the extent to which an individual is able to leverage *the diversity of e-commerce platforms* such as general retailers or daily deals, and (2) the extent to which an individual uses *supporting e-commerce features* such as price comparisons before the purchase to further benefit from e-commerce. Building on technology acceptance theory and social psychology, the paper proposes that socio-economically disadvantaged individuals are less likely to use e-commerce in a manner that promises economic gains than their socio-economically advantaged peers. We empirically test our hypotheses on a unique set of clickstream data that tracks the online behavior of 2,819 US e-commerce users for six months in 2012. The findings reveal that despite equal access, the socio-economically advantaged users use e-commerce more effectively in both dimensions – leveraging the diversity of e-commerce platforms and supporting e-commerce features. Most importantly and contrary to expectations, the findings show that socio-economic status does not primarily impact *how much* individuals buy online, but rather *how* they search for and buy products. The study also lines out important implications for IS research, public policy makers and business practitioners.

The third paper is entitled “*Mechanisms of engagement with and disengagement from Internet applications: A qualitative study of online job search*” and is one of the few papers that takes a qualitative research approach (Eisenhardt, 1989; Langley, 1999; Yin, 2003) to study digital inequality. This paper has been written in co-authorship with Katharina Buhtz. It seeks to deepen our current understanding of the factors and mechanisms underlying individual use and non-use of Internet applications and experienced use outcomes. Scholars have continuously emphasized that the persistence of digital inequality is problematic because Internet applications permeate multiple domains of life by enhancing or substituting offline

services in areas that are fundamental to life chances such as education, employment and health (W. Chen, Lee, Straubhaar, & Spence, 2014; Lindsay, 2005; Riggins & Dewan, 2005; K.-K. Wei et al., 2011). Consequently, it is imperative to understand the individual mechanisms and influencing factors that determine whether individuals engage with or disengage from Internet applications. This paper provides a new vantage point to this societally relevant debate by presenting a qualitative study of (online) job search in the German labor market. In order to gain insight on how individuals engage with job-related Internet applications and to triangulate our findings, we collected data from multiple sources (Miles, Huberman, & Saldaña, 2013; Yin, 2003). Most importantly, we conducted semi-structured interviews (Patton, 2002) among 16 job-seekers in Germany who differ substantially in how they use online job search applications, which yielded 182 pages of field notes. Additionally, the data set comprises self-tests of online job search applications, on-site visits at the German Federal Employment Agency (GFEA) including system demonstrations, interviews with a recruiter and an employment agent as well as archival data. Data was collected over a period of nine months from August 2014 to April 2015. By adopting coping theory as the primary theoretical lens, this study presents a dynamic perspective on how an individual's resources, social capital, cultural capital, and habitus, determine the appraisal of and the decision to use Internet applications or to abandon them. It also accounts for further contextual factors, namely perceived risk and trust in social capital. In contrast to existing research, the model developed in this study explicitly embraces the dynamic nature of ICT use and highlights how adopting a process-based view can help to gain a more thorough understanding of the mechanisms that lead to (dis-)engagement. Furthermore, the findings suggest that social capital plays a more important role in engaging people with Internet applications than portrayed in previous studies. The findings entail important implications for information systems research and for policy makers seeking to bridge digital divides in particular by uncovering the mechanisms that lead to 'digital exclusion' and by highlighting promising points of intervention for governmental institutions.

While the first three papers primarily address an academic audience, the fourth paper has the goal to synthesize and convey some of the key insights of the academic research to a practitioner audience, particularly to policy makers. The paper is entitled "*Bridging digital inequality: What can public policy makers do to ensure equal benefit from online opportunities?*" and has been written in co-authorship with Katharina Buhtz. In the light of the high societal relevance of digital inequality and the important role of public policy in

bridging digital gaps, this paper seeks to inform public policy makers about the issue itself, potential domains of digital opportunities that merit special attention, and potential means to bridge digital inequality. The paper introduces and explains the phenomenon of digital inequality and informs about its current stage. Against the backdrop of the progressing digitization, the paper then portrays six domains of digital opportunities that are likely to be most effective in decreasing social disparities and that should thus be at the focus of public policy makers, specifically, the domains of employment, e-government and public services, education, health, finance and insurance, and e-commerce. To illustrate the mechanisms and factors that impede individuals from using digital opportunities and the role governmental institutions can play in this context, the paper presents a case study of online job search in Germany (building on the qualitative research conducted for the third paper). The study identifies specific measures public policy makers can undertake to successfully bridge digital inequality. In particular, it highlights the importance of embedded institutional support structures, focusing on skill-building and enablement, application-oriented training and targeted initiatives.

All articles of this thesis have been submitted to peer-reviewed journals. Most notably, the article *“Second-order digital inequality: The case of e-commerce”*, an earlier version of the paper *“Second-order digital inequality: A clickstream analysis of e-commerce use”*, has already been published in the Proceedings of the International Conference on Information Systems (ICIS) (VHB Jourqual 3 rating: A). The literature review has been submitted to the European Journal of Information Systems (EJIS). The paper *“Mechanisms of engagement with and disengagement from Internet applications: A qualitative study of online job search”* is currently under review at the Journal of the Association for Information Systems (JAIS). The paper *“Second-order digital inequality: A clickstream analysis of e-commerce use”* is currently under review at the International Journal of Electronic Commerce (IJEC); and the practical perspective on digital inequality is currently under review at the Communications of the ACM (CACM).

Beyond the contributions of the single papers, this thesis as a whole provides substantial theoretical and methodological contributions to research on digital inequality and information systems – in particular technology adoption and use – and entails important implications for practitioners. First, this thesis contributes to research on digital inequality by empirically proofing that digital inequality is still a prevalent societal issue even in countries with

widespread Internet access. It advances our understanding in the little researched fields of ICT appropriation and ICT use outcomes by studying which mechanisms and factors influence the individual appropriation of e-commerce and the use (outcomes) of online job search applications. Further, this thesis underlines the essential role of (institutional) social capital for the digitally disadvantaged and illuminates how and under which circumstances social capital can be converted into forms of capital instrumental to technology appropriation, an area that has so far received little research attention (Hsieh, Rai, & Keil, 2011).

Second, this thesis also provides contributions to research on information systems and in particular to the field of technology use and adoption. In contrast to existing research, the qualitative study explicitly takes a dynamic perspective on technology use and non-use. As such, the study responds to calls to investigate alternative theoretical perspectives on technology acceptance in order to broaden the field's understanding towards a wider constellation of behavioral responses (Abraham, Boudreau, Junglas, & Watson, 2013; Schwarz & Chin, 2007; Venkatesh, Davis, & Morris, 2007). Similarly, the quantitative empirical study develops a novel and more holistic perspective on e-commerce use by accounting for the context in which a transaction takes place and contributes to understanding online shopping in a more holistic and nuanced manner.

Third, the thesis takes a multi-methodological approach and strengthens the methodological foundation of research on digital inequality and technology use. Most notably, we introduce clickstream data as an empirical basis for research on technology adoption and use. Clickstream data tracks actual rather than observed behavior and therefore allows to overcome the high risk of common method variance as a result of common-rater effects and self-report bias (Podsakoff, MacKenzie, Lee, & Podsakoff, 2003), one of the most critical methodological issues underlying TAM (Straub & Burton-Jones, 2007). Furthermore, following calls for more in-depth qualitative research (Selwyn, 2003; Venkatesh, Brown, & Bala, 2013), this thesis also contributes to strengthening the validity and explanatory power of digital inequality research by adopting a qualitative research design, a fairly underused method in this field. Combining interviews, observations and application self-tests allowed for grasping the complexity, the dynamism and the multitude of pathways that may lead to technology use or non-use – aspects that are unlikely to be captured in the same depth and richness through traditional, survey-based research.

Fourth, this thesis also entails important implications for public policy makers and online businesses. On a public policy level, the findings highlight that digital inequality continues to be a substantial societal issue and that bridging it should be a priority for public policy. Public policy should focus in particular on domains that are fundamental to life chances and should build on use-oriented as opposed to access-oriented ICT initiatives including application-oriented skill training. On an online business level, it is important to understand what impedes individuals from using certain online applications in order to more effectively target digitally less savvy societal groups – particularly in the light of growing online self-service technologies.

In conclusion, this thesis seeks to expand our knowledge on the phenomenon of digital inequality. The four individual papers introduced in this preface are presented in the following. The dissertation concludes with remarks on the key findings and contributions of this research.

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Digital inequality: An interdisciplinary literature review and future research agenda

Annika Reinartz

Abstract

In this paper, I review the growing research on the phenomenon of digital inequality, i.e. the unequal opportunity and ability of individuals to profit from information communication technologies (ICT). This paper informs researchers about the current state of digital inequality research through a critical, interdisciplinary analysis of the existing literature and provides a guideline for meaningful future research. The review reveals three core limitations of digital inequality research: First, digital inequality can be conceptualized as a multi-stage phenomenon, consisting of ICT access, ICT adoption, ICT appropriation and ICT use outcomes, but is rarely studied as such in a comprehensive manner; second, digital inequality research has so far focused on a narrow set of methods, on developed countries and has not yet incorporated the latest technological developments; and third, many studies and concepts lack a sound theoretical foundation. Altogether, these aspects limit the generalizability, comparability and explanatory power of digital inequality research. To address these limitations, I develop an integrated perspective on digital inequality and recommend that future research considers digital inequality as a multi-stage concept and shifts its efforts to exploring the so far less researched stages of ICT appropriation and ICT outcomes, in particular with respect to conceptualizing and measuring these constructs. I also call for research to use more diverse methods and data, to conduct more research that focuses on explaining and predicting theoretical contributions and to leverage existing theories from different disciplines more extensively. In other words, I suggest that research adopts a multi-level, multi-technology approach to studying digital inequality.

Keywords: Digital inequality, digital divide, information and communication technology, ICT appropriation, ICT use outcomes, review

1. Introduction

With the advent of the Internet, researchers started to debate the social repercussions of information communication technologies (ICT). Optimists predicted that ICTs and the Internet in particular would reduce societal disparities and enhance life chances by lowering information costs, creating opportunities to find jobs, opening up access to education, facilitating political participation and strengthening social networks (Anderson, Bikson, Law, & Mitchell, 1995; Bromley, 2004). At the same time researchers cautioned that ICTs could eventually increase social disparities because their benefits might accrue foremost to the privileged parts of society with earlier and better technology access, capital resources, and networks (DiMaggio et al., 2001). A decade later, we know that Internet-enabled ICTs in fact offer many of the opportunities Anderson predicted such as open online education, online job search and e-health programs. Yet, research has also shown that the possibility and ability to profit from ICTs is not equal for all individuals, a phenomenon that was termed ‘digital inequality’ (DiMaggio & Hargittai, 2001).

The phenomenon of digital inequality has received substantial research attention in particular from the field of information systems (IS) research which has mostly sought to explore the existence of digital inequality among individuals at several stages of the ICT adoption cycle and to identify its antecedents. IS research has shown that digital inequality exists with respect to ICT access and adoption (Hsieh et al., 2008; Niehaves & Plattfaut, 2014; Racherla & Mandviwalla, 2013) and can also be observed with respect to *how* ICTs are used (Sipior et al., 2011) and with respect to outcomes of ICT use (K.-K. Wei et al., 2011). For instance, Hsieh and colleagues (2008) explored the adoption behavior of Internet TVs and found that the socio-economically disadvantaged showed less intentions to use this technology continuously. Similarly, Wei and colleagues (2011) found that students with personal computer (PC) access at home had significantly better grades than those who did not. IS researchers have also studied the antecedents of digital inequality and found that in particular socio-demographic factors such as age (Agarwal et al., 2009; Brandtzæg, Heim, & Karahasanović, 2011) and socio-economic status (Venkatesh et al., 2014) demarcate the boundaries of digital inequality. They also built upon technology adoption models such as the Technology Acceptance Model (TAM) (Davis, 1989) or the Theory of Planned Behavior (Ajzen, 1991) to explain variations in technology use and adoption among individuals from different societal groups (Hsieh et al., 2008; Niehaves & Plattfaut, 2014).

Digital inequality has been studied not only by IS researchers but also by researchers from several other academic disciplines such as communication, public policy, economics, and sociology. For instance, scholars from the field of communication have taken a special interest in the matter of digital skills and have studied skills in the context of digital inequality from a much more differentiated perspective than commonly used in IS research (van Deursen & van Dijk, 2011; van Deursen, 2012). Scholars from the fields of economics and public policy have been particularly interested to understand the political contexts and economic factors that drive digital inequality and to identify measures to bridge digital gaps (Buys, Dasgupta, Thomas, & Wheeler, 2009; Chinn & Fairlie, 2007; Wallsten, 2005). Sociologists have mainly focused on understanding the underlying social structures and social repercussions of digital inequality such as social inclusion and cultural reproduction (Alam & Imran, 2015; Hargittai, 2006b; Kvasny, 2006).

Extant research on digital inequality in distinct disciplines, however, has evolved in a fairly non-integrated manner. As a consequence, digital inequality research currently lacks an overview that allows researchers to identify and focus on the most important issues in the field. In order to advance research on digital inequality, there is a need for an integrated perspective that comprehensively captures our current state of knowledge and that allows for identifying research gaps.

This paper seeks to inform researchers on the current state of digital inequality and to develop a substantial future research agenda, through a systematic review (Leidner & Kayworth, 2006; Tranfield, Denyer, & Smart, 2003; Webster & Watson, 2002) and critical analysis of the extant, interdisciplinary literature. The review aims at developing an integrated perspective on digital inequality and connecting insights from multiple otherwise separate academic disciplines. Given the rapid development of internet-enabled consumer technologies over the last decade, I also believe that it is time to scrutinize the direction in which digital inequality research is heading and to develop a research agenda by suggesting how we might learn more about what we do not yet know about digital inequality. This paper also seeks to provide policy makers with insights on the current state of academic knowledge on digital inequality.

This review is based on 439 reviewed journal articles and provides several findings and substantial implications for future digital inequality research. First, the review identifies a wide variety of topic areas relevant to digital inequality research and shows that digital inequality can be studied as a multi-stage concept, although few studies do so in a

comprehensive manner. This is problematic, because by focusing only on selected stages scholars risk neglecting relevant antecedents and limit the explanatory power of their findings if those cannot be related outcomes of ICT use. Second, the analysis reveals that research should shift its attention to the less researched fields of ICT appropriation and outcomes of ICT use to better reflect technological realities in developed countries and should work towards a common measurement and validated conceptualization of these constructs. This is crucial to ensure the comparability of results and to allow researchers to build upon the work of others Third, digital inequality research has not yet integrated recent developments in internet-enabled consumer technologies, in particular the rise of smartphones, which limits our understanding to an incomplete set of technologies. Fourth, the review shows that quantitative methods prevail that rely heavily on cross-sectional, official statistic data from developed countries which limits the generalizability and validity of findings. Fifth, digital inequality is mostly studied at the individual level, with less research on the country level and almost no research on the organizational level even though it entails important implications for organizations, in particular governmental institutions. I build on these findings to develop an integrated perspective on digital inequality and to line out research recommendations.

The paper is organized as follows. The first section provides a brief introduction to the phenomenon of digital inequality. The next section presents the methodological approach used to review the existing literature. Next, the article continues by discussing the findings from the literature review and by lining out the implications of these findings for future research on digital inequality. Finally, the paper concludes by developing an integrated perspective on digital inequality and a summary of recommendations as well as potential limitations of this study.

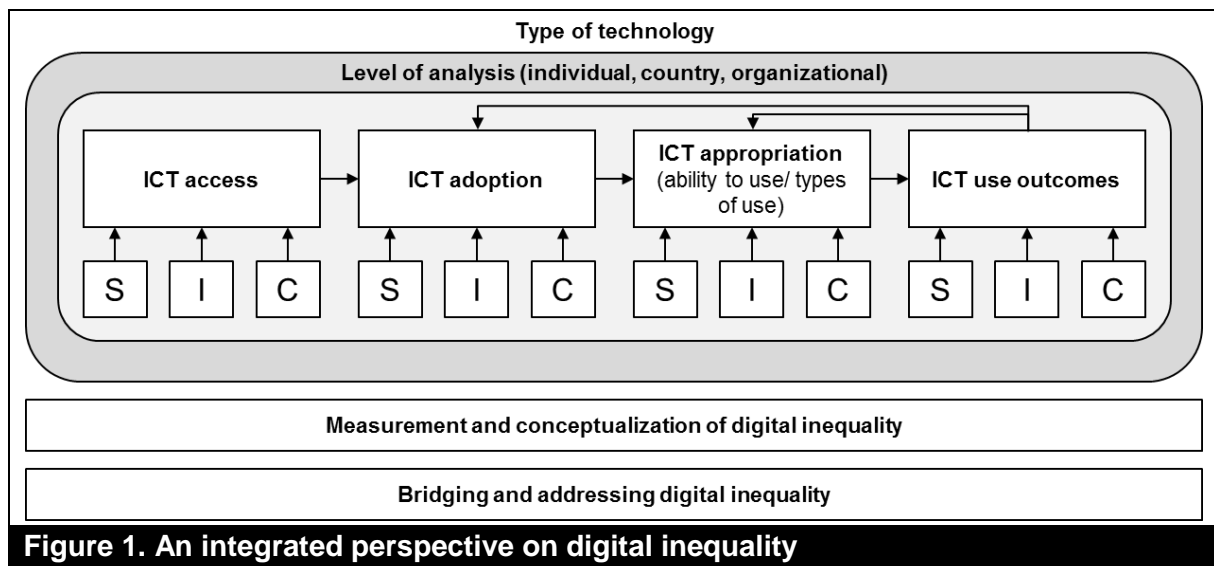
2. The phenomenon of digital inequality

A first challenge in conducting research on digital inequality is to arrive at a shared understanding of what is actually comprised by the phenomenon of digital inequality. Due to its multi-faceted nature and academic attention from many different disciplines, a myriad of perspectives on digital inequality have evolved. For instance, the Organization for Economic Cooperation and Development (OECD) defines the term “digital divide” as “the gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard to both their opportunities to access ICTs and to their use of the Internet for a wide variety of activities” (OECD, 2006) while others conceptualize it merely as individual

differences in Internet access and adoption (e.g., Agarwal et al., 2009; van Dijk & Hacker, 2003). Even though there are many definitions of digital inequality, there is little variance in the elements of the definitions which typically include the level of digital inequality, the focal technology and who is affected.

To cope with this challenge, I structured the disparate streams of digital inequality literature into an integrated perspective that is presented in Figure 1. The framework adopts a multi-stage perspective on digital inequality and looks at the frame conditions of the phenomenon. It will be used throughout the review to categorize the literature and to guide the critical analysis of extant research on digital inequality. A large part of research has focused on the often so-called first-level digital divide which relates to differences in ICT access and adoption (e.g., Agarwal et al., 2009; Hsieh et al., 2008; Niehaves & Plattfaut, 2014; Racherla & Mandviwalla, 2013). Others have focused on the second level of digital inequality which is concerned with the appropriation of ICTs, i.e. how ICTs are used and to which degree the user is capable of using them (e.g., Riggins & Dewan, 2005; Hargittai & Hinnant, 2008; Sipior, Ward, & Connolly, 2011; van Deursen & van Dijk, 2014; Venkatesh et al., 2014). The third and least researched level of digital inequality is concerned with the experienced outcomes of ICT use (DiMaggio & Bonikowski, 2008; Venkatesh & Sykes, 2013). Researchers mostly seek to identify which socio-demographic (S) and further individual factors (I), and which contextual factors (C) influence digital inequality on each level. Digital inequality has been also researched considering several types of technologies such as personal computers (e.g., Wei et al., 2011), the Internet (e.g., Hargittai, 2006), fixed line telephones (e.g., Hilbert, 2011), mobile phones (e.g., Kauffman & Techatassanasoontorn, 2005) and different Internet applications (e.g., Venkatesh et al., 2014) such as e-commerce, e-government or e-health.

Digital inequality can be observed on different levels of analysis: the individual level, the organizational level and the country level (Riggins & Dewan, 2005). On the individual level several socio-demographic groups defined by factors such as age, gender, education, income, socio-economic status or ethnicity have been found to be affected by digital inequality (e.g., Hsieh, Rai, & Keil, 2011; Meneses & Mominó, 2010; Niehaves & Plattfaut, 2014). On the organizational level research has mostly focused on differences between smaller and larger companies and private and non-governmental organizations (NGO) (e.g., Arbore & Ordanini, 2006; Wielicki & Arendt, 2010) while research on the country level has focused on differences between both developed and developing countries and countries within the same development stage (Cruz-Jesus, Oliveira, & Bacao, 2012; Schleife, 2010).



S=Socio-demographic factors, I=Individual factors excluding socio-demographics, C=Contextual factors

In addition to researching the existence and the determinants of digital inequality with regard to different stages, technologies and levels of analysis, other streams of research have focused on developing and testing ways to measure digital inequality (e.g., Corrocher & Ordanini, 2002; Hilbert, 2014) and on exploring how to bridge it (e.g., Kvasny & Keil, 2006; Srivastava & Shainesh, 2015). Research on measuring digital inequality has been primarily concerned with the development, testing and methodological analysis of measures, in particular indices (Bruno, Esposito, Genovese, & Gwebu, 2011; Vehovar, Sicherl, Hüsing, & Dolnicar, 2006). Research on bridging digital inequality mainly studies how digital gaps between countries or individual can be decreased and particularly focuses on the role of governmental institutions in designing policies and implementing ICT initiatives (P. N. Howard & Mazaheri, 2009; Hsieh, Keil, Holmström, & Kvasny, 2012).

3. Literature review methodology

In order to explore the phenomenon of digital inequality in the sociology, communication and information systems research, I conducted a systematic, in-depth review of the literature. The review follows the fundamental methodological guidelines for conducting a systematic literature review advocated by Leidner and Kayworth (2006), Webster and Watson (2002), and Tranfield and colleagues (2003). These guidelines require the specification of criteria and a systematic search strategy in order to ensure the replicability of the review and the inclusion of relevant articles. They further require the outlining of an analysis scheme to allow for a systematic coding of the findings.

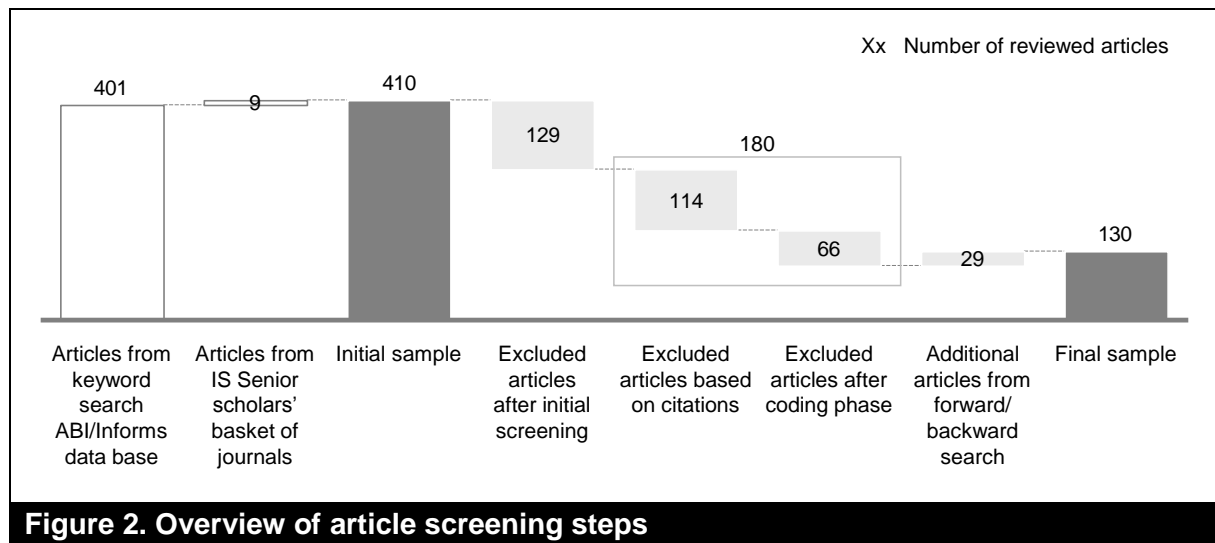
In the first stage of the literature review, I performed a criteria-specific, structured literature search using the ABI/Inform data base. Journal articles were required to meet several criteria. Only those articles were included in the literature review that were published in peer-reviewed journals between 2000 and 2015, written in English, and comprised *digital inequality* or *digital divide* as key constructs in their title, abstract or keywords. Based on these criteria, the search yielded 401 articles relating to digital inequality or the digital divide. As common with systematic literature reviews, this approach constitutes a conscious trade-off between the comprehensiveness of the search results on the one hand, and replicability and relevance on the other hand (Webster & Watson, 2002). Given that information systems research is an interdisciplinary research field, the search was conducted concept-centric and as such also included journals from related research fields such as sociology and communications (Webster & Watson, 2002). To make sure that all relevant articles published in leading information systems journals were included, an additional search was performed for the Association for Information Systems Senior Scholars' basket (Bélanger & Carter, 2012) including the *European Journal of Information Systems*, *Information Systems Journal*, *Information Systems Research*, *Journal of the Association for Information Systems*, *Journal of Information Technology*, *Journal of Management Information Systems*, *Journal of Strategic Information Systems*, and *MIS Quarterly*. The search yielded additional 9 papers previously not identified by the database search. In a preliminary screening all articles were excluded which were book reviews, conference proceedings, editorial prefaces, commentaries or opinion pieces. Articles that did not focus on digital inequality or the digital divide but on topics as diverse as ethics, tourism, infrastructure, trolling, laws or pedagogics, were also excluded. In total, 129 articles were excluded.

The remaining 281 articles were analyzed for in-depth coding. Several frameworks and perspectives were applied to structure and analyze the extant literature. First, I categorized the literature by topic area adapting a multi-stage view on digital inequality as advocated by Wei and colleagues (2011). Second, following Riggins and Dewan (2005), a structural analysis was conducted to categorize the literature based on the level of analysis. Third, a technology-centric perspective was applied to the digital inequality literature. Fourth, a detailed analysis of the methodological spectrum in digital inequality research was performed. And fifth, a review of theoretical perspectives on digital inequality was conducted and Gregor's (2006) framework of theory classification in information systems research was used to assess the theoretical contributions of digital inequality research. Each article was coded based on these

dimensions. Details of the in-depth coding results can be found in Appendix C-E and will be discussed in the following sections.

After in-depth coding, an additional 180 articles were excluded. Similar to the approach of Bélanger and Carter (2012), I excluded all papers published between 2000 and 2012 with less than 20 Google Scholar citations² to ensure an appropriate level of research quality and academic relevance. To account for the time lag of citations for recently published articles, in 2013 the limit for exclusion was set to at least 10 Google Scholar citations and no limit was applied for articles published in 2014 and 2015. Additionally, articles were removed from the list that were book reviews, commentaries or opinion pieces, working papers or editorial prefaces not previously identified and those that were published more than once, only contained table of contents or were not focused on digital inequality or the digital divide.

In the second stage of the literature search, I identified additional 29 papers through forward and backward search (Webster & Watson, 2002) based on the previously coded articles and applied the same coding procedures described above. Overall, I reviewed 439 articles resulting in 130 coded articles. Details on the total coded sample are presented in Appendix C-E. The complete steps of article screening are presented in Figure 2.



² I acknowledge that this approach constitutes a trade-off between comprehensiveness and relevance, that researchers have to face when conducting a literature review (Webster & Watson, 2002). For articles excluded based on the number of citations, an additional content screening confirmed that these did mostly not introduce new concepts but rather reconfirmed and applied those concepts developed in the more highly cited articles.

4. Findings

The review yielded several important insights about the state of digital inequality research. In the following sections, the findings of the literature review are discussed and their implications for digital inequality research are lined out.

4.1 Topics in digital inequality research

Scholars have studied digital inequality applying different lenses and discussing a wide variety of topics. As presented in Figure 3, six main topic areas emerged from the analysis, each covering a range of subtopics: ICT access, ICT adoption, ICT appropriation, ICT use outcomes, measurement of digital inequality and bridging digital inequality. A full list of topic areas in digital inequality is presented in Appendix A. Figure 3 also shows that some topics appear more often in journal articles than others. In the next sections I briefly discuss the most important findings in each of the main topic areas. Digital inequality with regard to ICT access and ICT adoption will be discussed jointly since both taken together have been framed to constitute the first-order digital inequality (Riggins & Dewan, 2005) and typically articles focusing on ICT adoption necessarily also address the issue of ICT access.

Topic areas in digital inequality research	No. of published articles	Exemplary subtopics	Most highly cited articles (Google scholar citations')
DI and ICT access	10	<ul style="list-style-type: none"> Socio-demographic determinants of DI Social influence and DI Institutional factors and ICT access 	Oyelaran-Oyeyinka & Lal (2005) James & Versteeg (2007) Wallsten (2005)
DI and ICT adoption	38	<ul style="list-style-type: none"> E-commerce adoption Self-efficacy and internet use Technology acceptance and internet use 	Eastin & LaRose (2000) Livingstone & Helsper (2007) Chinn & Fairlie (2007)
DI and ICT appropriation	35	<ul style="list-style-type: none"> Types and breadth of online activities Online health information seeking Digital literacy and skills 	Hargittai (2002) Hargittai (2007) Bonfadelli (2002)
DI and ICT use outcomes	14	<ul style="list-style-type: none"> Educational outcomes of ICT use Benefits of e-health solutions Economic outcomes of ICT use 	DiMaggio & Bonikowski (2008) Judge et al. (2006) Baye et al. (2003)
Bridging DI	14	<ul style="list-style-type: none"> Governmental policies and interventions Success factors of ICT interventions ICT as a tool to bridge disparities 	Kvasny & Keil (2006) Kvasny (2006) Buys et al. (2009)
Measurement of DI	9	<ul style="list-style-type: none"> Methodological analysis of indices Selection of measures and factor composition of indices 	Barzilai-Nahon (2006) Jung et al. (2001) Corrocher & Ordanini (2002)
Other DI topics	10	<ul style="list-style-type: none"> Information capitalism Social embeddedness of technology E-commerce and customer segmentation 	DiMaggio et al. (2001) Van Dijk & Hacker (2003) Selwyn (2004)
Σ=130			

Figure 3. Reviewed articles on digital inequality per topic area

*Citations as retrieved in August 2015; a list of the 25 most highly cited articles is presented in Appendix B
 DI=Digital inequality

4.1.1 Digital inequality and ICT access and adoption

Research on digital inequality in this area mainly seeks to explore the existence of systematic differences in ICT access and adoption among individuals, organizations, and countries and to identify the determinants of these differences. Findings suggest that a range of socio-demographic factors influences ICT access and adoption. In particular, age and socio-economic status have been found to impact ICT access and adoption, while for gender and age the effect remains unclear.

Age was found to influence the likelihood of having access to and using the Internet and mobile phones (Boase, 2010; Chen, 2013; Rice & Katz, 2003; Schleife, 2010). For instance, Niehaves and Plattfaut (2014) showed that particularly senior citizens perceived the Internet to be of limited usefulness which made them less likely to adopt it. Similarly, Lam and Lee (2006) found that the outcome expectations of Internet use were lower for older age groups and that lower self-efficacy was an additional encumbrance for them. Additionally, results suggest that a higher level of income and education positively influences the likelihood of having access to and using ICT (Goldfarb & Prince, 2008; Hsieh et al., 2011; Livingstone & Helsper, 2007). The most commonly expressed explanation is that restrictions on ICT access as well as a lack of ICT skills account for the differences in ICT adoption (Livingstone & Helsper, 2009).

Further, research shows contradictory findings for the effects of gender and race on ICT access and adoption. While some studies find that typically male whites are more likely to have access to and to adopt ICTs (D. L. Hoffman, Novak, & Schlosser, 2006; Meneses & Mominó, 2010), others find reverse effects (Wareham, Levy, & Shi, 2004) or that these effects disappear once other variables like age or income are controlled for (LaRose, Gregg, Strover, Straubhaar, & Carpenter, 2007; Rice & Katz, 2003). Additionally, it has to be noticed that many of the studies use data from before 2005 making the validity of the results questionable.

Given the high ICT penetration rates in developed countries, researchers might rather want to focus on resolving contradictory findings and understanding the socio-economic determinants of ICT access and adoption for societal groups that still seem to profit from these findings. In particular, better understanding why many senior citizens do not adopt the Internet and how they could be motivated to do so might be crucial to ensure that during the next 30 years a part of the aging population in developed countries will not be 'digitally excluded' from

society. They should further focus on testing what we have learned from research in developed countries in developing countries where inequalities with regard to ICT access and use are currently much more relevant.

While many studies focus mainly on a socio-demographic perspective, some studies apply theoretical lenses and constructs stemming from social cognitive theories to explore why differences in ICT access and adoption between individuals exist. For instance, Hsieh and colleagues (2008) applied the theory of planned behavior to study the Internet adoption behavior in an American community and found that differences in Internet adoption between advantaged and disadvantaged socio-economic groups could be explained by differences in hedonic outcome expectations and perceived control beliefs. Similarly, Brown and Licker (2003) drew from technology acceptance theory to explore differences in Internet usage between historically advantaged and disadvantaged groups in South Africa and found that the disadvantaged group was motivated mainly by perceived usefulness and used the Internet less because of less experience and exposure to the technology. Another stream of research focuses on different forms of social influence to explain variations in Internet use. For example, Agarwal and colleagues (2009) took a network perspective on social influence to explain that peer effects influence the individual choice to adapt the Internet. And, drawing on capital theory, Hsieh and colleagues (2011) showed the importance of that social capital resources for ICT adoption. Surprisingly, overall, relatively few studies build on these rich and well-researched theoretical perspectives from the field of general technology acceptance IS research. Given that these theories also capture the social and cultural contexts of individuals they might serve as a particularly insightful lens to study digital inequality in developing countries and might help to explain why people do not adopt ICTs.

Several studies also compare ICT access and adoption between different countries. Researchers typically seek to identify the state and the determinants of cross-country digital inequality differences and often build on technology diffusion theory to predict a country's ICT adoption development (e.g., Billon et al., 2009; Crenshaw & Robison, 2006; Kauffman & Techatassanasoontorn, 2005). Generally, disparities in ICT penetration can not only be observed between developing and developed countries (Dewan, Ganley, & Kraemer, 2010) but also within groups of similar country clusters like the European Union (Cruz-Jesus et al., 2012). Findings suggest that a range of economic variables like GDP, level of education or illiteracy, demographic variables like population age or urbanization rate, infrastructure indicators like the density of Internet host, cost factors like broadband prices, and

governmental regulation can influence Internet penetration on the macro-level (Bagchi, 2005; Chinn & Fairlie, 2007; Dewan, Ganley, & Kraemer, 2005). For instance, Hilbert (2010) modeled ICT access price scenarios and found that ICT prices would need to be reduced to 4% of current prices to match the income realities of the poorer population of several Latin American countries. Research should continue to test the findings for generalizability, in particular in a developing country context.

4.1.2 Digital inequality and ICT appropriation

This area of research typically studies how individuals appropriate and are capable of appropriating ICTs, in particular the Internet and its applications. Particularly two streams of research have emerged in this field. The first one focuses on exploring how individuals use the Internet for different online activities. The second one focuses on digital skills and their impact on ICT use and activities.

Research has studied how individuals use the internet exploring different online activities such as content creation and sharing (Brake, 2014; Hargittai & Walejko, 2008; Hargittai, 2007), e-commerce (Akhter, 2003), e-government and e-politics (Bélanger & Carter, 2009; Venkatesh et al., 2014), online health information seeking (Y.-M. Kim, 2015; Rains, 2008) and online job seeking (Lindsay, 2005). Several researchers do not focus on one particular online activity but explore systematic differences in the types and breadth of online activities (e.g., Brandtzæg, Heim, & Karahasanović, 2011; Pearce & Rice, 2013; Selwyn, Gorard, & Furlong, 2005). Results show that younger, better educated, higher income individuals exhibit a higher likelihood to shop online, to seek online for health information, to engage in online content creation, to seek for jobs online and to use e-government services (Akhter, 2003; Brake, 2014; Hale, Cotten, Drentea, & Goldner, 2010; Lindsay, 2005; Sipior et al., 2011). Further, findings suggest that more privileged individuals tend to engage more in “capital-enhancing” online activities (Zillien & Hargittai, 2009) as opposed to entertainment activities (Bonfadelli 2002). By applying a multi-modality perspective Wei (2012) also found that these individuals showed less modes of Internet activities and that the activities they performed were less advanced and of a more basic nature.

As the review reveals, the majority of research in this area focuses intensively on identifying socio-demographic determinants that indicate which group of individuals might not be profiting equally from online opportunities. While it is important to identify *who* is appropriating the Internet in which way, it is also crucial to understand *why* this happens.

Some studies are starting to explore the reasons for systematic differences in online activities. For example, Venkatesh and colleagues (2014) found that personality characteristics played a very important role when studying e-government service appropriation in rural India. Similarly, Sipior et al. (2011) found that income level, employment status and educational level mainly influenced the perceived access barriers and perceived ease of use of e-government services. Further studies are needed to understand *why* certain groups of individuals do not engage with certain online activities. Additionally, more research is needed to define which online activities actually enhance life chances and merit further academic attention. While some researchers from the field of communication have started to map and classify online activities (van Deursen & van Dijk, 2014) or sought to define what constitutes “efficient use” (Chen, 2015), a common frame and understanding of online activities relevant for the debate on digital inequality is still missing.

The second stream of research in the field of digital inequality and ICT appropriation considers digital skills as a central driver of differences in how ICTs are used. Van Deursen and van Dijk (2010) classified Internet skills into medium-related skills and content-related skills. Medium-related Internet skills comprise operational skills such as executing search operations and formal skills such as maintaining a sense of orientation when navigating online. Content-related Internet skills comprise information skills such as choosing a website or search system to seek information and strategic skills such as taking the right action to reach a certain goal. Findings suggest that in particular the educational background and age influence digital skills (Hargittai, 2002, 2006b). For example, van Deursen (2012) used performance tests to measure the skill level of Dutch participants and found that while education had a positive effect on all skill categories, age only had an influence on operational skills. Similar results were obtained in a study among Italian high school students (Gui & Argentin, 2011). Research also shows that digital skills can have a mediating role between socio-demographic determinants and the uptake of online risks and opportunities (Livingstone & Helsper, 2009).

While all of these are interesting aspects of digital skills and ICT appropriation, most studies explore this topic in isolation without incorporating alternative explanations and consequences of a lack of digital skills. For example, Hargittai (2006a) shows that there is a gap in actual and perceived Internet skill levels especially for female users. This implies that not digital skill levels alone but also factors like the self-efficacy to apply these skills or the social support needed to believe in one’s own skills might eventually decide about how well

an individual can appropriate a technology. Researchers should incorporate insights from communication research on digital skills with insights on external, motivational and psychological factors to work towards a more comprehensive understanding of the cognitive processes underlying ICT appropriation.

4.1.3 Digital inequality and ICT use outcomes

While the majority of digital inequality research assumes that the outcomes of ICT use will be beneficial only few researchers have so far sought to explore if that is actually the case by focusing on or at least considering the outcomes of ICT use. This is striking given that the manifestation of differences in ICT use outcomes ultimately defines if digital inequality translates into inequality in 'real' life. ICT use outcomes studied include academic achievement (Judge, Puckett, & Bell, 2006; Wei et al., 2011), economic outcomes (Baye, Morgan, & Scholten, 2003; DiMaggio & Bonikowski, 2008; Goode, 2010; Venkatesh & Sykes, 2013), health outcomes (Chen, Lee, Straubhaar, & Spence, 2014; Shaw et al., 2006) and social outcomes (Hampton, 2010). Findings suggest that ICT use and in particular the use of the Internet and certain online applications can have a beneficial impact on an individual's well-being and life chances. For instance, Wei and colleagues (2011) found that children from poorer backgrounds had fewer opportunities to use PCs at home or at schools and achieved worse grades than their more privileged counterparts. Furthermore, Shaw et al. (2006) studied the impact of an e-health program for breast cancer patients and found that e-health participants scored higher on social support and information competence and exhibited reduced levels of negative emotions.

Despite these very important insights, digital inequality research to date only touches upon single aspects of ICT use outcomes and the field remains highly unexplored. More studies are needed to explore and understand how ICT use actually materializes in outcomes. In line with Wei and colleagues (2011) researchers should seek to rule out alternative explanations for ICT use outcomes by considering the full ICT adoption cycle starting from ICT access in their studies. Additionally, we lack research on outcomes of Internet applications with potentially highly relevant real life implications such online job search and e-learning. Furthermore, research in the area of digital inequality is skewed towards the potential positive outcomes of ICT use while negative outcomes like escapism, stress or information overload have so far not been considered. Researchers and practitioners alike would profit from gaining a better understanding of how to avoid the potential negative outcomes of ICT use.

4.1.4 Bridging digital inequality

This area of research typically studies how digital gaps between countries or individuals can be bridged. Many studies focus on the role of governments in bridging digital inequality through governmental policies and interventions. Researchers emphasize that particularly in developing countries active governmental intervention with regard to digital infrastructure, institutions, encouragement of entrepreneurship, and provision of resources and support is needed to reduce digital inequality (Mistry, 2005). Besides highlighting the need for capital intensive interventions like broadband deployment (Wilhelm, 2003), several studies also emphasize the importance of the policy environment. For instance, Buys and colleagues (2009) studied the cell phone coverage in 44 sub-Saharan countries and found that by improving competition policies cell phone coverage could be doubled. Similarly, Hawkins and Hawkins (2003) studied digital inequality in 19 Latin American countries and found that introducing policies that favored flat price dialing schemes had the most influence on Internet use.

There are, however, some contradictory findings. While some researchers postulate market liberalization as a key instrument to bridge digital gaps (Hawkins & Hawkins, 2003), others find that regulatory withdrawal in fact exacerbates digital inequality and that an independent regulator might create the best policy environment (Howard & Mazaheri, 2009). A potential explanation could be the unique cultural, socio-economic and regulatory situation in different developing countries (Lachman, Nedd, & Hinings, 1994). More research is needed to understand which factors impact the influential power of policies in different cultural environments. Furthermore, researchers might want to not only investigate governmental policies and interventions in developing countries by analyzing large sets of countries but might seek to identify the successful cases in the developing as well as in the developed world and to explain these positive deviations.

Many researchers also aim to explore and understand the success factors of the implementation of ICT initiatives. Most studies in this area conduct ex-post analyses to investigate the reasons for success and failure of municipal or community ICT initiatives (e.g., Simpson, Daws, & Pini, 2004). For example, Rao (2003) studied 6 ICT initiatives in rural India and developed a catalogue of practical actions for increasing the probability of initiative success which included developing the projects in the local language, building on low-cost and sharable ICT solutions, ensuring ownership and participation by the community,

and using innovative ICTs and public access points. Others employed different theoretical lenses to understand ICT initiative failure and success. For instance, O'Neil and Baker (2003) explored the role of institutional motivation and found that in particular change agents and their ability to draw upon resources inside and outside of the project was important for initiative success. Furthermore, Hsieh and colleagues (2012) conducted a 3-year investigation of an Internet TV initiative in the United States by employing actor-network theory and found that one of the main reasons for initiative failure was that the translation process between initiators and participants – comprising problematization, interessement, enrollment and mobilization – stopped. These results show that many difficulties of ICT initiative implementations may in fact originate in the social system of the different stakeholders involved.

While extant research offers some interesting insights into why many ICT initiatives fail, more studies are needed to deepen our theoretical understanding of the complex (social) dynamics underlying ICT initiative design, initiation, implementation and maintenance (Warschauer, 2004). Furthermore, findings suggest that ICT initiatives are often successful in the provision of ICT access and literacy, however, they fail to mitigate digital inequality because there is “no mechanism to go to the next step” (Kvasny & Keil, 2006), i.e. there is no linkage that ensures the benefits of ICT use outcomes. Researchers should seek to apply a more holistic approach when investigating ICT access incorporating the actual “real life” ICT use outcomes. Researchers might also support practitioners in the field of initiative design by conceptually developing and testing ICT initiatives that account for the complete ICT adoption cycle from ICT access to ICT use outcomes.

4.1.5 Measurement of digital inequality

Research on measurement of digital inequality is mainly concerned with the development and the methodological analysis of digital inequality measures and primarily focuses on the country-level. In particular, cross-country comparisons are often performed by introducing composite indices that are calculated by aggregating individual indicators. Interestingly, most of the indices used have been introduced by organizations and institutions such as the International Telecommunication Union (ITU) that developed the Information Development Index (IDI), the ICT Opportunity Index (ICT-OI) and the Digital Access Index (DAI).

Typically, these indices as well as those developed by academic research, differ with regard to the number of indicators, the type of indicators and the aggregation method. Indices often

comprise indicators from the areas of socio-demography, infrastructure, technology diffusion, technology use, affordability, markets, competition, and governmental constraints (Barzilai-Nahon, 2006; Corrocher & Ordanini, 2002). Applying synthetic composite indices can generally help to summarize a complex and multi-layered phenomenon and can make it easier to compare and assess the progress of a country over time (Saisana & Tarantola, 2002). However, the extant indices to measure digital inequality have been criticized due to several reasons. From a methodological point of view, research has pointed out that data standardization and normalization leads to biased results (Menou & Taylor, 2006). It has also been criticized that many of the indices use too many factors, making data collection difficult and leading to missing values (Braithwaite, 2007). In particular, Bruno and colleagues (2011) employed principal component analysis and showed that composite indices often comprise redundant indicators and that the number of indicators can be reduced without losing explanatory power. Researchers should make use of statistical tools such as multivariate analysis to better understand interactions among individual indicators in order to avoid redundancies (Vehovar et al., 2006).

From a conceptual point of view, the selection of individual indicators still seems to lack a sound theoretical foundation. The selection is often subjective and follows no systematic weighting procedure (Bruno et al., 2011). Additionally, some researchers have argued that individual factors commonly used in digital inequality indices may not constitute meaningful measure in a developing country context. For instance, measuring technology use and access by relying on subscription statistics might lead to misleading results in developing countries where technology is often used collectively (James, 2005). More studies are needed to focus on the conceptual elaboration of index factor selection and weighting that take into account different contexts and recent developments in how technologies are used.

While a large variety of digital inequality measures exists at the individual level (Figure 4), there seems to be no active academic discussion or dedicated research on whether these are the right measures or whether these measures are sufficient to collectively describe the phenomenon of digital inequality. While measuring digital inequality on the level of ICT access and adoption seems straightforward, measuring it on the level of ICT appropriation and ICT use outcomes is less self-explanatory. Research would profit from studies that seek to capture the phenomenon of digital inequality on the level of ICT appropriation and ICT use outcomes more completely to make results more comparable and to be more comprehensive in the inferred implications. The conceptualization and measurement development of

constructs such as efficient use or ICT use outcomes could be promising future research avenues.

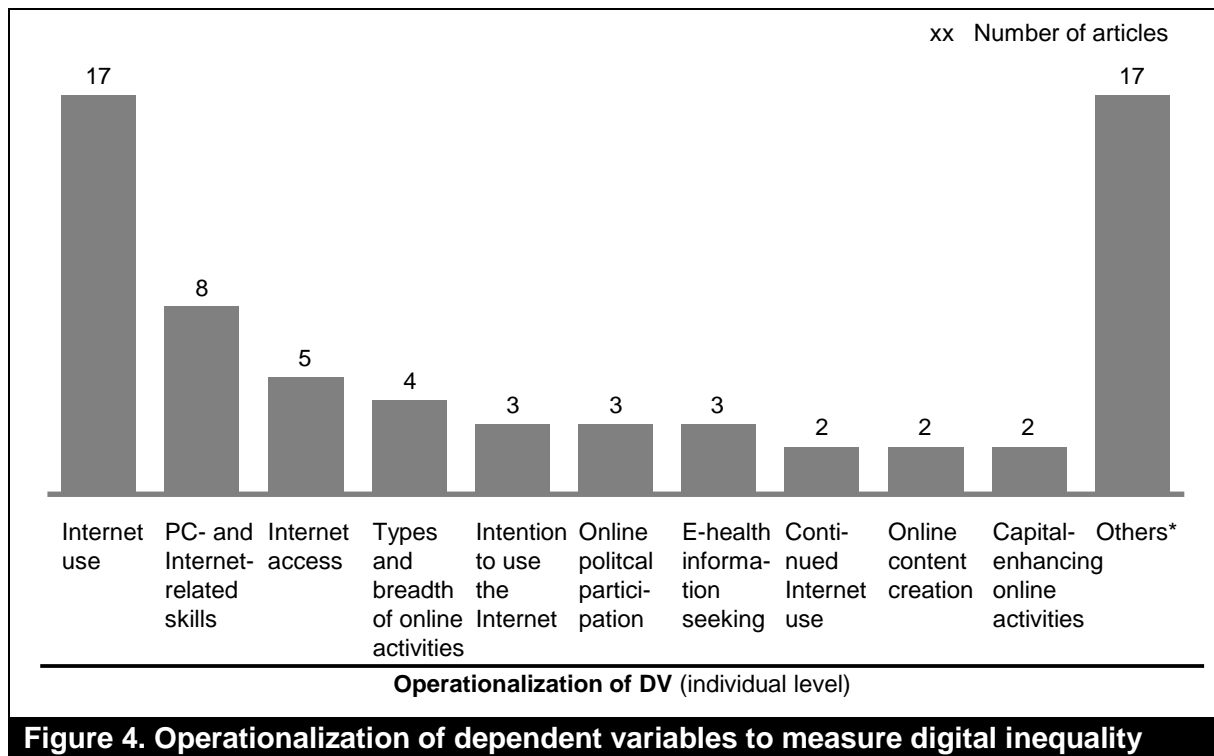


Figure 4. Operationalization of dependent variables to measure digital inequality

*Others includes all dependent variables that were operationalized in only one article, specifically: Academic achievement, digital choice/exclusion, collective efficacy, earnings, e-government adoption, internet self-efficacy, internet training, knowledge, mistake-free information seeking, online economic activity, online job seeking, size and composition of health information repertoires, social network sites use, internet skills (self-assessed), mobile phone use, PC use, uptake of online risks/opportunities

4.2 Structural view of digital inequality

I also classified the extant literature on digital inequality based on a structural view, i.e. levels of analysis as presented in Appendix C and summarized in Table 1. Riggins and Dewan (2005) identified three levels of digital inequality: the individual level, the country level and the organizational level. This classification by level of analysis serves as a starting point to analyze the conceptualization of digital inequality in various research disciplines. The review reveals two interesting findings: First, the phenomenon of digital inequality has been studied at various structural levels, even though most studies focus on the individual level of analysis. Second, results show that digital inequality has rarely been conceptualized and researched on the organizational level, even though digital inequality has important implications for both private organizations and government institutions.

As Table 1 reveals, most of the research – more than 60 percent - has conceptualized digital inequality on the individual level, in particular research on ICT adoption, appropriation and

ICT use outcomes. This is not surprising given that it is easier to gain access to or to collect and analyze large sample size data on the individual level in particular through national or self-developed surveys. Furthermore, digital inequality originates from the individual ability and decision to adopt and use a technology. As such research focusing particularly on technology adoption naturally conceptualizes digital inequality as an individual level construct. For example, when most people think about motivations to use a technology, it is at the individual level.

Table 1. Summary of topics per level of analysis in digital inequality research

Main topic areas	Level of analysis*		
	Individual	(Cross-) Country	Organizational
ICT access	2	8	-
ICT adoption	25	9	4
ICT appropriation	33	2	-
ICT use outcomes	13	1	-
Bridging DI	5	9	-
Measurement of DI	2	8	-
Total	80	37	4

*Five articles are counted more than once because they cover more than one level of analysis, in particular conceptual articles on digital inequality frameworks.

This does not mean that there are no further avenues for future research on digital inequality at the individual level. Clearly, there is a lack of research that considers the whole technology adoption cycle from ICT access to ICT use outcomes that particularly takes into account what influences and moderates the transition from ICT adoption to ICT appropriation to ICT use outcomes. In addition, as pointed out in the previous section there is a need to deepen our methodological and theoretical understanding of digital inequality metrics at the individual level; especially with respect to ICT appropriation and ICT use outcomes. Furthermore, researchers might seek to better understand the social dynamics influencing in particular the attempts to bridge digital inequality. Still, given the large amount of research on digital inequality at the individual level for most of the topic areas, the remaining discussion will focus on how digital inequality can be studied at the country and the organizational level.

An interesting finding from Table 1 is that almost no research has been done on the organizational level and that existing research focuses only on ICT adoption. The focus on studies in the area of ICT adoption might be the result of easier access to the data (official statistics and data bases). Research in this field has focused on the ability of small and medium sized enterprises (SMEs) or NGOs to adopt the Internet and found that sufficient IT

funds, organization size and IT strategy played an important role for Internet adoption (Arbore & Ordanini, 2006; Forman, 2005; Mercer, 2004). Wielicki and Arendt (2010) also found that for SMEs ICT implementation barriers have recently shifted more towards knowledge, education and information system planning.

It is not surprising that there has been no new research on ICT adoption on the organizational level since 2010 because Internet adoption is no longer a choice for SMEs or NGOs but a necessary requirement to survive and to be successful in today's economy; however, it is quite striking that none of the other areas has so far received academic attention. For instance, in particular in the context of growing online and offline self-service technologies (SSTs) companies should be interested in understanding how digital inequality effects the successful implementation and expansion of these technologies. SSTs are "technological interfaces that enable customers to produce a service independent of direct service employee involvement" (Meuter, Ostrom, Roundtree, & Bitner, 2000, p. 50). Researchers should explore whether and how companies could extend their customer base to those who are less technology savvy and might even be excluded from certain services if they are only delivered via SSTs. For example, researchers could contribute to better understanding the design implications in the context of marketing to the growing customer group of senior citizens.

Companies can also play an essential role in closing digital gaps, for instance by funding ICT initiatives through their corporate social responsibility programs (Venkatesh & Sykes, 2013). Digital inequality researchers could study how private companies could best deploy their financial resources to bridge digital gaps apart from indirect financial support, for instance by developing technology solutions particularly for those people who are digitally excluded. What can we learn from successful and less successful private company driven technology initiatives? Furthermore, companies may have to deal with digital inequality among their own employees – in particular between younger and older employees – which might eventually translate into a less motivated and less productive employee base. Future studies at the organizational level should explore how companies facilitate the transition of non-digital to digital work with a given work base and which role organizational culture plays in such a transition.

A further area for additional research at the organizational level is the role of governmental institutions. Research has shown that social influence can play an important role in the context of digital inequality (Agarwal et al., 2009; Chen, 2013) and it is acknowledged that the role of

schools, e.g. in the context of digital education, or the role of governmental institutions, e.g. in the context of ICT initiatives, is essential (Hsieh et al., 2011; Venkatesh & Sykes, 2013). Future researchers should build on these insights and further investigate how institutions can best influence digital inequality. For instance, we know little about how the technology affinity or other characteristics of governmental institution employees influences ICT initiative success or the provision of e-government services. It would also be interesting to better understand how governmental institutions could most effectively deploy their limited human and financial resources, i.e. which forms of support and influencing are most promising in closing digital gaps.

At the country level of analysis, most research concentrates on two main approaches to study digital inequality. First, many studies compare the state of digital inequality between countries with most studies focusing on ICT access and adoption (Crenshaw & Robison, 2006; Ramlal & Watson, 2014; Vicente Cuervo & López Menéndez, 2006). Many researchers also focus on conceptualizing and testing measures of digital inequality, to ensure that the phenomenon is fully captured and cross-country comparisons are feasible (Bruno et al., 2011; Hilbert, 2014). Second, another stream of research focuses on the design and effectiveness of policies on the national level which aim at bridging digital inequality (Buys et al., 2009; P. N. Howard & Mazaheri, 2009).

More studies on digital inequality should be conducted at the country-level. In particular, researchers should explore whether what we have learned in the context of one country is transferable to another country. For example, researchers might want to investigate similarities and differences in governmental policy contexts. What are barriers that prevent policies from showing positive results in one country even though the policies worked well in a different country? Which dimensions of cultural differences (Hofstede, 1991) affect the effectiveness of digital inequality policies? This is particularly important in the context of developing countries which are currently facing the same issues that were addressed in developed countries one or two decades ago. Furthermore, findings suggest that depending on the chosen measurement of digital inequality the results and implications for countries differ extremely (Vehovar et al., 2006). To gain richer insights, researchers might want to investigate how countries perform with respect to digital inequality if it is measured at the ICT appropriation or the ICT use outcome level.

4.3 Digital inequality and technology

The classification of extant literature on digital inequality based on the focal technology of the study reveals two interesting findings. First, it shows that research mainly considered five focal technologies as summarized in Table 2: personal computers, the Internet, mobile phones, fixed line telephones and distinct Internet applications. Second, one of the most interesting findings from the review is that almost no research has so far explored digital inequality considering the omni-present smartphone technology.

As Table 2 presents, academic attention has been shifting away from personal computers and fixed line telephones and has been focusing on the Internet in general (e.g., Hsieh et al., 2008) or specific Internet applications such as e-health, e-government services or e-learning (e.g., Eynon & Helsper, 2010; Shaw et al., 2006; Sipior et al., 2011). As mentioned previously, despite the large number of studies that focus on Internet applications, more research is needed to better conceptualize the measurement of digital inequality in particular at the level of appropriation and use outcomes of Internet applications. Researchers might also seek to gain a deeper understanding of how creating awareness and teaching or facilitating the use of certain Internet applications could be helpful in bridging digital inequality.

Table 2. Summary of focal technologies per topic area in digital inequality research

Main topic areas	Focal technology*				
	Computer	Internet	Mobile phones	Fixed line	Internet applications
ICT access	5	8	6	3	-
ICT adoption	6	34	4	1	4
ICT appropriation	2	34	2	-	27
ICT use outcomes	4	10	2	-	5
Bridging DI	6	11	2	-	-
Measurement of DI	3	6	3	2	-
Total	26	103	19	6	36

*41 articles are counted more than once because they cover more than one technology.

A minor part of research has also focused on mobile phones while most of the studies were conducted with respect to ICT access and adoption (e.g., Kauffman & Techatassanasoontorn, 2005). However, with the exception of three studies (Kelley, 2014; Pearce & Rice 2013; Park & Lee, 2015), there is no research to date that studies digital inequality by considering smartphones as a focal technology. This is quite surprising given the pervasiveness of smartphones as well as their existential nature and indispensability for mobile applications

such as car sharing or map services. Furthermore, because smartphones rely on wireless technology such as 3G connections they exhibit the potential to bridge digital inequality in particular in rural areas where a lack of high-speed Internet connections impacts Internet usage behavior.

We need more research that investigates the role and potential of smartphones in the context of digital inequality. For example, researchers might want to explore whether smartphones in general and Apps in particular can facilitate Internet application adoption and use for digitally less savvy groups such as senior citizens. Future studies could also seek to better understand the potential life enhancing chances and social implications of mobile applications and their implications for the debate on digital inequality. Those seeking to bridge digital inequality might also be interested in understanding how smartphones and mobile applications can be helpful and how they might be able to solve or address issues responsible for ICT initiative failure.

4.4 Digital inequality and research methodology

As a next step I investigated the range and type of research methods used for both conceptual and empirical research on digital inequality. In particular, the literature was categorized by the method of analysis applied, the type of data used and the type as well as the origin of sample respondents. As summarized in Table 3, findings suggest that research on digital inequality has been quite narrow in its choice of methods of analysis mostly applying a quantitative approach and relying heavily on official statistics and databases. I also find that digital inequality research is skewed towards developed countries and the United States in particular. Respondent types on the other hand were found to be quite diverse. The detailed results are presented in Appendix D.

4.4.1 Methodology and type of data

Researchers often use quantitative methods such as regression models to explore most research areas of digital inequality. Only research on ICT use outcomes and on bridging digital inequality extensively builds on qualitative methods. Except for two studies in the area of ICT adoption, there are no studies employing a mixed methods approach. This heavy reliance on quantitative methods of analysis may be the result of easily accessible official statistics, census data and databases, which allow for faster and less extensive data collection.

While quantitative methods have yielded rich insights in particular on the predictors of digital inequality, the reliance on this method might limit research in exploring and better understanding the more complex and multi-layered forms of digital inequality as evident in ICT appropriation and ICT use outcomes. Diversity in research methods is generally considered to be a major strength for a research discipline and to emphasize the validity of findings (Sidorova, Evangelopoulos, Valacich, & Ramakrishnan, 2008). Research has also highlighted the ability of qualitative research to “extract key information [...] from a highly complex, uncertain, turbulent, multi-faceted context” (Conboy, Fitzgerald, & Mathiassen, 2012, p. 117). There has also been a call for more mixed methods research in particular in the context of complex social phenomena in IS research (Cao et al., 2006; Venkatesh et al., 2013). As such using more qualitative and mixed methods research may help to substantially deepen our understanding of the digital inequality phenomenon. For example, researchers could use qualitative methods to explore the cognitive processes and dynamics underlying the ICT appropriation and ICT use outcomes.

Table 3. Digital inequality research methods by topic and structural level

Main topic areas	Level*	Methodology					Type of data								
		Quantitative	Qualitative	Mixed methods	Descriptive	Theoretical	Official statistics**	Interviews	Observations	Secondary data***	Survey	Focus groups	Experiments	Performance tests	Other
ICT access	I	2	-	-	-	-	■								
	C	6	-	-	1	1	■								
ICT adoption	I	21	2	-	2	-	■				■				
	C	7	-	-	-	2	■								
ICT appropriation	I	26	-	2	4	1	■				■				
	C	2	-	-	-	-	■								■
ICT use outcomes	I	6	5	-	-	2	■				■				■
	C	1	-	-	-	-	■								
Bridging DI	I	-	5	-	-	-		■	■	■					
	C	3	3	-	-	3	■				■				
Measurement of DI	I	1	-	-	-	1					■				
	C	5	1	-	1	2	■								
Total	I	56	12	2	6	4	33	12	10	6	26	3	2	3	5
	C	24	4	-	2	8	26	-	-	5	2	1	-	-	2

Color shading increases with frequency of data use

*I = Individual; C = Country

**The category “Official statistics” also includes data drawn from databases, census data and national surveys

***The category “Secondary data” includes data such as news, documents, reports, and websites

A large amount of digital inequality studies relies either on official statistics and census data or on surveys. While it makes sense to explore and analyze readily accessible data, the insights that can be gained are limited in particular for such a complex social phenomenon as digital inequality. Self-developed surveys are commonly used in digital inequality research and allow for richer insights, however, they come along with methodological issues such as self-rater bias (Podsakoff et al., 2003).

Interestingly, digital inequality researchers have started to employ a range of innovative data types that help to study actual behavior such as performance tests (van Deursen, 2012), search engine queries (Segev & Ahituv, 2010), price quotes (Baye et al., 2003), ethnographic research (Kvasny, 2006), blog posts (Brock, Kvasny, & Hales, 2010) or website experiments (Hampton, 2010). Researchers should use data originating from actual behavior more intensively. For example, a promising avenue for future research could be the use of clickstream data (Bucklin & Sismeiro, 2009) that tracks individual online behavior.

Furthermore, as presented in Appendix D, 90 percent of quantitative digital inequality research relies on cross-sectional data, while only 10 percent uses longitudinal data. Researchers should conduct more longitudinal studies in order to track the digital inequality development and the impact of measures to bridge it. For example, researchers might want to better understand how certain policies impact digital inequality over time. It could also be interesting to identify countries that managed to close digital gaps rapidly and to learn from these examples.

4.4.2 Respondent origin

As presented in Table 4, a large number of digital inequality research studies – around 70 percent – have been concentrating on developed countries, with many of them being U.S.-centric. Particularly, research on ICT adoption, ICT appropriation and ICT use outcomes is heavily skewed towards developed countries, accounting for 72 percent, 88 percent, and 83 percent of research in these topic areas, respectively. Consequently, studies in these areas provide few insights on developing countries and only limited insights on countries outside the United States. This is especially troubling given that the severity of digital inequality is much more pressing in developing countries than in the more developed parts of the world. Researchers may seek to more often consider the situation of developing countries in their

research and may also seek to cooperate with researchers based in developing countries to exchange knowledge and to facilitate data collection.

Individuals from different countries might have different cultures and values that may result in different attitudes towards technologies and, most importantly, may face different technology environments and realities. For example James (2005) found that the Western concept of technology access and adoption needs to be adapted for developing countries where technologies are often owned and used collectively. Similarly, Venkatesh and Sykes (2013) showed the importance of adapting the theoretical research perspective to the context of developing countries, by using a social network lens to study ICT initiative outcomes in rural India, thereby embracing the oral tradition of information dissemination and high collectivism of the village people. This emphasizes the need for researchers to critically scrutinize the generalizability of their findings to other countries, particularly to developing countries. Researchers should also consider how digital inequality concepts need to be adapted in order to be meaningful in the context of developing countries. For example, researchers could conceptualize ICT appropriation and ICT use outcomes considering the particular developing country context.

Table 4. Summary of respondent origin per topic area in digital inequality research

Main topic areas	Respondent origin			
	Developed countries	Developing countries	Global*	Thereof USA
ICT access	3	5	1	2
ICT adoption	26	2	8	17
ICT appropriation	30	3	1	16
ICT use outcomes	10	1	1	7
Bridging DI	5	5	1	4
Measurement of DI	3	1	4	1
Total	77	17	16	47

*Studies considering multiple countries including developed and developing countries

One stream of research that has benefitted from insights on non-U.S. countries and developing countries in particular – and as such presents a more global and multicultural perspective – is that of bridging digital inequality. Less than half of the studies focus on the U.S. and explore ICT initiatives and policies in Australia, India, Latin America and Sub-Saharan Africa (Buys et al., 2009; Hawkins & Hawkins, 2003; Mistry, 2005; Srivastava & Shainesh, 2015). In particular in the area of bridging digital inequality, researchers might want to continue and to intensify their research efforts given that cultural differences and different policy

environments may limit the generalizability of findings with respect to ICT initiative success factors and effective policy design.

4.4.3 Respondent type

Research on information systems often relies primarily on student samples to explore various research questions; however, this is not the case for the field of digital inequality. As presented in Table 5, most studies rely on individuals from households and seek to present a representative sample. Interestingly, some studies also focus on a particular group of people, such as children, senior citizens or low-income adults. The high number of studies based on representative data collection from households suggests that for the areas of ICT access, ICT adoption and ICT appropriation studies provide good insights into the digital inequality situation of the average citizen and are likely to be generalizable to the population of the specific country.

For research on ICT use outcomes and on bridging digital inequality, however, there are few or no studies that assure the generalizability of findings in these two areas. In particular research on ICT initiatives would profit from insights that consider a large number of initiatives. For example researchers could test what we have learned from ICT initiative case studies with a large sample of participants of several initiatives. Similarly, there are only three studies on ICT use outcomes that do not focus on a particular group. Researchers should build on the insights from studies focusing on a particular group of people and test if the findings can also be generalized.

Table 5. Summary of respondent type per topic area in digital inequality research				
Main topic areas	Respondent type on the individual level			
	Households	Particular group	Other*	Particular groups studied
ICT access	2	-	-	-
ICT adoption	16	8	1	Children/ teenagers, students, low-income adults, senior citizens
ICT appropriation	23	9	-	Children/ teenagers, students, unemployed, veterans
ICT use outcomes	3	5	3	Children/ teenagers, students, refugee migrants, Afro-Americans
Bridging DI	-	-	5	-
Measurement of DI	1	-	-	-
Total	45	22	9	

*Others include individual interview partners who contributed to a case study, e.g. participants of an ICT initiative

Several studies purposefully focus on particular – often potentially disadvantaged – groups which are at the center of the digital inequality debate. For example, studies focus on unemployed individuals in the context of online job seeking (Lindsay, 2005), on the Internet use behavior of senior citizens (Niehaves & Plattfaut, 2014), or the blog posting behavior of Afro-American women in the context of cultural appropriation of technical capital (Brock et al., 2010). Even though the findings of these studies are not necessarily generalizable to a greater population, they play a pivotal role in identifying the mechanisms that eventually impede a certain group of individuals from profiting from digital opportunities. More research is needed to deepen our understanding of why certain socio-demographic determinants eventually predict digital inequality and which mechanisms and dynamics underlie this relationship. Researchers should build on the research on socio-demographic determinants and explore the mechanisms leading to digital inequality for each identified group.

4.5 Theoretical contributions and perspectives of digital inequality research

4.5.1 Theoretical contributions of digital inequality research

To analyze the theoretical contributions of digital inequality research, the literature was categorized using an adaptation of Gregor's (2006) proposed framework for classifying theories in IS research. The framework suggests that there are five categories of theories: analyzing, explaining, predicting, explaining and predicting, and design and action. The types of theories and definitions as adapted to the research field of digital inequality are presented in Table 6³. Furthermore, as presented in Appendix E, an analysis on theoretical perspectives in digital inequality research was conducted.

The review of the types of theoretical contributions in digital inequality research, as presented in Table 6, reveals some interesting findings. First, it is apparent that most of the research on digital inequality has focused on explaining and predicting theoretical contributions, with explaining and analytical theoretical contributions being the second and third major categories. Second, findings suggest that the theoretical contributions vary depending on the topic area, in particular with research on ICT use outcomes, measurement of digital inequality, and bridging digital inequality not focusing on a particular theory type but conducting some studies in each theory category.

³ For analyzing the theoretical contributions of digital inequality research the category of design and action was not considered in the analysis because this type of theory focuses on prescriptions for constructing and artifact (Gregor 2006, p.620) which has no relevance in the context of digital inequality research.

Table 6. Types of theoretical contributions per topic area in digital inequality

Types of theoretical contributions (adapted from Gregor (2006, p.620))	Topic area					
	ICT access	ICT adoption	ICT appropriation	ICT use outcomes	Bridging DI	Measurement of DI
Analyzing: Describe the state and the phenomenon of digital inequality	2	4	2	2	4	3
Explaining: Explain how and why digital inequality occurs but do not focus on formulating testable predictions	2	3	6	5	7	3
Predicting: Predict indicators of digital inequality based on explanatory factors but do not focus on elaborating on the causal relationships	2	7	7	2	1	2
Explaining and Predicting: Explain underlying causes of relationships and formulate testable predictions	4	24	20	5	2	1
Total	10	38	35	14	14	9

As shown in Table 6, the majority of research on digital inequality and in particular on ICT adoption and appropriation has been dedicated to explaining and predicting theories. In his framework of theory classification, Gregor (2006) proposes that the process of theory development for each research domain starts with analyzing and explaining the phenomenon of interest which is followed by explaining and predicting theories. Many studies on ICT adoption and appropriation already seek to not only explain the underlying causes of relationships but also formulate testable predictions. For instance, for the research area of ICT adoption this includes substantial work on understanding how and why socio-demographic factors influence ICT adoption (e.g., Hsieh et al., 2008).

While research on ICT adoption and digital inequality has benefitted from this approach and from fundamental theory development in general IS research (e.g., Davis, 1989), research on ICT appropriation has already moved to explaining and predicting theories without having developed a common way of conceptualizing and measuring the manifestation of digital inequality. Research in this domain would profit from developing of a common framework first, to ensure that researchers can build upon the results of others and that findings are comparable. Similarly, the development of a common conceptualization and measurement would also be beneficial for the domain of ICT use outcomes.

Another interesting finding from Table 6 is that, contrary to research on ICT adoption and appropriation, some research areas do not yet focus on explaining and predicting theories, in particular research on ICT use outcomes and bridging digital inequality. In these two research areas many studies concentrate on analyzing and explaining theories. Especially, research on bridging digital inequality is concerned with describing observed means to bridge digital inequality (James, 2003; Rao, 2003) and explaining what could be reasons for success or failure, however, without providing testable predictions (e.g., Hsieh et al., 2012; Srivastava & Shainesh, 2015).

While for research on ICT use outcomes, as explained previously, it appears to be reasonable to further develop analyzing and explaining theories, research on bridging digital inequality has already evolved to a point where one could expect to see more explaining and predicting theories. For instance, building on the dynamic interplay of social and technical requirements for ICT initiatives, research could explain and predict initiative characteristics that lead to a successful reduction of digital gaps. Additionally, researchers could develop theories on how these characteristics can be promoted and to which degree they are applicable in different cultural settings.

4.5.1 Theoretical perspectives on digital inequality

Furthermore, as presented in Appendix E, I reviewed the extant literature with respect to theoretical perspectives used to explore different aspects of the digital inequality phenomenon. The review yielded some interesting results: First, the interdisciplinarity of digital inequality research is reflected by a multitude of concepts and theoretical perspectives originating from different domains such as information systems, sociology, economics, psychology, public policy and communication. Second, despite a broad range of different concepts used there are many studies which can be classified as ‘a-theoretical’, i.e. these studies do not explicitly take any theoretical perspective. Third, many studies use theoretical concepts as lenses to view or ‘explain the world’ (Orlikowski & Robey, 1991), while few studies use theories as statements that explain relationships among constructs that can be tested empirically (see e.g., Davis, 1989). The following paragraphs and Table 7 summarize the most commonly used theoretical perspectives.

Table 7. Most common theoretical perspectives in digital inequality research		
Overarching dimension	Explanation of theoretical perspectives and constructs in digital inequality research	Exemplary digital inequality articles
Individual factors perspective	Socio-demographic perspective , predicts which socio-demographic factors influence inequality. Factors include education, income, employment status, ethnicity, gender, rural versus urban residence, etc. (e.g. Jung, 2001).	Lengsfeld (2011)
	Psychosocial barriers (Stanley, 2003) , are defined as “obstacles that significantly undermine motivation for acquiring computer skills: ‘relevance,’ ‘fear,’ and ‘self-concept.’” (p. 407)	Stanley (2003)
	Personality characteristics (e.g., Levy, 1970) , are generally defined as patterns of behavior that describe a personality and influence his/her affective, cognitive and behavioral reactions (Levy, 1970). The Big Five (Costa & McCrae, 1992) , include extraversion, neuroticism, conscientiousness, agreeableness and openness to experience.	Venkatesh et al. (2014)
Technology acceptance	Technology acceptance theory (Davis, 1989) , “predicts peoples' computer acceptance from a measure of their intentions, and the ability to explain their intentions in terms of their attitudes, subjective norms, perceived usefulness, perceived ease of use, and related variables” (Davis, Bagozzi, & Warshaw, 1992, p. 1111)	Sipior et al. (2011)
	Theory of planned behavior (Ajzen, 1991) , shows that “intentions to perform behaviors of different kinds can be predicted [...] from attitudes toward the behavior, subjective norms, and perceived behavioral control; and these intentions, together with perceptions of behavioral control, account for considerable variance in actual behavior.” (Ajzen, 1991, p. 179)	Hsieh et al. (2008)
	Theory of technology diffusion (Rogers, 1995) , defines technology diffusions as “the process in which an innovation is communicated through certain channels over time among the members of a social system” (Rogers, 2003, p. 5). The diffusion of the new technology is influenced by the innovation itself, the communication system, time, and the social system.	Dewan et al. (2010)
Sociological lenses	Social cognitive theory (Bandura, 1986, 1997, 2001) , proposes that an individual's learning and behavior is influenced by personal, behavioral and environmental factors which impact one another, the so-called ‘triadic reciprocity’ (Bandura, 1986). It also suggests that an individual has agency or “the capacity to exercise control over the nature and quality of one's life” (Bandura, 2001, p.1) in a purposeful manner.	Wei et al. (2011)
	Capital theory (Bourdieu, 1984) , uses concepts of capital, such as cultural capital, social capital, and economic capital to understand human behavior within societal structures. Capital and its distribution constitute the set of constraints under which societies and individuals act (Bourdieu, 1986).	Hsieh et al. (2011)
	Theory of social and cultural reproduction (Bourdieu & Passeron, 1979; Bourdieu, 1984) , is concerned with the role of culture in the reproduction of social order and proposes that inequality arises as the result of individual investment strategies (e.g. educational, employment strategies) and the logic of educational institutions (e.g. competitive exams, selection criteria).	Kvasny & Keil (2006)

Table 7. Most common theoretical perspectives in digital inequality research (continued)		
Overarching dimension	Explanation of theoretical perspectives and constructs in digital inequality research	Exemplary digital inequality articles
Social influence and dynamics	Actor-network theory (Callon, 1986) , is a “disparate family of material-semiotic tools, sensibilities, and methods of analysis that treat everything in the social and natural worlds as a continuously generated effect of the webs of relations within which they are located” (John Law, 2009, p. 141). It describes interaction as a translation process that comprises four different stages: problematization, interessement, enrollment, and mobilization (Callon, 1986).	Hsieh et al. (2012)
	Peer effects (Duflo & Saez, 2002; Munshi, 2004) , occur when an individual’s action depends directly on the existence of this action in a reference group. Peer effects may be present due to social learning, normative group pressure or pressure of network externalities (Duflo & Saez, 2002).	Agarwal et al. (2009)
	Social networks (Scott, 2000) , are a map of individual interrelationships and describes how individual ties with network members influence certain outcomes.	Venkatesh & Sykes (2014)
	Social capital (Bourdieu, 1986) , can be defined as “resources embedded in a social structure that are accessed and/or mobilized in purposive action” (N. Lin, 2001, p. 29).	Hsieh et al. (2011)
	Subjective norm (Ajzen & Fishbein, 1975) , is defined as “a person’s perception that most people who are important to him think he should or should not perform the behavior in question” (p. 302).	Niehaves & Plattfaut (2014)
Contextual factors	Economic perspective , explains which economic factors predict inequality on the country-level. Factors include national wealth, economic inequality, supply and demand dynamics, trade flows, etc. (e.g. Oyelaran-Oyeyinka & Lal, 2005).	Cruz-Jesus et al. (2012)
	Policy/ Institutional perspective , describes how institutions can influence inequality through the means of political reforms, regulation or infrastructure provision (e.g. Hawkins & Hawkins, 2003)	Howard & Mazaheri (2009)

Many researchers use different theoretical perspectives to explore and explain how individual predispositions may lead to digital inequality. The vast majority of research in this area takes a socio-demographic perspectives and studies which socio-demographic factors predict inequalities in ICT access, adoption, appropriation or outcomes (Lengsfeld, 2011; Schleife, 2010; Selwyn et al., 2005). While it is important to understand the socio-demographic factors that determine the strata of digital inequality, many of these studies fall short of explaining how these factors actually translate into digital inequality. Others tried to fill this gap by understanding psychosocial barriers (Stanley, 2003) or by exploring the role of demographic and personality characteristics, such as the Big Five, in conjunction (Venkatesh et al., 2014). A frequently mentioned argument is that individuals with lower income and lower education suffer from a lack of digital literacy and skills which eventually leads to digital inequality (van Deursen & van Dijk, 2010). Based on this assumption, many researchers, in particular from the field of communication and sociology, tried to better understand the causalities of digital inequality by taking a skills centered perspective (Hargittai, 2006b; Livingstone & Helsper, 2009; van Deursen, 2012).

While all of these single concepts used to study digital inequality have generated interesting insights, they often focus on a one-dimensional portrayal of factors leading to digital inequality. Researchers should incorporate the concepts of individual predispositions into more comprehensive perspectives that account for the multi-layered, complex, and context-dependent nature of digital inequality. For example, researchers could integrate Van Deursen and Van Dijk's (2010) detailed perspective on digital skills into the greater concept of cultural capital (Bourdieu, 1984) when studying digital inequality using a capital theory lens.

Another stream of research uses different theoretical lenses to better understand the process of technology adoption and use in the context of digital inequality. In particular, IS researchers used technology acceptance theory (Davis, 1989) or the theory of planned behavior (Ajzen, 1991) on the individual level and the theory of technology diffusion (Rogers, 1995) on the country level to explore inequalities in technology adoption (e.g., Dewan et al., 2010; Hsieh et al., 2008; Kauffman & Techatassanasoontorn, 2005; Sipior et al., 2011). Others (e.g., Kvasny and Keil 2006, Wei et al. 2011, Hsieh et al. 2011) draw from sociology and approach the phenomenon of digital inequality by applying social cognitive theory (Bandura, 1997, 2001), capital theory (Bourdieu, 1984), and the theory of social and cultural reproduction (Bourdieu & Passeron, 1979; Bourdieu, 1984). The fact that many of these studies have been published

in highly ranked journals highlights the richness of insights that can be gained by using well-established theories and concepts in digital inequality research.

Given that many of the studies on digital inequality are in fact ‘a-theoretical’ or take certain views on the issue without leading to empirically testable predictions, I encourage researchers to build upon validated theoretical concepts to further deepen our understanding of digital inequality. For example, researchers could explore how coping theory (Lazarus & Folkman, 1984) could be helpful in understanding individual technology use and appropriation behavior. The dynamic perspective of coping theory makes it particularly promising for studying complex individual use patterns such as (dis-)engagement with a new technology. Coping theory has also proven to be an insightful lens to explain individual behavior in both mandatory and quasi-mandatory settings, where individuals are not forced but expected to make use of a new technology (Beaudry & Pinsonneault, 2010), as it is the case with many Internet applications such as online job search.

Other researchers use different concepts to explore how external factors or the technology itself can influence digital inequality. First, some researchers seek to capture the role of social influence and social dynamics in the context of digital inequality (e.g., Agarwal et al., 2009; Hsieh et al., 2012; Venkatesh & Sykes, 2013) by drawing from actor-network theory (Callon, 1986) and from what we know about ‘peer-effects’ (Duflo & Saez, 2002; Munshi, 2004) and social networks (Scott, 2000). The concept of social influence is also captured in the constructs of ‘social capital’ in capital theory (e.g., Hsieh et al., 2011) and ‘subjective norm’ or ‘normative beliefs’ in the case of technology acceptance theory (e.g., Niehaves & Plattfaut, 2014). While it is commonly believed that social influence can play a pivotal role in bridging digital inequality, we still do know little about which mechanisms of social influence are most effective to accomplish it. Researchers should build upon what we know about social influence in particular from IS research and apply these theoretical concepts to better understand the role of social influence in the context of digital inequality. For example, researchers may expand on Kelman’s (1958) dimensions of normative and information social influence – comprising compliance, identification, and internalization – to get a more precise view of which forms of social influence are most effective in influencing individual technology adoption behavior.

Second, in particular research focusing on country-level digital inequality seeks to incorporate the contextual factors of digital inequality. Researchers have tried to identify determinants of

digital inequality on the country level from an economic perspective (e.g., Cruz-Jesus et al., 2012; Oyelaran-Oyeyinka & Lal, 2005), considering factors such as wealth or supply and demand dynamics, from a policy perspective (e.g., Hawkins & Hawkins, 2003; Howard & Mazaheri, 2009) or institutional perspective (e.g., Mistry, 2005; Zhao, Kim, Suh, & Du, 2007). Interestingly, most studies building upon an institutional perspective conceptualize institutional influence as means of regulatory policy and provision of infrastructure and resources (see e.g., Wallsten, 2005). While it is important to understand the effectiveness of these means of institutional intervention, research has so far neglected that institutions can also influence digital inequality through means of direct interaction with individuals, for example, in the context of e-government, the educational system or in centralized labor agencies. Tying into the previously described concept of social influence, it would be interesting to explore the role governmental institutions can play apart from regulation and policy reforms.

5. Moving forward: Towards an integrated perspective on digital inequality

The findings of this literature review reveal that there is still much to be studied in the realm of digital inequality. However, they also show that it is time for digital inequality research to acknowledge what we already know and to focus research efforts on areas that are of current relevance given the technological development in both developed and developing countries. Based on the disparate streams of literature and the findings lined out in this paper I developed a multi-stage, integrated perspective on digital inequality as presented in Figure 1. This integrated perspective highlights some of the overall conclusions that will be crucial in further developing research on digital inequality, which I will discuss in the following section, in particular, (1) the need for a multi-stage view on digital inequality, (2) the importance of a clear measurement and conceptualization of digital inequality at all stages, (3) the need for rich theoretical insights that help to explain how and through which mechanisms digital inequality arises and, (4) a multi-technology and multi-level understanding of digital inequality.

First, following Wei and colleagues (2011), I want to encourage researchers to take an integrated, multi-stage view on digital inequality. Eventually, the true severity of digital inequality is determined by significant differences in ICT use outcomes. Until research can prove that digital inequality materializes and affects the ‘real life’ of people, the discussion on digital inequality will in fact stay a theoretical one that is based on assumptions only. Still,

ICT use outcomes are the result of an ICT adoption cycle starting with ICT access, leading to ICT adoption and ICT appropriation. As such, conceptualizing and understanding digital inequality as a multi-stage phenomenon incorporates that reasons for differential ICT use outcomes might actually originate in one of the antecedent stages and that perceived ICT use outcomes can influence continued ICT adoption and appropriation. Adopting a ‘funnel’ logic and understanding why and how individuals get lost at a certain stage of the ICT adoption cycle should be at the heart of future digital inequality research.

Second, understanding all stages of digital inequality and, in particular, ICT appropriation and ICT use outcomes, is only possible with a common and validated conceptualization of these constructs. So far, research has only considered single aspects of ICT appropriation such as the breadth of online activities or the use of certain online applications such as e-health solutions (Hale et al., 2010; Pearce & Rice, 2013) and ICT use outcomes such as educational achievements (Wei et al., 2011). A comprehensive conceptualization of ICT appropriation and ICT use outcomes in the context of digital inequality is still missing. Researchers might seek to expand on existing conceptualizations of system usage (e.g., Burton-Jones & Straub, 2006). In particular, researchers may use the later work of Burton-Jones and Grange (2012, p. 633) as a starting point which conceptualizes effective information system usage as “using a system in a way that increases achievement of the goals for using the system”. In addition, to strengthening our conceptual understanding of what constitutes digital inequality with respect to ICT appropriation and ICT use outcomes, a common measurement needs to be established to ensure comparability and allow for researchers to build upon the work of others.

Third, there is a need to deepen our theoretical understanding of digital inequality. Researchers should not accept monolithic conclusions linking socio-demographic factors to technology adoption behavior, but seek to understand why, how and under which conditions certain socio-demographic strata lead to digital inequalities. For each stage of ICT adoption research should aim at explaining how socio-demographic factors, other individual factors and contextual factors such as social influence lead to or impact the manifestation of digital inequality. The interdisciplinary nature of the digital inequality phenomenon offers a range of promising theoretical perspectives that can be leveraged to deepen and complement our current understanding of digital inequality. Recent research has shown that drawing from established concepts such as a service perspective on digital inequality (Srivastava & Shainesh, 2015), the influence of ‘peer effects’ (Agarwal et al., 2009) and social networks (Venkatesh & Sykes, 2013) yields particularly rich insights. Research should leverage the

diverse theoretical foundations from disciplines such as information systems, sociology, psychology and economics to strengthen our understanding of the mechanisms leading to digital inequality.

Finally, taking a multi-level and multi-technology perspective is required to achieve a comprehensive understanding of digital inequality and to guide research efforts. While it is important to study digital inequality at the individual level, employing only this single perspective neglects that the individual is part of a greater collective which may be influenced by additional factors, e.g. as inhabitant of a country. Vice versa, studying digital inequality only at the country level makes it difficult to detect and identify individual characteristics influencing digital inequality. Similarly, with the ongoing digitization and growing pervasiveness of mobile technologies research on digital inequalities should aim at reflecting technology realities. In particular, research should seek to take a multi-technology approach when studying digital inequality and to focus their research efforts on those technologies that are impacting and changing individuals the most such as Internet-enabled smartphones. In addition, given the increasing pervasiveness of mobile technologies researchers should deepen our understanding of the role the relationship between individuals and technologies plays in the context of digital inequality, for example by exploring concepts of technology identity (Goode, 2010; Wenger, 1998) or technology-in-practice (Orlikowski, 2000).

6. Summary of recommendations and limitations

A number of recommendations have been made throughout the paper about potential future research on digital inequality. Table 8 summarizes the most important research recommendations in six broad categories. Hopefully, these recommendations and examples will help future research to build on and expand the current work on digital inequality. Finally, there are some limitations of this literature based research that need to be acknowledged and that warrant further research. In particular, these limitations are related to the literature search approach and the exclusion of conference proceedings and working papers.

First, even though a thorough search methodology was used to find and review the extant literature on digital inequality, it is possible that some articles of relevance have been inadvertently omitted. In particular, research that does not study digital inequality as the focal phenomenon but does nevertheless present relevant implications for digital inequality research might not mention it in the title, abstract or keywords. However, given the large

number of articles mentioning the keywords in the full text, I consciously limited my search to those studies that focus on and discuss digital inequality as the focal phenomenon. Furthermore, the additional search based on the Association for Information Systems Senior Scholars' basket (Bélanger & Carter, 2012) as well as the forward backward search approach (Webster & Watson, 2002) make it highly unlikely that crucial findings were omitted. Still, researchers that work with more boundary conditions, e.g., only covering a certain aspect of digital inequality, might get an even more comprehensive picture of the state of the literature by also conducting a full text search.

Table 8. Summary of recommendations for digital inequality research

Recommendation	Examples	Section
1. Moving towards an integrated view on digital inequality and focusing on relevance	<ul style="list-style-type: none"> • Consider digital inequality as a multi-stage concept from ICT access to ICT use outcomes • Shift focus for ICT access and adoption research to digitally disadvantaged societal groups and developing countries • Emphasize the further development of our understanding of ICT appropriation and ICT use outcomes in developed country contexts, i.e. proof 'real life' effects of digital inequality 	4.1.1 4.1.2 4.1.3 5
2. Using more diverse methods and data while ensuring generalizability	<ul style="list-style-type: none"> • Employ more qualitative and mixed-methods research • Rely less on official statistics and surveys and explore more data originating from actual behavior, e.g. clickstream data • Conduct more longitudinal studies to understand how digital inequality develops and can be influenced over time • Conduct more large-scale studies with representative samples in particular in the areas of ICT use outcomes and bridging digital inequality • Use less developed-country centric samples 	4.4
3. Building upon established theories	<ul style="list-style-type: none"> • Leverage well-established theories in particular from the fields of information systems and sociology • Conduct more research using explaining and predicting theories in particular in the area of bridging digital inequality • Consider concepts of social influence 	4.1.4 4.5
4. Developing a better conceptualization and measurement of ICT appropriation and ICT use outcomes	<ul style="list-style-type: none"> • Conceptualize what constitutes digital inequality in the area of ICT appropriation and ICT use outcomes • Use more analyzing and explaining theories in these two areas • Develop more validated measurements for digital inequality in these two areas to ensure that researchers can compare findings and readily build upon another 	4.1.2 4.1.3 4.1.5 4.5
5. Moving beyond the individual and explore other levels of analysis	<ul style="list-style-type: none"> • Consider multiple level of analysis • Conduct more research focusing on the role of institutions • Study the relevance of different stages of digital inequality in an organizational context 	4.2
6. Considering more current technology developments	<ul style="list-style-type: none"> • Conduct more multi-technology studies • Conduct more studies focusing on smartphones • Explore the implications of mobile, pervasive technologies on digital inequality • Consider more types of life-chance enhancing Internet applications 	4.3

Second, I did not include studies from conference proceedings or working papers in this review. This decision was mainly taken in order to manage the scope of this literature review. In particular, because this review takes a topic-centric and thus an interdisciplinary approach to study the extant literature on digital inequality, also incorporating conference proceedings from different domains would have led to an unmanageably high number of papers to be reviewed. In the interest of ensuring research quality, the focus was therefore set on published journal articles. Still, scholars seeking to review the literature on digital inequality with a focus on a certain research domain might want to include conference proceedings and working papers in order to include the most recent trends.

Third, a common limitation of systematic literature reviews is that they often mainly rely on a conceptual comparison and analysis of the extant literature as opposed to conducting a meta-study and statistically comparing the significance of the employed constructs. Similarly, in the context of digital inequality it would be interesting to understand in which circumstances which factors exhibit the greatest explanatory power. However, as outlined in the previous sections, the widely divergent conceptualization of digital inequality poses a challenge to scholars attempting to conduct a meta-study. The number of studies with identical construct definitions is currently too small to yield a relevant sample for statistical comparison.

7. Conclusions

This research sought to review and scrutinize the extant literature on digital inequality, to integrate interdisciplinary perspectives on the phenomenon and to inform researchers on the current state of digital inequality research. The review reveals how digital inequality has been conceptualized and studied by scholars from domains as diverse as information systems, public policy, economics, communication, sociology or psychology. Based on these findings, a set of research recommendations and an integrated perspective on digital inequality were developed which seek to serve as a guideline and stimulus for future research. In conclusion, digital inequality is still a very exciting and prevailing research domain that will continue to evolve with the growing pervasiveness of technologies. However, researchers need to reflect the evolving technological environment by shifting the focus of their research efforts to those topics that are current and relevant for society.

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Appendix

Appendix A: Topics in digital inequality research

Table 9. Topics in digital inequality research
<p>Digital inequality and ICT access</p> <ul style="list-style-type: none"> • Determinants of country-level/ cross-country digital divides • State and development of country-level/ cross-country digital divide • Institutional factors and ICT access • Socio-demographic determinants of digital inequality • Social influence and digital inequality • Prices and ICT diffusion
<p>Digital inequality and ICT adoption</p> <ul style="list-style-type: none"> • Determinants of corporate Internet adoption • Determinants of country-level/ cross-country digital divides • State and development of country-level/ cross-country digital divide • Institutional factors and ICT diffusion • Socio-demographic determinants of Internet / mobile use • Psychosocial determinants of Internet use • Digital choice and digital exclusion • Determinants of rural versus urban ICT adoption • Differences in smartphone use • E-commerce adoption • Self-efficacy and Internet use • Social influence and digital inequality • Capital theory and Internet use • Technology acceptance and Internet use • Technology diffusion • Theory of planned behavior and Internet use
<p>Digital inequality and ICT appropriation</p> <ul style="list-style-type: none"> • Types and breadth of online activities • Differences in Internet use of particular groups, e.g., children, disabled etc. • Content creation, sharing, social networks • Digital literacy and skills • E-commerce activities • E-government and e-politics • Online health information seeking • Online job seeking • Efficient Internet use
<p>Digital inequality and ICT use outcomes</p> <ul style="list-style-type: none"> • Benefits of e-health solutions • Economic outcomes • Educational outcomes • Informational outcomes • Intervention success • Macro-economic outcomes of technologization • Social/civic inclusion/engagement • Technology identity • Technical capital creation
<p>Bridging digital inequality</p> <ul style="list-style-type: none"> • Governmental policies and interventions to bridge the digital divide • Success factors of ICT initiatives • ICT as a tool to bridge disparities

Table 9. Topics in digital inequality research (continued)

<p>Measurement of digital inequality</p> <ul style="list-style-type: none"> • How to measure – methodological analysis of indices • What to measure – factors and compositions of indices
<p>Digital inequality and further topics</p> <ul style="list-style-type: none"> • E-commerce and customer segmentation • Informational capitalism • Social embeddedness of technology • Theoretical conceptualization of digital inequality

Appendix B: Most highly cited articles in digital inequality research

Table 10. Most highly cited articles in digital inequality research

No.	Author	Journal	Title
1	DiMaggio et al. (2001)	Annual Review of Psychology	Social implications of the internet
2	Hargittai (2002)	First Monday	Second-level digital inequality: Differences in people's online skills
3	Hargittai (2007)	Journal of Computer-Mediated Communication	Whose space? Differences among users and non-users of social network sites
4	Van Dijk & Hacker (2003)	Information Society	The digital divide as a complex and dynamic phenomenon
5	Eastin & LaRose (2000)	Journal of Computer-Mediated Communication	Internet self-efficacy and the psychology of the digital divide
6	Selwyn (2004)	New Media & Society	Reconsidering political and popular understandings of the digital divide
7	Livingstone & Helsper (2007)	New Media & Society	Gradations in digital inclusion: Children, young people and the digital divide
8	Chinn & Fairlie (2007)	Oxford Economic Papers	The determinants of the global digital divide: A cross-country analysis of computer and internet penetration
9	Bonfadelli (2002)	European Journal of Communication	The Internet and knowledge gaps: A theoretical and empirical investigation
10	Hargittai & Hinnant (2008)	Communication Research	Digital inequality: Differences in young adults' use of the Internet
11	Rice & Katz (2003)	Telecommunications Policy	Comparing internet and mobile phone usage: Digital divides of usage, adoption and dropouts
12	Hargittai (2006)	Social Science Quarterly	Differences in actual and perceived online skills: The role of gender
13	Hargittai & Walejko (2008)	Information, Communication & Society	The participation divide: Content creation and sharing in the digital age
14	Hsieh et al. (2008)	MIS Quarterly	Understanding digital inequality: Comparing continued use behavioral models of the socio-economically advantaged and disadvantaged
15	Riggins & Dewan (2005)	Journal of the Association for Information Systems	The digital divide: Current and future research directions
16	Barzilai-Nahon (2006)	Information Society	Gaps and bits: Conceptualizing measurements for digital divides
17	Jung et al. (2001)	Communication Research	Internet connectedness and inequality: Beyond the divide
18	Goldfarb & Prince (2008)	Information Economics and Policy	Internet adoption and usage patterns are different: Implications for the digital divide
19	Hoffman et al. (2006)	Journal of Computer-Mediated Communication	The Evolution of the digital divide: How gaps in Internet access may impact electronic commerce

No.	Author	Journal	Title
20	Forman (2005)	Management Science	The corporate digital divide: Determinants of Internet adoption
21	Kvasny & Keil (2006)	Information Systems Journal	The challenges of redressing the digital divide: A tale of two US cities
22	Warschauer (2003)	Information Society	Dissecting the "digital divide": A case study in Egypt
23	Livingstone & Helsper (2009)	New Media & Society	Balancing opportunities and risks in teenagers' use of the internet: The role of online skills and internet self-efficacy
24	Zillien & Hargittai (2009)	Social Science Quarterly	Digital distinction: Status-specific types of internet usage
25	Stanley (2003)	Information Society	Beyond access: Psychosocial barriers to computer literacy

Appendix C: Reviewed literature – topic areas, levels of analysis, and focal technology

Table 11. Topic areas, levels of analysis, and focal technology of the reviewed literature																
Author	Topic area						Level of analysis			Focal technology						
	ICT access	ICT adoption	ICT appropriation	ICT use outcomes	Measurement of DI	Bridging DI	Other	Topic	Individual	(Cross-) Country	Organizational	Computer	Internet	Mobile phone	Fixed line	Internet applic.
Agarwal et al. (2009)		x						Social influence and digital inequality	x				x			
Akther (2003)			x					E-commerce activities	x				x			x
Alam & Imran (2015)				x				Social/civic inclusion/engagement	x				x	x		
Arbore & Ordanini (2006)		x						Determinants of corporate Internet adoption			x		x			
Bagchi (2005)	x							Determinants of country-level/ cross-country digital divides		x		x	x	x	x	
Barzilai-Nahon (2006)					x			What to measure - factors and compositions of indices	x	x		x	x			
Baye et al. (2003)				x				Economic outcomes	x							x
Bélanger & Carter (2009)			x					E-government and e-politics	x				x			x
Billon et al. (2009)		x						State and development of country-level/ cross-country digital divide		x			x	x	x	
Boase (2010)	x							Social influence and digital inequality	x				x			
Bodie & Dutta (2008)			x					Online health information seeking	x				x			x
Bonfadelli (2002)			x					Types and breadth of online activities	x				x			
Brake (2014)			x					Content creation and sharing	x				x			x
Brandtzaeg et al. (2011)			x					Types and breadth of online activities	x				x			x
Brock et al. (2010)				x				Appropriation of technical capital	x				x			x
Brown & Licker (2003)		x						Technology acceptance and Internet use	x				x			

Author	Topic area							Level of analysis			Focal technology					
	ICT access	ICT adoption	ICT appropriation	ICT use outcomes	Measurement of DI	Bridging DI	Other	Topic	Individual	(Cross-) Country	Organizational	Computer	Internet	Mobile phone	Fixed line	Internet applic.
Bruno et al. (2011)					x			How to measure - methodological analysis of indices		x			x	x	x	
Buys et al. (2009)						x		Governmental policies and interventions to bridge the digital divide		x				x		
Chen (2013)		x						Social influence and digital inequality	x				x			
Chen (2015)			x					Efficient Internet use	x				x			
Chen et al. (2014)				x				Informational outcomes (health information)	x				x			x
Chinn & Fairlie (2007)		x						Determinants of country-level/ cross-country digital divides		x		x	x			
Corrocher & Ordanini (2002)					x			What to measure - factors and compositions of indices		x						
Crang, Graham, & Crosbie (2006)				x				Social/civic inclusion/engagement	x				x			
Crenshaw & Robison (2006)	x							Determinants of country-level/ cross-country digital divides		x			x			
Cruz-Jesus et al. (2012)			x					State of digital divide in Europe including online activities		x		x	x	x		x
Cuervo & López Menéndez (2006)	x							State and development of country-level/ cross-country digital divide		x		x	x		x	
Dewan et al. (2005)		x						Country-level determinants of IT penetration		x		x	x			
Dewan et al. (2010)		x						Technology diffusion		x		x	x			
DiMaggio & Bonikowski (2008)				x				Economic outcomes	x			x	x			
DiMaggio et al. (2001)							x	Conceptualization of digital inequality	x	x			x			
Dutton, Gillett, McKnight, & Peltu, (2004)							x	Conceptualization of digital inequality	x				x			
Eastin & LaRose (2000)		x						Self-efficacy and Internet use	x				x			

Author	Topic area							Level of analysis			Focal technology					
	ICT access	ICT adoption	ICT appropriation	ICT use outcomes	Measurement of DI	Bridging DI	Other	Topic	Individual	(Cross-) Country	Organizational	Computer	Internet	Mobile phone	Fixed line	Internet applic.
Eynon & Helsper (2010)		x						Digital choice and digital exclusion	x				x			x
Fink & Kenny (2003)							x	Conceptualization of digital inequality		x		x	x			
Forman (2005)		x						Determinants of corporate Internet adoption			x		x			
Goldfarb & Prince (2008)		x						Socio-demographic determinants of Internet / mobile use	x				x			
Goldfinch, Gauld, & Herbison (2009)			x					E-government and e-politics	x				x			x
Goode (2010)				x				Technology identity	x			x	x			
Gui & Argentin (2011)			x					Digital literacy and skills	x				x			
Hale et al. (2010)			x					Online health information seeking	x				x			x
Hampton (2010)				x				Social/civic inclusion/engagement	x				x			
Hargittai (2002)			x					Digital literacy and skills	x				x			
Hargittai (2006a)			x					Digital literacy and skills	x				x			x
Hargittai (2006b)			x					Digital skills and gender	x				x			
Hargittai (2007)			x					Social network sites use	x				x			x
Hargittai & Hinnant (2008)			x					Differences in Internet use of children and teenagers	x				x			
Hargittai & Walejko (2008)			x					Content creation and sharing	x				x			x
Hawkins & Hawkins (2003)						x		Governmental policies and interventions to bridge the digital divide		x			x			
Hilbert (2010)	x							Prices and ICT diffusion		x		x	x	x	x	
Hilbert (2011)							x	Conceptualization of digital inequality	x	x		x	x	x	x	
Hilbert (2014)				x				What to measure - factors and compositions of indices		x			x	x		

Author	Topic area							Level of analysis			Focal technology					
	ICT access	ICT adoption	ICT appropriation	ICT use outcomes	Measurement of DI	Bridging DI	Other	Topic	Individual	(Cross-) Country	Organizational	Computer	Internet	Mobile phone	Fixed line	Internet applic.
Hilbert, López, & Vásquez (2010)					x			What to measure - factors and compositions of indices		x		x		x	x	
Hill & Dhanda (2004)				x				Macro-economic outcomes of technologizations		x						
Hoffman et al. (2006)		x						Socio-demographic determinants of Internet / mobile use	x				x			
Howard & Mazaheri (2009)						x		Governmental policies and interventions to bridge the digital divide		x			x	x		
Hsieh et al. (2008)		x						Theory of planned behavior and Internet use	x				x			
Hsieh et al. (2011)		x						Capital theory and Internet use	x				x			
Hsieh et al. (2012)						x		Success factors of ICT initiatives	x				x			
James (2003)						x		Governmental policies and interventions to bridge the digital divide		x		x				
James (2005)					x			What to measure - What to measure - factors and compositions of indices		x			x			
James & Versteeg (2007)	x							State and development of country-level/ cross-country digital divide		x				x		
Judge et al. (2006)				x				Educational outcomes of ICT use	x			x				
Jung, Qui, & Kim (2001)					x			What to measure - factors and compositions of indices	x							
Kauffman & Techatassanasoontorn (2005)		x						State and development of country-level/ cross-country digital divide		x				x		
Kelley (2014)				x				Social/civic inclusion/engagement	x				x	x		x
Kim (2015)			x					Online health information seeking	x				x			x
Kvasny (2006)						x		Success factors of ICT initiatives	x							

Author	Topic area							Level of analysis			Focal technology					
	ICT access	ICT adoption	ICT appropriation	ICT use outcomes	Measurement of DI	Bridging DI	Other	Topic	Individual	(Cross-) Country	Organizational	Computer	Internet	Mobile phone	Fixed line	Internet applic.
Kvasny & Keil (2006)						x		Success factors of ICT initiatives	x			x	x			
Lam & Lee (2006)		x						Self-efficacy and Internet use	x				x			
LaRose et al. (2007)		x						Determinants of rural versus urban ICT adoption	x				x			
Lawson-Body, Willoughby, Illia, & Lee (2014)			x					E-government and e-politics	x				x			x
Lengsfeld (2011)					x			What to measure - factors and compositions of indices		x			x			
Lindsay (2005)			x					Online job seeking	x				x			x
Livingstone (2006)			x					Differences in Internet use of children and teenagers	x				x			x
Livingstone & Helsper (2007)		x						Socio-demographic determinants of Internet / mobile use	x				x			
Livingstone & Helsper (2009)			x					Digital skills and online opportunities and risks	x				x			x
Martin & Robinson (2007)		x						Socio-demographic determinants of Internet / mobile use	x				x			
Meneses & Mominó (2010)		x						Social influence and digital inequality	x			x	x			
Mercer (2004)		x						Determinants of corporate Internet adoption			x		x			
Middleton & Sorensen (2006)		x						Socio-demographic determinants of Internet / mobile use	x				x			
Mills & Whitacre (2003)		x						Determinants of rural versus urban ICT adoption	x				x			
Mistry (2005)						x		Governmental policies and interventions to bridge the digital divide		x		x	x			
Muir & Oppenheim (2002)						x		Governmental policies and interventions to bridge the digital divide		x			x			
Niehaves & Plattfrait (2014)		x						Technology acceptance and Internet use	x				x			
Okoli & Mbarika (2003)		x						State/ development of country-level digital divide		x						x

Author	Topic area							Level of analysis			Focal technology					
	ICT access	ICT adoption	ICT appropriation	ICT use outcomes	Measurement of DI	Bridging DI	Other	Topic	Individual	(Cross-) Country	Organizational	Computer	Internet	Mobile phone	Fixed line	Internet applic.
O'Neil & Baker (2003)						x		Success factors of ICT initiatives	x			x	x			
Oyelaran-Oyeyinka & Lal (2005)	x							Determinants of country-level/ cross-country digital divides		x		x	x	x		
Parayil (2005)							x	Informational capitalism		x		x	x			
Park & Lee (2015)		x						Differences in smartphone use	x					x		
Pearce & Rise (2013)			x					Types and breadth of online activities	x			x	x	x		x
Prieger (2013)		x						State and development of country-level/ cross-country digital divide		x			x			
Racherla & Mandviwalla (2013)		x						Determinants of universal use	x				x			
Rains (2008)			x					Online health information seeking	x				x			x
Ramlal & Watson (2014)	x							State and development of country-level/ cross-country digital divide		x		x	x	x		
Rao (2003)						x		Success factors of ICT initiatives		x		x	x			
Rice & Katz (2003)		x						Socio-demographic determinants of Internet / mobile use	x				x	x		
Riggins (2004)							x	E-commerce and customer segmentation	x				x			
Riggins & Dewan (2005)							x	Conceptualization of digital inequality	x	x	x	x	x	x	x	
Roy & Ghose (2006)		x						E-commerce adoption	x				x			x
Schleife (2010)		x						Socio-demographic determinants of Internet / mobile use	x				x			
Segev & Ahituv (2010)			x					Types and breadth of online activities		x			x			x
Selwyn (2004)							x	Conceptualization of digital inequality	x	x						
Selwyn (2006)		x						Digital choice and digital exclusion	x			x	x			

Author	Topic area							Level of analysis			Focal technology					
	ICT access	ICT adoption	ICT appropriation	ICT use outcomes	Measurement of DI	Bridging DI	Other	Topic	Individual	(Cross-) Country	Organizational	Computer	Internet	Mobile phone	Fixed line	Internet applic.
Selwyn et al. (2005)			x					Types and breadth of online activities	x				x			
Shaw et al. (2006)				x				Benefits of e-health solutions	x				x			x
Shelley, Thrane, & Shulman (2006)			x					E-government and e-politics	x							x
Simpson et al. (2004)						x		Success factors of ICT initiatives		x			x			
Sipior et al. (2011)			x					E-government and e-politics	x				x			x
Srivastava & Shainesh (2015)						x		ICT as a tool to bridge disparities	x				x			
Stanley (2003)		x						Psychosocial determinants of Internet use	x			x				
Sylvester & McGlynn (2010)		x						Socio-demographic determinants of Internet / mobile use	x				x			x
Van Deursen (2012)			x					Digital literacy and skills	x				x			x
Van Deursen & Van Dijk (2010)			x					Digital literacy and skills	x				x			
Van Deursen & Van Dijk (2014)			x					Types and breadth of online activities	x				x			x
Van Dijk & Hacker (2003)							x	Conceptualization of digital inequality	x			x	x			x
Vehovar et al. (2006)					x			How to measure - methodological analysis of indices		x		x	x			
Venkatesh & Sykes (2013)				x				Intervention success	x				x			
Venkatesh et al. (2014)			x					E-government and e-politics	x				x			x
Vicente & López (2010)			x					Differences in Internet use of disabled people	x				x			x
Wallsten (2005)	x							Institutional factors and ICT access		x			x			
Wareham et al. (2004)	x							Socio-demographic determinants of Internet / mobile use	x					x		
Warschauer (2003)							x	Social embeddedness of technology	x			x	x			
Wei (2012)			x					Types and breadth of online activities	x				x			x

Author	Topic area							Level of analysis			Focal technology					
	ICT access	ICT adoption	ICT appropriation	ICT use outcomes	Measurement of DI	Bridging DI	Other	Topic	Individual	(Cross-) Country	Organizational	Computer	Internet	Mobile phone	Fixed line	Internet applic.
Wei et al. (2011)				x				Educational outcomes of ICT use	x			x				
Wielicki & Arendt (2010)		x						Determinants of corporate Internet adoption			x	x				
Wilhelm (2003)						x		Governmental policies and interventions to bridge the digital divide		x		x	x			
Zhao et al. (2007)		x						Institutional factors and ICT diffusion		x			x			
Zhao, Collier, & Deng (2014)		x						Impact of digital inequality on e-government development		x			x			
Zillien & Hargittai (2009)			x					Types and breadth of online activities	x				x			x

Appendix D: Reviewed literature – methods of analysis, type of data, study design, and sample

Table 12. Methods of analysis, type of data, study design, and sample of the reviewed literature

Author	Method of analysis					Type of data										De-sign		Sample		
	Quantitative	Qualitative	Mixed methods	Descriptive	Theoretical	Official statistics*	Interviews	Observations	Secondary data**	Survey	Focus groups	Experiments	Performance tests	Other	Cross-sectional	Longitudinal	Sample size	Respondent type	Respondent origin	
Agarwal et al. (2009)	x					x									x		156.941	Individuals***	United States	
Akther (2003)	x								x						x		1.794	Individuals***	United States	
Alam & Imran (2015)		x								x							28	Refugee migrants	Australia	
Arbore & Ordanini (2006)	x								x						x		920	Enterprises	Italy	
Bagchi (2005)	x					x									x		63	Countries	Multiple countries	
Barzilai-Nahon (2006)					x												-	-	-	
Baye et al. (2003)	x													x	x		4 m	Price quotes	United States	
Bélanger & Carter (2009)	x								x						x		105	Individuals***	United States	
Billon et al. (2009)	x					x									x		142	Countries	Multiple countries	
Boase (2010)	x					x									x		2.200	Individuals***	United States	
Bodie & Dutta (2008)					x												-	-	-	
Bonfadelli (2002)				x		x									x		1.757	Teens/ adults	Switzerland	
Brake (2014)				x		x									x		471	Individuals***	United States	
Brandtzaeg et al. (2011)	x					x									x		12.666	Individuals***	Europe	
Brock et al. (2010)		x												x			3	Blogs	United States	
Brown & Licker (2003)	x														x		269	Students	South Africa	

Author	Method of analysis					Type of data										De-sign		Sample		
	Quantitative	Qualitative	Mixed methods	Descriptive	Theoretical	Official statistics*	Interviews	Observations	Secondary data**	Survey	Focus groups	Experiments	Performance tests	Other	Cross-sectional	Longitudinal	Sample size	Respondent type	Respondent origin	
Bruno et al. (2011)	x					x									x		149	Countries	Multiple countries	
Buys et al. (2009)	x					x									x		41	Countries	Sub-Saharan Africa	
Chen (2013)	x					x									x		926	Individuals***	United States	
Chen (2015)	x					x									x		13.257	Individuals***	Taiwan	
Chen et al. (2014)	x					x									x		1.701	Individuals***	United States	
Chinn & Fairlie (2007)	x					x									x		161	Countries	Multiple countries	
Corrocher & Ordanini (2002)	x					x									x		10	Countries	Multiple countries	
Crang et al. (2006)		x					x		x								2	Neighborhood	UK	
Crenshaw & Robison (2006)	x					x									x		80	Countries	Developing countries	
Cruz-Jesus et al. (2012)	x					x									x		27	Countries	Europe	
Cuervo & López Menéndez (2006)	x					x									x		15	Countries	Europe	
Dewan et al. (2005)	x					x									x		40	Countries	Multiple countries	
Dewan et al. (2010)	x					x									x		26	Countries	Multiple countries	
DiMaggio & Bonikowski (2008)	x					x									x		9.446	Individuals***	United States	
DiMaggio et al. (2001)					x												-	-	-	
Dutton et al. (2004)					x												-	-	-	
Eastin & LaRose (2000)	x								x						x		171	Students	United States	
Eynon & Helsper (2010)	x					x									x		2.350	Individuals***	UK	
Fink & Kenny (2003)					x	x											-	Selected statistics	-	

Author	Method of analysis					Type of data										De-sign		Sample		
	Quantitative	Qualitative	Mixed methods	Descriptive	Theoretical	Official statistics*	Interviews	Observations	Secondary data**	Survey	Focus groups	Experiments	Performance tests	Other	Cross-sectional	Longitudinal	Sample size	Respondent type	Respondent origin	
Forman (2005)	x					x									x		6156	Enterprises	United States	
Goldfarb & Prince (2008)	x					x									x		18.439	Individuals***	United States	
Goldfinch et al. (2009)	x								x						x		438	Individuals***	Australia + New Zealand	
Goode (2010)		x											x				3	Students	United States	
Gui & Argentin (2011)	x								x			x		x			980	Children / teenagers	Italy	
Hale et al. (2010)	x					x									x		5.586	Individuals***	United States	
Hampton (2010)		x					x				x						1	Neighbourhoods	United States	
Hargittai (2002)				x			x	x							x		54	Individuals***	United States	
Hargittai (2006a)	x							x							x		100	Individuals***	United States	
Hargittai (2006b)	x							x	x						x		100	Individuals***	United States	
Hargittai (2007)	x								x						x		85	Students	United States	
Hargittai & Hinnant (2008)	x								x						x		270	Children / teenagers	United States	
Hargittai & Walejko (2008)	x								x						x		1.060	Students	United States	
Hawkins & Hawkins (2003)	x					x			x						x		19	Countries	Latin America	
Hilbert (2010)	x					x									x		4	Countries	Latin America	
Hilbert (2011)				x	x	x											-	Selected statistics	-	
Hilbert (2014)	x					x									x		171	Countries	Multiple countries	
Hilbert et al. (2010)				x	x	x											-	Selected statistics	Multiple countries	

Author	Method of analysis					Type of data										De-sign		Sample		
	Quantitative	Qualitative	Mixed methods	Descriptive	Theoretical	Official statistics*	Interviews	Observations	Secondary data**	Survey	Focus groups	Experiments	Performance tests	Other	Cross-sectional	Longitudinal	Sample size	Respondent type	Respondent origin	
Hill & Dhanda (2004)	x					x									x		72	Countries	Multiple countries	
Hoffman et al. (2006)				x		x									x		4.000	Individuals***	United States + Canada	
Howard & Mazaheri (2009)	x					x									x		154	Countries	Multiple countries	
Hsieh et al. (2008)	x								x						x		451	Individuals***	United States	
Hsieh et al. (2011)	x								x						x		900	Individuals***	United States	
Hsieh et al. (2012)		x					x	x									1	ICT initiatives	United States	
James (2003)					x												-	-	-	
James (2005)						x		x									5	ICT initiatives	India	
James & Versteeg (2007)					x												-	-	-	
Judge et al. (2006)	x					x	x								x		8.239	Children / teenagers	United States	
Jung, Qui, & Kim (2001)	x								x						x		1.560	Individuals***	United States	
Kauffman & Techatassanasoontorn (2005)	x					x									x		43	Countries	Multiple countries	
Kelley (2014)					x												-	-	-	
Kim (2015)	x					x									x		1.617	Individuals***	United States	
Kvasny (2006)		x					x	x	x					x			1	ICT initiatives	United States	
Kvasny & Keil (2006)		x					x	x	x								2	ICT initiatives	United States	
Lam & Lee (2006)	x								x		x				x		1.000	Senior citizens	Hong Kong	

Author	Method of analysis					Type of data										De-sign		Sample		
	Quantitative	Qualitative	Mixed methods	Descriptive	Theoretical	Official statistics*	Interviews	Observations	Secondary data**	Survey	Focus groups	Experiments	Performance tests	Other	Cross-sectional	Longitudinal	Sample size	Respondent type	Respondent origin	
LaRose et al. (2007)	x								x						x		1.592	Individuals***	United States	
Lawson-Body et al. (2014)	x								x						x		183	Veterans	United States	
Lengsfeld (2011)	x					x									x		25	Countries	Europe	
Lindsay (2005)			x				x								x		220	Unemployed	Scotland	
Livingstone (2006)				x		x		x			x				x		1.511	Children / teenagers	UK	
Livingstone & Helsper (2007)	x					x									x		1.511	Children / teenagers	UK	
Livingstone & Helsper (2009)	x					x									x		789	Children / teenagers	UK	
Martin & Robinson (2007)	x					x										x	89.461/ 105.387	Individuals***	United States	
Meneses & Mominó (2010)	x					x									x		6.602	Children / teenagers	Spain	
Mercer (2004)		x				x	x		x								1	NGO sector	Tanzania	
Middleton & Sorensen (2006)				x		x										x	n/a	Households	Canada	
Mills & Whitacre (2003)	x					x									x		47.084	Individuals***	United States	
Mistry (2005)		x				x			x								1	Countries	India	
Muir & Oppenheim (2002)					x												-	-	-	
Niehaves & Plattfraut (2014)	x								x						x		150	Senior citizen	Germany	
Okoli & Mbarika (2003)					x												-	-	-	
O'Neil & Baker (2003)		x					x	x	x								1	ICT initiatives	United States	
Oyelaran-Oyeyinka & Lal (2005)	x					x									x		41	Countries	Sub-Saharan Africa	

Author	Method of analysis					Type of data										De-sign		Sample		
	Quantitative	Qualitative	Mixed methods	Descriptive	Theoretical	Official statistics*	Interviews	Observations	Secondary data**	Survey	Focus groups	Experiments	Performance tests	Other	Cross-sectional	Longitudinal	Sample size	Respondent type	Respondent origin	
Parayil (2005)					x	x											-	Selected statistics	-	
Park & Lee (2015)	x								x						x		395	Students	United States	
Pearce & Rise (2013)	x					x									x		1.420	Individuals***	Armenia	
Prieger (2013)					x												-			
Racherla & Mandviwalla (2013)		x						x		x							1	ICT initiatives	United States	
Rains (2008)	x					x									x		5.586	Individuals***	United States	
Ramlal & Watson (2014)				x		x									x		585	Communities	Trinidad and Tobago	
Rao (2003)		x						x									6	ICT initiatives	India	
Rice & Katz (2003)	x					x									x		1.305	Individuals***	United States	
Riggins (2004)					x												-	-	-	
Riggins & Dewan (2005)					x												-	-	-	
Roy & Ghose (2006)									x						x		380	Individuals***	United States	
Schleife (2010)	x					x									x		16.662	Individuals***	Germany	
Segev & Ahituv (2010)	x													x	x		20	Countries	Multiple countries	
Selwyn (2004)					x												-	-	-	
Selwyn (2006)	x								x						x		1.001	Individuals***	UK	
Selwyn et al. (2005)			x			x	x								x		1.001	Individuals***	United Kingdom	
Shaw et al. (2006)					x												-	-	-	
Shelley et al. (2006)	x								x						x		478	Individuals***	United States	

Author	Method of analysis					Type of data										De-sign		Sample		
	Quantitative	Qualitative	Mixed methods	Descriptive	Theoretical	Official statistics*	Interviews	Observations	Secondary data**	Survey	Focus groups	Experiments	Performance tests	Other	Cross-sectional	Longitudinal	Sample size	Respondent type	Respondent origin	
Simpson et al. (2004)		x							x	x	x						200	Individuals***	Australia	
Sipior et al. (2011)	x								x						x		37	Individuals***	United States	
Srivastava & Shainesh (2015)		x					x	x	x								2	Enterprises	India	
Stanley (2003)		x					x	x	x					x			100	Low-income adults	United States	
Sylvester & McGlynn (2010)	x					x									x		n/a	Individuals***	United States	
Van Deursen (2012)	x												x		x		88	Individuals***	Netherlands	
Van Deursen & Van Dijk (2010)	x												x		x		109	Individuals***	Netherlands	
Van Deursen & Van Dijk (2014)	x					x									x		1.200	Individuals***	Netherlands	
Van Dijk & Hacker (2003)				x	x	x											-	Selected statistics	Netherlands	
Vehovar et al. (2006)	x					x									x		986	Individuals***	Slovenia	
Venkatesh & Sykes (2013)	x								x						x		210	Individuals***	India	
Venkatesh et al. (2014)	x						x								x		300	Individuals***	India	
Vicente & López (2010)	x					x									x		9.807	Individuals***	Europe	
Wallsten (2005)	x								x						x		45	Regulatory agencies	Developing countries	
Wareham et al. (2004)	x					x									x		>8.700	Individuals***	United States	
Warschauer (2003a)		x					x	x	x		x						1	Educational sector	Egypt	
Wei (2012)	x					x									x		2.251	Individuals***	United States	
Wei et al. (2011)	x								x						x		4.000	Students	Singapore	
Wielicki & Arendt (2010)	x					x			x						x		1.701	Enterprises	Multiple countries	

Author	Method of analysis					Type of data										De-sign		Sample		
	Quantitative	Qualitative	Mixed methods	Descriptive	Theoretical	Official statistics*	Interviews	Observations	Secondary data**	Survey	Focus groups	Experiments	Performance tests	Other	Cross-sectional	Longitudinal	Sample size	Respondent type	Respondent origin	
Wilhelm (2003)					x												-	-	-	
Zhao et al. (2007)	x					x									x		39	Countries	Multiple countries	
Zhao et al. (2014)	x					x									x		n/a	Countries	Multiple countries	
Zillien & Hargittai (2009)	x					x									x		10.287	Individuals***	Germany	

*The category “Official statistics” also includes data drawn from databases, census data and national surveys

**The category “Secondary data” includes data such as news, documents, reports, and websites

***The term individual refers to those respondents that were contacted in their households

Appendix E: Reviewed literature – types of theoretical contributions and theoretical perspectives

Table 13. Types of theoretical contributions and theoretical perspectives					
Author	Theoretical contribution				Theoretical perspective
	Analyzing	Explaining	Predicting	Analyzing & predict.	
Agarwal et al. (2009)				x	Social influence
Akther (2003)				x	Psychology and personality
Alam & Imran (2015)		x			Multi-factor perspective
Arbore & Ordanini (2006)			x		No theory
Bagchi (2005)		x			Economic factors perspective
Barzilai-Nahon (2006)	x				Index development
Baye et al. (2003)				x	Economic factors perspective
Bélanger & Carter (2009)			x		Socio-demographic perspective
Billon et al. (2009)				x	Technology diffusion theory
Boase (2010)				x	Social influence
Bodie & Dutta (2008)	x				Digital literacy, skills and motivation
Bonfadelli (2002)				x	Knowledge gap hypothesis
Brake (2014)		x			Socio-demographic perspective
Brandtzaeg et al. (2011)				x	Socio-demographic perspective
Brock et al. (2010)		x			Capital theory, black feminist theory
Brown & Licker (2003)				x	Technology acceptance theory
Bruno et al. (2011)		x			Statistics
Buys et al. (2009)				x	Policy perspective
Chen (2013)				x	Capital theory
Chen (2015)		x			Production efficiency
Chen et al. (2014)				x	Information repertoires and social capital
Chinn & Fairlie (2007)				x	Supply and demand
Corrocher & Ordanini (2002)				x	Technology diffusion theory
Crang et al. (2006)		x			Socio-spacial inequalities
Crenshaw & Robison (2006)				x	Technology diffusion theory
Cruz-Jesus et al. (2012)		x			Economic factors perspective
Cuervo & López Menéndez (2006)			x		No theory
Dewan et al. (2005)				x	Technology diffusion theory
Dewan et al. (2010)				x	Technology diffusion theory
DiMaggio & Bonikowski (2008)				x	Human capital theory

Author	Theoretical contribution				Theoretical perspective
	Analyzing	Explaining	Predicting	Analyzing & predict.	
DiMaggio et al. (2001)	x				No theory
Dutton et al. (2004)	x				No theory
Eastin & LaRose (2000)				x	Capital theory
Eynon & Helsper (2010)				x	Choice and decision making
Fink & Kenny (2003)	x				No theory
Forman (2005)				x	Technology diffusion theory
Goldfarb & Prince (2008)			x		Opportunity cost of time
Goldfinch et al. (2009)				x	Socio-demographic perspective
Goode (2010)		x			Technology identity
Gui & Argentin (2011)				x	Digital literacy and skills
Hale et al. (2010)			x		Socio-demographic perspective
Hampton (2010)		x			Collective efficacy
Hargittai (2002)		x			Digital literacy and skills
Hargittai (2006a)				x	Digital literacy and skills
Hargittai (2006b)				x	Digital literacy and skills
Hargittai (2007)				x	Socio-demographic perspective
Hargittai & Hinnant (2008)				x	Capital-enhancing activities
Hargittai & Walejko (2008)				x	Socio-demographic perspective
Hawkins & Hawkins (2003)		x			Policy perspective
Hilbert (2010)				x	Pricing
Hilbert (2011)	x				No theory
Hilbert (2014)	x				No theory
Hilbert et al. (2010)		x			No theory
Hill & Dhanda (2004)			x		Technological achievement
Hoffman et al. (2006)		x			Socio-demographic perspective
Howard & Mazaheri (2009)			x		Policy perspective
Hsieh et al. (2008)				x	Theory of planned behavior
Hsieh et al. (2011)				x	Capital theory
Hsieh et al. (2012)		x			Actor-network theory
James (2003)	x				No theory
James (2005)	x				No theory
James & Versteeg (2007)	x				No theory
Judge et al. (2006)			x		No theory
Jung, Qui, & Kim (2001)		x			Index development

Author	Theoretical contribution				Theoretical perspective
	Analyzing	Explaining	Predicting	Analyzing & predict.	
Kauffman & Techatassanasoontorn (2005)				x	Technology diffusion theory
Kelley (2014)	x				Geosocial activity
Kim (2015)				x	Digital literacy and skills
Kvasny (2006)		x			Theory of social and cultural reproduction (Bordieu)
Kvasny & Keil (2006)				x	Theory of social and cultural reproduction (Bordieu)
Lam & Lee (2006)				x	Capital theory
LaRose et al. (2007)				x	Technology diffusion theory
Lawson-Body et al. (2014)			x		Multi-factor perspective
Lengsfeld (2011)			x		Socio-demographic perspective
Lindsay (2005)				x	Capital theory
Livingstone (2006)	x				No theory
Livingstone & Helsper (2007)				x	Socio-demographic perspective
Livingstone & Helsper (2009)				x	Digital literacy and skills
Martin & Robinson (2007)			x		Technology diffusion theory
Meneses & Mominó (2010)			x		Social influence
Mercer (2004)	x				No theory
Middleton & Sorensen (2006)	x				Socio-demographic perspective
Mills & Whitacre (2003)			x		Socio-demographic perspective
Mistry (2005)		x			Institutional factors perspective
Muir & Oppenheim (2002)	x				No theory
Niehaves & Plattfrait (2014)				x	Technology acceptance theory
Okoli & Mbarika (2003)	x				Technology diffusion theory
O'Neil & Baker (2003)		x			No theory
Oyelaran-Oyeyinka & Lal (2005)				x	Economic factors perspective
Parayil (2005)		x			Informational capitalism
Park & Lee (2015)			x		Socio-demographic perspective
Pearce & Rise (2013)				x	Sociotechnical perspective
Prieger (2013)	x				No theory
Racherla & Mandviwalla (2013)				x	Sociotechnical perspective
Rains (2008)			x		Socio-demographic perspective
Ramlal & Watson (2014)	x				No theory
Rao (2003)	x				No theory
Rice & Katz (2003)				x	Socio-demographic perspective

Author	Theoretical contribution				Theoretical perspective
	Analyzing	Explaining	Predicting	Analyzing & predict.	
Riggins (2004)				x	Pricing
Riggins & Dewan (2005)	x				No theory
Roy & Ghose (2006)				x	Technology diffusion theory
Schleife (2010)				x	Socio-demographic perspective
Segev & Ahituv (2010)			x		No theory
Selwyn (2004)	x				Concept of inclusion, capital theory
Selwyn (2006)		x			Choice and decision making
Selwyn et al. (2005)		x			Socio-demographic perspective
Shaw et al. (2006)	x				No theory
Shelley et al. (2006)			x		Multi-factor perspective
Simpson et al. (2004)		x			No theory
Sipior et al. (2011)				x	Technology acceptance theory
Srivastava & Shainesh (2015)		x			Service perspective
Stanley (2003)		x			Psychology and personality
Sylvester & McGlynn (2010)			x		Socio-demographic perspective
Van Deursen (2012)				x	Digital literacy and skills
Van Deursen & Van Dijk (2010)				x	Digital literacy and skills
Van Deursen & Van Dijk (2014)				x	Cluster of online activities
Van Dijk & Hacker (2003)	x				Forms of access
Vehovar et al. (2006)			x		Statistics
Venkatesh & Sykes (2013)				x	Social influence
Venkatesh et al. (2014)				x	Psychology and personality
Vicente & López (2010)		x			Digital literacy, skills and motivation
Wallsten (2005)		x			Institutional factors perspective
Warschauer (2003a)			x		Socio-demographic perspective
Wareham et al. (2004)				x	Social embeddedness of technology
Wei (2012)			x		Multi-modality of Internet use
Wei et al. (2011)				x	Social cognitive theory
Wielicki & Arendt (2010)				x	No theory
Wilhelm (2003)	x				Policy perspective
Zhao et al. (2007)				x	Institutional factors perspective
Zhao et al. (2014)				x	Multi-factor perspective
Zillien & Hargittai (2009)				x	Technology-in-practice

Second-order digital inequality: A clickstream analysis of e-commerce use

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Mammen

Abstract

“Second-order digital inequality” describes a phenomenon in which certain individuals profit less from digital opportunities not only due to limited access but also due to a limited ability to use information and communication technologies (ICT). In particular, this study extends research on second-order digital inequality to the realm of e-commerce. We introduce a novel perspective on effective – potentially economically beneficial – e-commerce use that encompasses two dimensions: (1) the diversity of e-commerce platforms used by an individual and (2) the degree to which an individual uses supporting e-commerce features, such as price comparison or coupon sites. Building on technology acceptance theory and social psychology, we argue that socio-economically disadvantaged individuals are less likely than their socio-economically advantaged peers to use e-commerce in a manner that potentially promises economic gains. We empirically test our hypotheses using clickstream data that track the online behavior of 2819 US e-commerce users for six months. Our findings reveal that despite equal access, the socio-economically advantaged use e-commerce more effectively in both dimensions. Implications for research and practice are discussed.

Keywords: Digital inequality, e-commerce, digital divide, e-commerce platforms, e-commerce functionalities, technology acceptance, clickstream

Introduction

Since its inception, scholars have discussed the impact on society of information and communication technology (ICT) in general and the Internet in particular (DiMaggio et al., 2001). Proponents of the Internet have argued that it could provide people with access to new ways of creating value and thus foster societal wealth and wellbeing (Hargittai, 1999; Madon, 2000). Some of these authors have even suggested that new Internet-based technologies would level the playing field between societal strata and reduce social inequality (Anderson et al., 1995). In contrast, opponents of the Internet have contended that rather than reducing economic disparities within and across societies, the Internet could in fact lead to “increasing inequalities, improving the prospects of those who are already in privileged positions while denying opportunities for advancement to the underprivileged” (Hargittai, 2003, p. 822).

Within the debate on the social ramifications of the Internet, the phenomenon of “digital inequality” has received substantial attention (Hargittai & Hinnant, 2008; Hsieh et al., 2008; Kvasny & Keil, 2006; Riggins & Dewan, 2005). Digital inequality refers to the difference between individuals regarding their access to and ability to use Internet-based ICT (DiMaggio, Hargittai, Coral, & Steven, 2004). Early studies in this domain have observed so-called “first-order” digital inequality by showing that socio-economically disadvantaged individuals typically have less access to ICT than better situated individuals (DiMaggio et al., 2001; Katz & Rice, 2002). More recently, scholars have increasingly turned their attention to “second-order” digital inequality by noting that individuals also differ with regard to how they *use* ICT depending on their socio-economic status (DiMaggio & Hargittai, 2001). Scholars have explored the existence and implications of digital inequality, focusing on central and potentially beneficial Internet applications such as information search (Van Deursen, 2012), e-government participation (Bélanger & Carter, 2009) and capital-enhancing websites (Zillien & Hargittai, 2009). The observations show that, as a result of digital inequality, socio-economically disadvantaged individuals are less able to profit from the opportunities the Internet has to offer, including better education, better access to information, and cheaper communication (Mossberger, Tolbert, & Stansbury, 2003).

Recently, electronic commerce (e-commerce) has emerged as an additional area of opportunity creation within the digital inequality discussion. With worldwide e-

commerce sales exceeding US\$1 trillion (eMarketer, 2013), e-commerce captures a substantial share of global business. More importantly, a wide range of e-commerce platform formats and features have evolved that help individuals to optimize the economic outcome of their purchases. For example, auctions, price comparisons, daily deals, and e-coupons are means by which individuals can shop more inexpensively than in the brick-and-mortar world. In other words, users who are able to shop more effectively by leveraging e-commerce functionalities can potentially generate a substantial economic surplus (Riggins & Dewan, 2005). Thus, e-commerce might be particularly beneficial for socio-economically disadvantaged individuals.

Despite the potential benefits of e-commerce for individual – particularly underprivileged – shoppers, almost no scholarly attention has to date been devoted to digital inequality in the context of e-commerce. Prior research (Akhter, 2003; Howard, Rainie, & Jones, 2001; Zillien & Hargittai, 2009) suggests that, contrary to the homo-economicus expectations, those individuals with the least economic resources are also the least likely to fully leverage the breadth of opportunities available to realize savings when shopping online. As such, these findings imply that economic inequality in the “offline” world might be further perpetuated in the “online” universe. However, existing digital inequality research has mainly focused on selective aspects of e-commerce. In fact, so far there is only limited empirical evidence on the existence of digital inequality within e-commerce and only a limited theoretical conceptualization of what actually constitutes inequality with regard to e-commerce use. In this vein, scholars have called out for research that better conceptualizes and studies digital inequality in the context of e-commerce (Riggins & Dewan, 2005).

In this paper, we address this research gap by exploring the variation among individuals in how they use e-commerce as a function of their socio-economic status in order to determine whether digital inequality can be observed in the e-commerce realm. We focus specifically on the influence of an individual’s socio-economic status on two aspects of the online shopping process that promise economic gains, namely, (1) the extent to which an individual is able to leverage *the diversity of e-commerce platforms* available within the product purchasing step (e.g., general retailers, daily deals, flash sales) and (2) the degree to which an individual employs *supporting e-*

commerce features such as e-coupons and price comparisons within the information search step to further benefit from e-commerce. We draw on technology acceptance theory and social psychology to hypothesize that socio-economically disadvantaged online shoppers tend to shop less diversely and will be less likely to make use of supporting e-commerce features. We test these hypotheses on a unique set of clickstream data that track the online behavior of 2819 US participants for 6 months in 2012.

Our study makes several key contributions. Most importantly, we contribute to digital inequality research (DiMaggio et al., 2004; Zillien & Hargittai, 2009) by highlighting that second-order digital inequality persists within the context of e-commerce and that contrary to what one would expect, socio-economic status does not primarily impact *how much* individuals buy online, but rather *how* they search for and buy products. We further add to the broader context of information systems research by introducing clickstream data as the empirical basis of our research, which represents an innovative approach to investigating technology acceptance based on actual rather than self-reported, intended behavior. Moreover, we introduce a novel perspective on potentially beneficial e-commerce system use from an economic point of view. Finally, our research has important implications for public policy and managerial practice. Understanding how socio-economic status impacts e-commerce use may influence policy making with regard to digital skills, ICT education and consumer protection. Our insights may also help business practitioners to effectively target different societal groups.

Theory and hypotheses

Digital inequality: The perpetuation of socio-economic status online

“Digital inequality” denotes the difference between individuals in terms of their access to and ability to use ICT, which in turn restrains certain individuals from realizing the opportunities offered through these technologies (DiMaggio et al., 2004). While digital inequality has been observed with regard to various demographic dimensions such as gender, race, and age (Chaudhuri, Flamm, & Horrigan, 2005; Rice & Katz, 2003), the phenomenon has been particularly highlighted in the context of socio-economic differences between individuals as reflected in their income and

education (Jung, Qui, & Kim, 2001). Mossberger et al. (2003), for instance, suggest that individuals with lower income and education levels are restricted in their job prospects due to their relative lack of access to ICT and the associated skills in a work environment. Relatedly, Hsieh et al. (2008) show that individuals with fewer financial resources show less intention to use a government-funded TV Internet connection.

Digital inequality constitutes a complex and multi-faceted societal challenge at a global level as well as within national societies (OECD, 2013; UN, 2013). Researchers have argued that digital inequality is a perpetuation and a reinforcement of underlying social disparities in the “real” world (Kvasny & Keil, 2006; see also Norris, 2001; Warschauer, 2003). It has been suggested that, comparable to the so-called “Matthew effect” (Merton, 1973), peoples’ initial advantages in technology access may translate into increasing relative returns over time, thereby further widening the gap between the more and the less privileged parts of society.

Scholars have devoted increasing attention to digital inequality and its underlying mechanisms. Earlier research in this domain focus on the first-level “digital divide”⁴ (DiMaggio & Hargittai, 2001), which denotes differences in people’s access to ICT and its sociological implications such as exclusion from online education (Katz & Rice, 2002). More recent studies note that access to the Internet is losing importance, with broadband penetration in developed countries almost at saturation levels (e.g., in 2012, 80% of individuals had access to broadband in the US; OECD, 2013). Correspondingly, recent research seeks to elucidate so-called “second-level”⁵ digital inequality (Hargittai, 2002, p. 1): rather than studying *whether* individuals have access to the Internet or not, the debate now focuses on exploring differences in *how* people use the Internet to create opportunities for themselves. Mossberger et al. (2003), in particular, suggest three different manifestations of digital inequality in addition to disparities in access to ICT: first, a skills divide related to the individual ability to handle computers and the Internet and to obtain access to information via these

⁴ DiMaggio and Hargittai (2001) differentiate between the “digital divide” – used to connote whether an individual has or does not have access to a technology – and “digital inequality”, which refers not just to differences in access but also to differences in how individuals with formal access to a technology use it. The term “digital inequality” has dominated the research debate over the last decade as increasing ICT penetration has diminished the purely access-driven divide.

⁵ The terms “first-level” and “second-level” were originally used to define digital divide and digital inequality, respectively. Within current research, these terms are used interchangeably with “first-order” and “second-order”.

devices; second, an economic opportunity divide resulting from people's inability to participate in Internet-based education, training, and employment opportunities; and third, a democratic divide due to the inability to engage in e-government. In this vein, digital inequality scholars have explored aspects such as general Internet skills (Hargittai, 2010; Litt, 2013) and the adoption of e-government (Bélanger & Carter, 2009; Helbig, Ferro, & Boella, 2009). For instance, van Deursen and van Dijk (2011) study Internet skills in the Dutch population and observed that a lower educational level predicted lower Internet skills. In our study, we focus on one additional principal Internet-based application that has been proposed to be affected by and to affect digital inequality (Riggins & Dewan, 2005): the use of electronic commerce.

E-commerce and the potential economic benefits of platform use diversity and supporting e-commerce features

E-commerce in the business-to-consumer context is defined as the trade of products and services online (Olson & Olson, 2000). The U.S. Department of Commerce (2014) estimates that in 2013, US citizens spent US\$ 263 billion online for products and services and that online sales will reach US\$ 370 billion by 2017 (Forrester Research Inc, 2013). In 2014 alone, e-commerce sales were expected to increase by an additional 14% compared to 2013 (Centre for Retail Research, 2014).

Given the growing importance of e-commerce, scholars in information science have studied various aspects of people's e-commerce use. For instance, behavioral research in e-commerce illuminates the factors that motivate individuals to engage in online shopping (Gefen, Karahanna, & Straub, 2003; Gefen & Straub, 2000; Pavlou & Fygenson, 2006). Overby and Lee (2006) find that utilitarian aspects such as convenience and the ability to save time and money are key factors driving e-commerce use. Other researchers have investigated specific e-commerce functions such as auctions and e-coupons. Jung and Lee (2010), for instance, find that the redemption rate for online coupons is significantly higher than that for offline coupons.

In the context of second-order digital inequality, it is important to define what actually constitutes effective – that is, potentially beneficial from an economic point of view – e-commerce use to be able to identify meaningful differences in the way *how*

individuals shop online. This necessitates a more holistic perspective on e-commerce use that goes beyond simply measuring use or non-use as a binary variable. Burton-Jones and Grange (2012, p. 633) propose a definition of effective use as “using a system in a way that increases achievement of the goals for using the system.” Given the premise of utility-maximizing decision making, online shoppers will aim to realize a successful product or service transaction at the minimum economic and opportunity cost. Building on this premise and in line with Alvesson and Kärreman (2007), we adopt a view of “sensitive constructions” (p. 1269) to develop a new perspective on e-commerce use by involving a flexible theoretical framework and taking a “reflexive approach to empirical material” (p.1269), that is, considering alternative framings and constructions conveyed by the empirical material.

Buyer decision-making models break down the purchasing process into a number of steps⁶ (Engel, Kollat, & Blackwell, 1973), of which information search and the product purchasing decision are considered to be the most important within the online context (Gefen & Straub, 2000; Pavlou & Fygenson, 2006). In the information search step, consumers can choose between different e-commerce features to optimize prices (in addition to obtaining general product information), predominantly through price comparisons and e-coupons⁷. When considering the product purchasing step, the continuous evolution of the e-commerce landscape over the last decade needs to be taken into account. Today, consumers can choose among a diverse variety of formats and vendors from which to buy a product. For instance, the rapid proliferation of innovative formats such as auction, daily deal or flash sale sites provide consumers with an increasing range of alternatives to traditional online retailers such as Amazon.com and the opportunity to save money by finding the best deal. Table 1 provides a summary of the different e-commerce platforms and their potential consumer value. Consequently, a conceptualization of effective e-commerce use should account for the heterogeneous information search and product purchase

⁶ The Engel, Kollat and Blackwell model comprises five steps: problem/need recognition, information search, evaluation of alternatives, purchase, post-purchase evaluation (Engel et al., 1973). Alternative comprehensive consumer decision making models put forward by Nicosia (1966) and Howard and Sheth (1969) follow a similar approach.

⁷ Online reviews of retailers are also an important e-commerce feature and serve as a signaling function for consumers to make inferences about price validity (Bodur et al., 2015). As such, they may influence the choice of retailer, however they do not substitute the use of price comparison or e-coupon sites as a means to optimize purchase prices.

options available that offer individuals the potential to achieve economic benefits and thus go beyond the traditional use concept of a simple transaction made online.

Table 1. E-commerce platforms and potential consumer value add				
Purchasing process step	E-commerce platform	References	Definition	Examples of potential consumer value add
Information search	Price comparisons	Bock, Lee, & Li (2007); Bodur, Klein, & Arora (2015); Grewal, Monroe, & Krishnan (1998); Passyn, Diriker, & Settle (2013); Tan, Goh, & Teo (2010)	Website with a search engine that aggregates product listings from different retailers.	Substantial price dispersion exists online (Lindsey-Mullikin & Grewal, 2006). Price comparisons can generate value through price transparency and arbitrage (Bock et al., 2007).
	E-coupons	Chiou-Wei & Inman (2008); K. Jung & Lee (2010); Oliver & Shor (2003); Venkatesan & Farris (2012)	Website that aggregates free promotional savings codes that can be applied to a purchase transaction on another e-commerce website.	In 2014, consumers in the US made total savings of \$3.6 billion on consumer packaged goods by redeeming coupons (NCH Marketing Services, 2015).
Product purchase	General retailer	Campbell, Wells, & Valacich (2013); Gefen et al. (2003); Hinz, Hann, & Spann (2011); Luo, Ba, & Zhang (2012); Overby & Lee (2006); Pavlou & Fygenson (2006)	Website offering a wide range of products not limited to one brand or product type.	Value for money, convenience of locating and comparing multiple vendors, and time savings relative to offline alternatives (Overby & Lee, 2006). Low search and switching costs online facilitate cross-shopping across multiple websites and platforms (Pathak, 2012).
	Specialized retailed		Website specialized in one type of product with multiple brands on offer.	
	Brand shop		Website offering a range of products dedicated to one brand.	
	Auctions	Chang & Chen (2015); Dholakia & Simonson (2005); Suter & Hardesty (2005)	Website with a wide range of products not limited to one brand or product. Purchase via bidding process or direct purchase at fixed price.	Consumers extract a median surplus of at least \$4 per eBay auction (Bapna, Jank, & Shmueli, 2008).
	Daily deals	Boon (2013); Gafni, Geri, & Aziz (2014); Hughes & Beukes (2012)	Website offering virtual vouchers for a limited time for a selection of typically local, discounted goods/services which may be employed offline.	According to Groupon's own statistics, it has sold more than a million deals and saved consumers \$42 million (Grewal et al., 2011).
	Flash sales	Barone & Roy (2010); Martinez & Kim (2012); Ryu & Feick (2007)	Website offering a limited stock of discounted (often brand-name) products. Purchase directly on the website at a fixed price.	Mostly sign-up only, exclusive promotions of limited stock at sharp discounts (often 50% or more) (Grewal et al., 2011).

In this study, we focus on two specific aspects of e-commerce use, both of which are particularly likely to create economic benefits for users in either the information search or the product purchasing phase: (1) the extent to which an individual is able to leverage the diversity of e-commerce platforms available within the product purchasing step (e.g., general retailers, daily deals, flash sales) and (2) the degree to which an individual employs supporting e-commerce features such as e-coupons and price comparisons within the information search step to further benefit from e-commerce. Figure 1 summarizes the key aspects of our proposed conceptualization of e-commerce use.

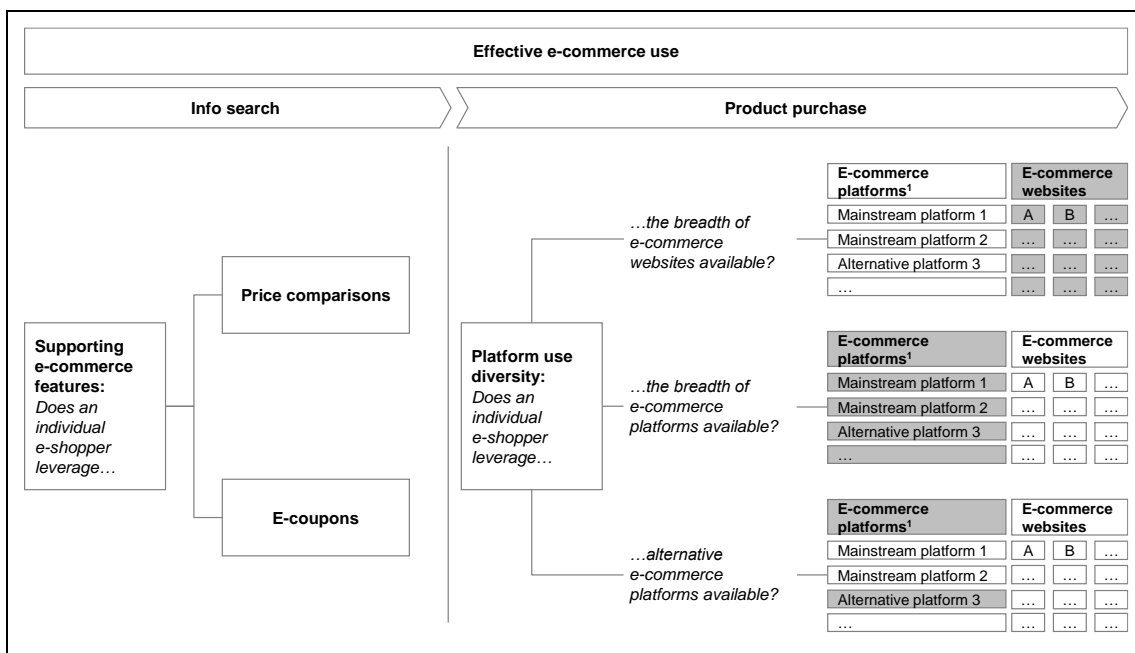


Figure 1. Dimensions of effective e-commerce use at the focus of the study

We define “e-commerce platform use diversity” as the variety of e-commerce platforms an individual uses when shopping online. This definition entails two particular aspects. First, it accounts for the general degree to which an individual makes use of different e-commerce websites and different e-commerce platforms when shopping online. Online shoppers can access a wide a range of e-commerce platforms: for example, general retailers such as Amazon.com, specialized retailers such as Zappos.com, and brand shops such as Nike.com. Research within offline retail has shown that a larger number and variety of store visits per week leads to an economic advantage (Carlson & Gieseke, 1983): those individuals shopping for groceries who make more trips to different stores achieve lower prices on average because of price dispersion between stores. Similar patterns of price dispersion can be

observed in the online space (Ba, Stallaert, & Zhang, 2012), while information search and switching costs are significantly lower (Carter, Wright, Thatcher, & Klein, 2014). Correspondingly, online shoppers who are able to selectively switch between different e-commerce websites and platform formats, and thereby leverage the breadth of product offerings available are more likely to achieve economic gains.

A second particular aspect entailed in the definition of platform use diversity is the users' participation in 'alternative' e-commerce formats such as auctions (e.g., Ebay.com), flash sales (e.g., Gilt.com), and daily deal sites (e.g., Groupon.com). Prior research shows that alternative e-commerce formats in particular offer significant cost savings for users. For instance, Bapna et al. (2008) estimate that the consumer surplus from auctions on Ebay.com exceeded US\$ 7 billion in 2003. Similarly, daily deal and flash sale websites offer heavily discounted deals for a limited time (Boon, 2013; Martinez & Kim, 2012), improving users' odds of achieving lower prices than they could through other sales channels.

We define "*supporting e-commerce features use*" as an individual's use of price comparisons and e-coupons in connection with an online transaction. Price comparison websites such as Shopping.com, Bizrate.com, and Nextag.com increase consumer power (Rezabakhsh, Bornemann, Hansen, & Schrade, 2006) by creating price transparency and by offering additional product relevant information. E-commerce research has shown that the potential savings resulting from the use of price comparison websites can be significant. For instance, Baye, Morgan, and Scholten (2004) examine four million prices for 1000 consumer electronics products and find that despite increased transparency, price dispersion ranged from an average of 3.5% up to 23%.

Moreover, consumers can achieve additional savings by leveraging websites that offer free promotional e-coupons such as Retailmenot.com or Coupons.com. E-coupons are digital codes that entail a price reduction for a given product or website (Jung & Lee, 2010). Thus, using supporting e-commerce features enables users to capture a higher economic surplus per transaction on a given platform. The use of price comparisons and e-coupons in combination can be expected to elicit an even higher consumer surplus.

Digital inequality in e-commerce Use

E-commerce use and the technology acceptance model

Extant studies have repeatedly called for research on digital inequality in the context of different ICT use applications (DiMaggio et al., 2004, 2001; Hargittai & Hinnant, 2008; Zillien & Hargittai, 2009) and of e-commerce in particular (Akhter, 2003; Hoffman, Novak, & Schlosser, 2006). Specifically, Riggins and Dewan (2005) introduce the notion of an “e-commerce divide,” which they defined as “certain people’s inability to make use of more advanced e-commerce online functionalities and services” (2005, p. 318). They argue that even in the case of equal Internet access, socio-economically disadvantaged individuals might be less able to seize the multiple opportunities to achieve the economic gains that are offered by e-commerce.

The notion of an “e-commerce divide” carries a number of intriguing theoretical implications. Most strikingly, such a divide contradicts assumptions about rational behavior, opportunity cost and the decreasing marginal value of money. Under such assumptions, one would expect that the motivation to minimize costs through e-commerce be strongest for those individuals with the least financial resources and that those who earn the least would incur lower opportunity costs when investing time online. Ultimately, these two factors would prevent the emergence of an e-commerce divide. Moreover, the existence of an e-commerce divide appears to be counterintuitive because e-commerce theoretically carries the potential to reduce – rather than reinforce – disparities regarding consumption possibilities in the offline world (Anderson et al., 1995). While in the brick-and-mortar universe, product availability, access, and pricing are highly dependent on the consumer’s place of residence and typically favor those consumers who live in well developed areas, in the online world, the product offering and prices are identical for everyone. In addition, the costs to search for products and prices on the Internet are lower compared to the costs in the offline world due to, for instance, automated price comparisons. In the offline world, information search is costly, which might prevent those in lower income classes from extensively searching for the best product at the best price. Altogether, the notion of an “e-commerce divide” contradicts homo-economicus assumptions about consumer behavior and the theoretical “equalizing power” of e-

commerce. Thus, it seems particularly interesting to explore if and why digital inequality can be observed in the field of e-commerce.

To build hypotheses on the relation between an individual's socio-economic status and his or her tendency to use a diverse set of e-commerce platforms and supporting e-commerce features, we draw on Davis' (1989) technology acceptance model (TAM). TAM is a particularly suitable theoretical lens for the context of our study since is a widely accepted model in information systems research (Venkatesh & Bala, 2008; Venkatesh, Morris, Davis, & Davis, 2003; Venkatesh, Thong, & Xu, 2012), it has proven to yield rich insights in the context of digital inequality (Hsieh et al., 2008) and has been extended to robustly predict various facets of consumer usage behavior in the context of e-commerce (Gefen & Straub, 2000; Koufaris, 2002; Pavlou, 2003), such as online auctions (Stern, Royne, Stafford, & Bienstock, 2008) and e-coupons (Kang, Han, Fortin, Hyun, & Eom, 2006). TAM originally predicts an individual's intention to use new technologies as a function of two factors (Davis, 1989): perceived ease of use, which describes the subjective degree of effort required to use a technology; and perceived usefulness, which refers to the individual's perception of the utilitarian gains that can be derived from using a technology. In our study, we use the equivalent term of utilitarian motivation in lieu of perceived usefulness (see Hsieh et al., 2008) to denote an individual's motivational disposition.

In line with prior e-commerce research (e.g., Ahn, Ryu, & Han, 2007; Pavlou, 2003), we apply an extended, context-specific TAM. In their quest to continuously refine the TAM and adapt it to the context of e-commerce, scholars have dedicated particular attention to perceived risk as an additional precursor of an individual's e-commerce usage (Gefen, Benbasat, & Pavlou, 2008). The individual's perception of risk⁸ is a quintessential component of e-commerce use because the consumer and the Internet store are physically separated, and online transactions therefore have an inherently impersonal nature (Bhatnagar & Ghose, 2004; Kim & Benbasat, 2003; Pavlou, 2003). Glover and Benbasat (2010) describe the perceived risk of online shopping as an aggregate of an individual's subjective assessment of three dimension of risk: first, the

⁸ In line with Glover and Benbasat (2010), we focus on the construct of perceived risk rather than the closely related construct of trust given that a reduced level of perceived risk will require a lower level of necessary trust in the first place. Trust itself has been researched in great detail as well and discussed as an antecedent of perceived usefulness, perceived ease of use and perceived risk (Pavlou, 2003).

risk of information misuse, for example the abuse of personal or financial data; second, the risk related to product benefits, for instance that a product will not arrive or might be defective; and third, the risk of functionality inefficiency, for example that returning a product will be too difficult.

Further, scholars have introduced the construct of hedonic motivation as a complementary element to increase the predictive power of the TAM model in the context of e-commerce (Ahn et al., 2007; Ha & Stoel, 2009; van der Heijden, 2004). In this context, hedonic motivation is the degree to which an individual can derive enjoyment from online shopping (Childers, Carr, Peck, & Carson, 2001). In contrast to utilitarian motivation, which describes the outcome-driven extrinsic motivational factors for using a technology, hedonic motivation refers to the intrinsic motivation reinforced only by “the process of performing the activity per se” (Davis et al., 1992, p. 112). Researchers investigating online consumer behavior have shown that hedonic aspects of online shopping are different from those in the brick-and-mortar universe but equally important. For instance, sensory stimulation offered through a website, the playfulness of a website, and the ability to share e-commerce experiences with others improve the odds that consumers perceive online shopping to be enjoyable and show more intention to shop online (e.g., Ahn et al., 2007; Childers et al., 2001; Lin, Wu, & Tsai, 2005; Moon & Kim, 2001).

The central idea of our study is that because of their socio-economic status, individuals tend to differ in their use of e-commerce. The socio-economically disadvantaged will differ from their advantaged peers in terms of their perceived ease of use, that is, the degree to which they are affected by e-commerce complexity. Moreover, less privileged individuals are likely to differ from the more privileged in their motivational dispositions, that is, regarding the relative importance of hedonic and utilitarian stimuli. Lastly, they are likely to be distinct regarding the degree to which they perceive e-commerce to be risky. We argue that these dispositions, in turn, lead to status-induced differences in how individuals behave regarding their e-commerce platform use diversity and their use of supporting e-commerce features. Table 2 in the next section illustrates the general logic of our theorizing by using TAM constructs to link socio-economic status and e-commerce use. We display our research model in Figure 2 and describe it in the following passages.

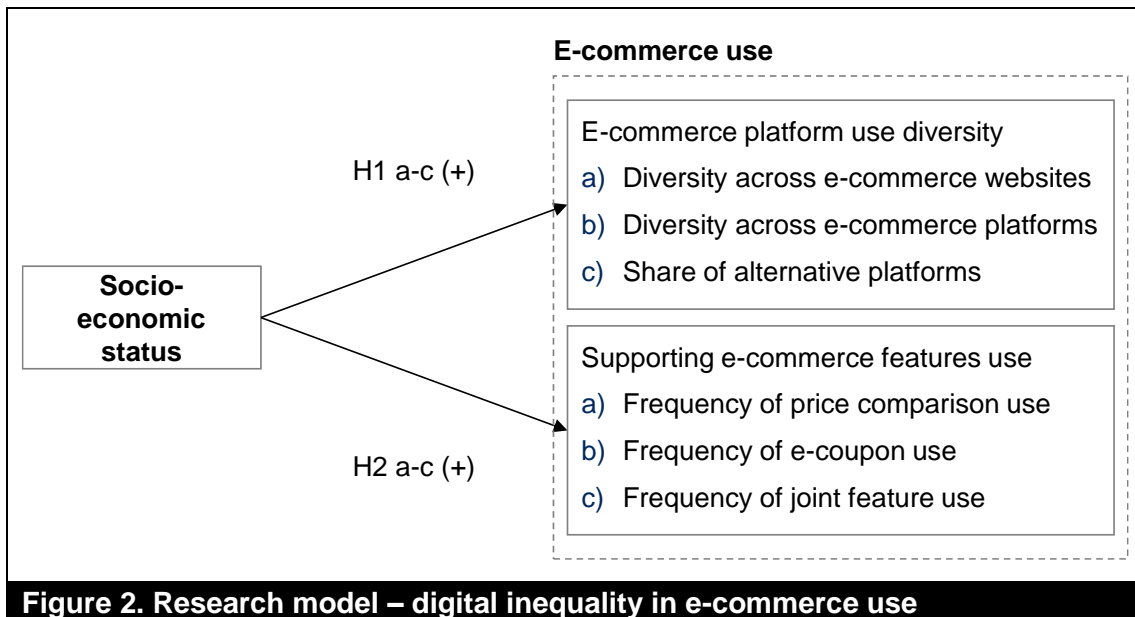


Figure 2. Research model – digital inequality in e-commerce use

Digital inequality in e-commerce platform use diversity

Three rationales lead us to argue that socio-economic status is linked to platform use diversity. First, the complexity of using multiple e-commerce platforms is likely to be affected by the individual’s perceived ease of use. Technology complexity has long been identified as a major barrier to ICT use, including e-commerce (Rice & Katz, 2003). However, social psychology suggests that socio-economic differences cause people to vary in how they perceive complexity: privileged individuals typically have better access to skills and techniques that allow them to cope more easily and flexibly with challenges (Fan & Eaton, 2001), which is one reason why they are less affected by stress-creating factors (Hoffman, 2003), including environmental complexity. Relatedly, scholars studying individual digital skills found a divide between socio-economic classes regarding the skills required to accomplish certain Internet tasks. For instance, van Deursen (2012) observes that individuals with a lower level of education were less able to access health information on the Internet. In this vein, we argue that the perceived ease of using a diverse set of e-commerce platforms is likely to be higher for the socio-economically advantaged given their general disposition to cope more easily with complexity as well as their higher level of education and Internet skills. Therefore, we anticipate that the socio-economically advantaged are likely to shop more diverse than the socio-economically disadvantaged.

Second, socio-economic status is likely to influence the motivational dispositions of individuals (Holbrook and Hirschman 1982; Holbrook 1986), in particular, their

utilitarian and hedonic motivations. Findings from digital inequality research suggest that obtaining utilitarian benefits is likely to be relatively more important for the socio-economically advantaged as opposed to their disadvantaged peers. For instance, Hargittai and Hinnant (2008) investigated the Internet use behavior of young adults and found that those with less education and from lower income backgrounds used the web to a lesser degree to read news or to gather information on finance, health, politics or products. Further, Bonfadelli (2002) studies the Internet use behavior of more than 1400 individuals and found that those with less formal education used the Internet mostly for entertainment, while those study participants with more education used the Internet instead for informational and serviced-related purposes. Some scholars argue that the better education of the socio-economically advantaged puts them in a better position to assess and acknowledge the usefulness of ICT functionalities (Norris, 2001). Other authors see the relatively lower importance of utilitarian benefits as a consequence of the lack of digital skills required to fully leverage existing utility-maximizing opportunities (van Deursen & van Dijk, 2011).

A high level of utilitarian motivation, in turn, positively influences an individual's inclination to shop using a diverse range of e-commerce platforms. Shopping on different platforms provides utilitarian benefits, such as a greater potential to save costs and to profit from better product availability as a result of visiting a range of shopping platforms instead of just one. Similarly, the use of alternative platforms such as auctions, daily deals and flash sales offers significant cost savings (Bapna et al., 2008; Boon, 2013; Martinez & Kim, 2012) and thus provides utilitarian benefits. Given the relatively higher importance of utilitarian benefits for the socio-economically advantaged, they will most likely exhibit more diverse shopping patterns than socio-economically disadvantaged individuals.

Table 2. Using TAM constructs to link socio-economic status and e-commerce use					
TAM construct	Definition	Relative importance of construct depending on socio-economic status	Support for identified relative importance from existing literature	Illustration of specific TAM construct influence on e-commerce use (examples)	
				Platform use diversity	Supporting e-commerce features
Perceived ease of use (PEOU)	Subjective degree of effort required to shop online (Davis, 1989)	Relatively higher for the socio-economically advantaged	Fan & Eaton (2001); Hoffman (2003); Rice & Katz (2003); Van Deursen (2012)	(+) Requires PEOU to manage, for example the complexity of multiple interfaces	(+) Requires PEOU, for example to evaluate price comparison search results
Utilitarian motivation	Individual perception of gains that can be derived from shopping online (Davis, 1989)	Relatively higher for the socio-economically advantaged	Bonfadelli (2002; Hargittai & Hinnant (2008); Norris (2001); van Deursen & van Dijk (2011)	(+) Provides utilitarian benefit of cost savings, for example through using auctions or daily deals	(+) Provides utilitarian benefit of cost savings, for example through price transparency
Hedonic motivation	Degree to which an individual can derive enjoyment from online shopping (Childers et al., 2001)	Relatively higher for the socio-economically disadvantaged	Aneshensel (1992); Hsieh et al. (2008); Mathwick, Malhotra, & Rigdon (2001); Parker & Endler (1996)	(+) Provides hedonic benefits such as novelty, experiencing thrills and feeling of escaping reality	(+) Hedonic benefits limited, for example to the joy of searching
Perceived Risk	Individual assessment of the risks associated with online shopping related to information misuse, product benefits and functionality inefficiency (Glover & Benbasat, 2010)	Relatively higher for socio-economically disadvantaged	Schechter (2007); McLeod & Kessler (1990); Bhatnagar & Ghose (2004); Shaw (1996)	(-) Increases risk, for example through multiple disclosures of personal and financial data	Not applicable

Vice-versa, consumer research and social psychology suggest that obtaining hedonic benefits is likely to be relatively more important to the socio-economically disadvantaged than to their more advantaged peers. Less privileged individuals were found to be generally more exposed to stressors (Aneshensel, 1992) and hence more in need of hedonically achieved stress relief, which is, for instance, provided by shopping (Arnold & Reynolds, 2003). Moreover, socio-economically disadvantaged individuals exhibit a greater tendency to cope with life difficulties by escaping into different worlds (Parker & Endler, 1996). This form of social escapism has already been found to be a hedonic motivational driver of online shopping behavior (Kim, 2002; Monsuwé, Dellaert, & Ruyter, 2004; Overby & Lee, 2006). Internet-based entertainment provides a further opportunity especially for the socio-economically disadvantaged to “get away from it all” (Mathwick, Malhotra, & Rigdon, 2001). As such, it is not surprising that earlier work on digital inequality finds that socio-economically disadvantaged individuals are more strongly attracted to the hedonic elements of ICT use than their more advantaged peers (Hsieh et al., 2008).

Diverse online shopping patterns may also be driven by hedonic motivation. In particular, hedonic benefits such as novelty (Arnold & Reynolds, 2003), a feeling of escaping reality (Mathwick, Malhotra, & Ridgon, 2001) or experiencing thrills in the case of auctions (Turel, Serenko, & Giles, 2011) may be further augmented through diverse e-commerce use. Consequently, from a hedonic motivation point of view, the socio-economically disadvantaged may be more inclined to shop on a broad range of platforms. However, we believe that hedonic motivators are less relevant in the context of our study than utilitarian motivators given that scholars found utilitarian motivation to have a much stronger impact on ICT use than hedonic motivation. Notably, this relationship has been substantiated not only in the case of workplace ICT use (Davis et al., 1992), where it might be expected, but also in the case of leisure activities such as e-commerce (e.g., Ahn et al., 2007; Childers et al., 2001). These findings reflect that people predominantly use ICT in an instrumental way to achieve a certain outcome, corresponding to a utilitarian motivation, rather than for reasons of performing the activity per se, which correspond to a hedonic motivation. So even though shopping on a broad range of platforms may convey some hedonic benefits, utilitarian benefits are expected to be a stronger driver of diverse shopping behavior. As such, socio-economically advantaged individuals, who are more strongly motivated by utilitarian benefits, will most likely exhibit more diverse shopping patterns than socio-economically disadvantaged individuals, who are more strongly motivated by hedonic shopping benefits.

Third, socio-economically disadvantaged individuals are less likely to shop on a broad range of platforms because their risk perception of a given e-commerce activity is likely to be relatively higher than that of their advantaged peers. Economists generally postulate that people with higher incomes are less risk averse (Schechter, 2007). Additionally, psychologists have found that individuals from lower income classes show more intense emotional vulnerability with regard to financial losses (Jane D McLeod & Kessler, 1990). In the specific context of e-commerce, Bhatnagar and Ghose (2004) segment consumers based on their risk and benefit perceptions of online shopping and find that the perceived product risk as well as the perceived security risk were highest in the lowest income class.

A high level of perceived risk associated with online shopping, in turn, inhibits diverse shopping behavior on multiple platforms. With the transfer of transactions from the offline to the online world, the risk associated with buying a product has undeniably risen and constitutes a major influencing factor on e-commerce behavior (Pavlou, 2003). The required multiple disclosures of private and financial data on the different e-commerce sites associated with a diverse shopping behavior further increases the probability of personal data misuse. This might discourage risk-averse individuals from engaging in diverse e-commerce use. This behavior is likely to be reinforced as soon as an individual has built a trust-based relationship with one e-vendor through repeated transactions, making risk-averse individuals even more reluctant to switch to another e-vendor (Gefen, 2002). Given the relatively higher risk perception of online shopping of the socio-economically disadvantaged, they might thus be less inclined to shop on a broad range of platforms compared to the socio-economically advantaged.

Based on the differential behavior regarding perceived ease of use, hedonic and utilitarian motivation, and perceived risk, we formally propose the following:

H1a-c: The higher an individual's socio-economic status, the more diverse will be that individual's transaction behavior when shopping online in terms of (a) e-commerce websites used, (b) e-commerce platforms used, and (c) share of alternative e-commerce platforms used.

Digital inequality regarding supporting e-commerce features use

In line with the argumentation above, perceived ease of use and differences in motivational dispositions will result in differential use of supporting e-commerce features by the socio-economically advantaged and disadvantaged. Perceived risk is assumed to not influence the use of supporting e-commerce features because price comparison and e-coupon websites do not usually require the disclosure of personal data, and the use of these features does not constitute a transaction.

Building on findings that perceived ease of use is relatively lower for the socio-economically disadvantaged, it appears likely that they will experience greater difficulty in using supporting e-commerce features. The use of supporting e-commerce features adds complexity to online shopping. While it is relatively easy for an individual to access price comparison websites, a certain level of information evaluation skills is required to sort out search results and to select a vendor, thereby imposing a potential complexity barrier (van Deursen & van Dijk, 2011). In line with traditional coupon research (Levedahl, 1988), we assume that the complexity of searching for e-coupons on a broad variety of websites and testing e-coupon validity constitutes an additional barrier. Building on the argumentation above, we argue that due to fewer skills and a lower ability to handle complexity, using supporting e-commerce features will be more difficult for the socio-economically disadvantaged.

Given that the socio-economically disadvantaged are also likely to be relatively less motivated by utilitarian benefits, which are important drivers of supporting e-commerce feature use, they are likely to use price comparisons and e-coupons less frequently when shopping online. The use of price comparison websites and e-coupons is mainly driven by utilitarian motivation, while hedonic motivation plays a minor role. Price comparisons generate utilitarian value through increased price transparency and the potential to save costs (Bock et al., 2007). Similarly, e-coupons offer additional savings at the point of sale by providing product- or retailer-specific promotional discounts and thus primarily cater to utilitarian motivations (Jung & Lee, 2010). For both price comparisons and e-coupons, the factors related to hedonic motivation are limited. As theorized above, the socio-economically disadvantaged are relatively less motivated by utilitarian shopping benefits. Thus, we posit that the socio-economically disadvantaged will be less motivated to use supporting e-commerce features. Building on the reasoning above, we formally propose the following:

H2a-b: The higher an individual's socio-economic status, the higher will be the frequency of (a) price comparison use and (b) e-coupon use when shopping online.

An individual who not only uses either price comparisons or e-coupons but also uses both conjointly is likely to achieve even higher gains but at the same time will be faced with higher task complexity. Thus,

H2c: The higher an individual's socio-economic status, the higher will be the frequency of joint price comparison and e-coupon use when shopping online.

Methodology

Data sample

We tested our hypotheses on a unique set of clickstream data courtesy of comScore. Clickstream data represents a record of an individual's online activities. It tracks the user's navigation path online, collecting information, for example, on the websites the user visits, on the actions conducted at each site as well as on e-commerce transaction details such as domain names, products and prices. In contrast to site-centric data, which only assimilates information for a given website, syndicated clickstream data is "user-centric" (Padmanabhan, Zheng, & Kimbrough, 2001) because it chronicles the online activities of individual users across multiple websites.

Clickstream data provides a particularly powerful empirical basis for studying facets of Internet use. It is frequently applied in the field of online marketing to evaluate browsing behavior, the effectiveness of online advertising and online shopping patterns (Bucklin & Sismeiro, 2009). With regard to the latter, the focus of research has largely been on predicting purchase conversion, understanding the factors driving successful transactions and investigating alternative pricing mechanisms in auctions (Moe, 2006; Y.-H. Park & Bradlow, 2005).

Using clickstream data as an empirical basis has several key advantages. First, it avoids the typical weaknesses of cross sectional data such as self-report bias and common rater effects (Podsakoff et al., 2003) by tracking actual behavior. Second, a clickstream dataset typically covers a period of several months. The longitudinal nature of the data means that the risk of a sustained behavioral bias by the user is minimal. Third, user-centric clickstream data in particular encompasses a very large and detailed set of information that would be difficult to aggregate using survey-based measures. For the purpose of our study, which attempts to

understand e-commerce use in a more in-depth and nuanced manner, clickstream data provides the level of detail needed to accurately capture actual use. These advantages come with the tradeoff that the clickstream dataset does not provide empirical insight on the mediating factors that influence use.

Our dataset comprised 19958 Internet users from 10000 households in the US whose Internet activities were tracked for a period of 6 months from May to October 2012. Participants were part of an opt-in comScore consumer sample which is compiled using industry standard methodologies such as random digit dial (RDD) recruitment and membership incentives (Padmanabhan et al., 2001). To normalize self-selection bias in the opt-in sample, comScore employs a technique called “iterative proportional fitting”. In this process, they use an enumeration survey and calibration panel sample with participants only recruited via offline channels (Cook & Pettit, 2009). The obtained measures are used to calculate a weighting scheme for the opt-in panel to ensure population representativeness and normalize the main sources of online recruitment bias as well as self-selection bias, such as proportionally attracting more heavy Internet users (comScore, 2014).

To ensure sample validity, we applied a number of restrictions. We limited transactional data observations to four product categories: apparel & accessories, consumer electronics, home supplies & living, and health & beauty. Other purchases, such as music downloads, digital subscriptions and food delivery orders, were excluded. The rationale behind this selection was to define a homogeneous comparison basis that only includes products that can be purchased online on several different platforms and for which price comparisons and e-coupons are available. In addition, we only included participants with complete demographic data, a minimum age of 18 years and at least one e-commerce transaction in the observation period. The resulting sub-sample encompassed 2819 users and 14260 transactions. This constitutes one of the largest samples in the study of e-commerce use to date.

The dataset included user-level browsing and transaction-related data points from the top 200⁹ mainstream e-commerce websites in the US and the largest alternative e-commerce, e-coupon and price comparison websites. As we were interested in e-commerce platforms rather than individual websites, we classified the URLs in one of the following disjoint categories: general retailers, specialized retailers, brand shops, auctions, daily deals, flash

⁹ In the resulting sub-sample of 14260 transactions, only 144 of the top 200 mainstream e-commerce websites were represented (see Appendix I).

sales, price comparisons and e-coupons. The URL classification was undertaken by two independent raters, who received the same platform descriptions and coding criteria. Intercoder reliability between the two raters was 97%. After discussing the 8 discrepant codes, the two raters reached full agreement.

Table 3 summarizes the sample characteristics. We observe an even gender split in all except for the highest income category. The age distribution is skewed towards users between the ages of 18-44. This is, however, consistent with findings on the age distribution of the actual online shopping population in the US (Forrester Research Inc, 2013).

Table 3. Demographic characteristics of sample (n=2,819)					
	Household income (US\$)				
	<25000	25000 - 49999	50000 - 74999	75000 - 99999	>=100000
Age					
18 - 24	32.1%	29.7%	26.1%	24.7%	25.4%
25 - 34	28.3%	23.7%	23.5%	21.4%	19.6%
35 - 44	16.3%	19.0%	18.8%	23.6%	18.2%
45 - 54	12.9%	14.3%	12.0%	14.0%	19.9%
55 - 64	7.3%	9.1%	11.0%	8.7%	10.7%
65+	3.1%	4.2%	8.6%	7.6%	6.3%
Gender					
Female	50.1%	50.7%	50.9%	51.1%	44.8%
Male	49.9%	49.3%	49.1%	48.9%	55.2%
Household size					
1 person	14.4%	11.9%	9.3%	11.5%	10.1%
2 people	23.2%	28.5%	28.5%	25.8%	22.8%
3 people	22.8%	17.6%	17.3%	21.4%	23.7%
4 people	15.1%	17.5%	20.9%	21.9%	19.4%
5 people	17.2%	17.8%	16.7%	12.9%	20.1%
6+ people	7.3%	6.7%	7.3%	6.5%	3.9%
Internet use					
<5 hours / week	15.1%	18.4%	19.5%	20.5%	20.8%
5-16 hours / week	44.9%	40.1%	43.1%	40.5%	44.3%
>16 hours / week	40.0%	41.5%	37.4%	39.0%	34.9%
Transactional data					
Ø number of transactions	4.6	4.8	5.4	5.1	5.7
Ø overall spend (US\$)	163.4	167.4	201.3	202.6	230.7

Over 80% of the participants use the Internet for personal purposes for at least 5 hours a week. This reflects a good level of exposure. Notably, the average number of transactions for each income class is fairly equal across groups, and participants from the lowest income class spend a proportionally higher percentage of their income online compared to participants

from higher income classes. As such, a general familiarity with e-commerce transactions can be expected for all income groups.

Measurement development

Dependent variables: E-commerce use

To study the aspects of e-commerce platform diversity and the use of supporting e-commerce features, we developed a total of six dependent variables (DV). We operationalized the DVs in the following manner:

DV1: Platform use diversity. To measure platform use diversity, we assessed the degree to which an individual diversified their transactions (a) across different websites within each e-commerce platform, (b) across different e-commerce platforms, and in terms of (c) the share of transactions on alternative platforms.

DV1a-b: Across-website & across-platform diversity. We adapted an entropy measure of diversification (Jacquemin & Berry, 1979) from the field of corporate diversification to evaluate a user's spread of transaction activity across different e-commerce platforms and websites. The key advantage of this diversification index is that it combines the benefits of a frequency-type measure with the added insight of a classification scheme (Palepu, 1985). Due to this feature, the total diversification can be further disaggregated into (*DV1a*) *across-website* and (*DV1b*) *across-platform* diversity. It is calculated as follows (Palepu, 1985):

$$DT = DR + DU = \sum_{j=1}^M P^j \left(\sum_{i \in j} P_i^j \ln \frac{1}{P_i^j} \right) + \left(\sum_{j=1}^M P^j \ln \frac{1}{P^j} \right)$$

where DT = total diversification; DR = across-website diversification; DU = across-platform diversification; $j = 1, \dots, M$ = e-commerce platforms; P^j = share of transactions on platform j ; and P_i^j = share of transactions on domain i within platform j .

Across-website diversity captures the spread of a user's transaction activity across websites on a given e-commerce platform, for example, specialized retailers. A user who, for instance, buys a pair of shoes at each of the online footwear retailers Footlocker.com and Zappos.com will score higher than a comparable user who buys both pairs at Zappos.com. *Across-platform diversity* in turn measures the spread of a user's transaction activity across the six e-commerce platforms defined for the purpose of this study. A user who, illustratively, purchases two pairs of Nike sneakers, one on Nike.com – a brand shop – and the other on

Amazon.com – a general retailer – will again have a higher diversification score than a comparable user who purchases both pairs on amazon.com. Furthermore, both measures take into account a user's total number of transactions within and across platforms, thereby controlling for pure volume-driven diversity.

DV1c: Share of transactions on alternative platforms. To validate the spread of transactions between mainstream (general retailer, specialized retailer, brand shop) and alternative e-commerce platforms (daily deals, flash sales, auctions), we developed a second measure of diversity by calculating a user's share of transactions on alternative e-commerce sites in relation to the user's total number of transactions. Taking into account the data distribution, we clustered the results into 6 categories (0, 0.1%-25%, 25-49.9%, 50-74.9%, 75-99.9%, 100%) to enable a meaningful differentiation between non-users, occasional users and those for whom alternative platforms are an integral part of their shopping behavior. On the one hand, this serves to corroborate the entropy measure of diversification postulated above. On the other, it extends the concept of diversity by evaluating whether a user simply uses a broad range of mainstream e-commerce sites or, in fact, leverages alternative e-commerce platforms as well, which typically offer large discounts.

DV2: Use of supporting e-commerce features. Searching for e-coupons and product prices can be observed as part of an information search taking place before a transaction (Pavlou & Fygenson, 2006). Following previous research (Johnson, Moe, Fader, Bellman, & Lohse, 2004), we defined a pre-purchase period of 3 days prior to the transaction to cover the longitudinal aspect of searching and to avoid inadvertently including non-transaction-related searches at the same time. This timespan appears reasonable given the need for prices and e-coupons to be transaction-related and up-to-date. Search theory (Diamond, 1989) suggests that a search will only be executed if its marginal benefit is expected to exceed its marginal cost. Thus, we measured the use of supporting e-commerce features only for transactions with a value of at least US\$ 50 to ensure a sufficiently high incentive for all income groups to search. Applying this condition resulted in a sub-sample of 1195 users. Three aspects related to supporting e-commerce features were measured:

- *DV2a:* The number of transactions for which the participant accessed price comparison sites within a period of 3 days prior to the transaction, aggregated over 6 months

- *DV2b*: The number of transactions for which the participant accessed e-coupon sites within a period of 3 days prior to the transaction, aggregated over 6 months
- *DV2c*: The number of transactions for which the participant accessed both price comparison and e-coupon sites within a period of 3 days prior to the transaction, aggregated over 6 months

In the subsequent statistical regression model, these count variables of the number of transactions in which a supporting e-commerce feature was used were put in relation to the user's total number of transactions within the 6 month period via an exposure variable in order to account for the proportionate level of use.

Independent variable: Socio-economic status

Socio-economic status is generally defined based on household income and education level (Jung et al., 2001; Lenhart, 2002). Given that household income is viewed as the strongest indicator of standard of living (Duncan, Daly, McDonough, & Williams, 2002) and that education has been shown to be highly indicative of household income (Chiou-Wei & Inman, 2008), in this study we operationalized socio-economic status on the basis of household income. Participants' household income was operationalized as an ordinal scale (1-5) in US\$ 25000 increments. Household rather than individual income was used because an individual's socio-economic status is generally highly dependent on the overall economic welfare of their household. Furthermore, household income is a useful indicator particularly for women, who may not be the primary earners in the household (Galobardes, Shaw, Lawlor, Lynch, & Davey Smith, 2006).

Control variables

We controlled for the demographic variables age, gender and household size. Age and household size were operationalized as continuous variables and gender as a binary variable (men = 0, women = 1). Furthermore, we took into account potential rural-urban¹⁰ disparities

¹⁰ The United States Census Bureau (2010) identifies two types of urban areas: urbanized areas (UAs) of 50,000 or more people and urban clusters (UCs) of at least 2500 and fewer than 50000 people. We consider both types as being "urban" for our analysis. "Rural" encompasses all population, housing, and territory not included within these urban areas. The ZIP Code Tabulation Area (ZCTA) relationship file provided by the US Census Bureau is used to match the 2010 Census urban-rural classification with the ZIP codes provided in the clickstream dataset.

in online shopping behavior that may be driven by differences in access, availability of products and social norms (Lennon et al., 2007). This was included as a binary variable (urban = 1, rural = 0). In addition, we also controlled for Internet use intensity (measured on a three-point scale ranging from 1 = “<5 hours per week” to 3 = “16+ hours per week), which has been shown to be a strong predictor of online buying (Goldsmith, 2002). Finally, when evaluating the use of supporting e-commerce features, we accounted for an individual’s familiarity with e-coupon and price comparison sites by controlling for prior visits to such sites outside of the 3 day period prior to a transaction.

Selection of statistical methods

To account for differences in the composition of our six dependent variables, we used ordinary least squares (OLS), ordered logit and zero-inflated regression models to test our hypotheses. The two DVs related to the entropy measure of diversification (DV1a-b) exhibit properties of a continuous variable as well as linearity in parameters and were therefore treated using linear multiple regression. For DV1c, which is operationalized as an interval variable, we used an ordered logit model to account for the discreteness of the DV. The model predicates that a series of breakpoints exist between the DV categories (McKelvey & Zavoina, 1975), as is the case for DV1c.

DV2a-c were operationalized as count variables and required special consideration. The discrete, nonlinear and nonnegative integer properties of count data imply that the parametric assumptions of an OLS regression would result in biased results. A Poisson distribution is much better suited to model count data because it is also a discrete distribution and takes on a probability value only for integer values of 0 or greater (Coxe, West, & Aiken, 2009).

When using Poisson regression models, it is important to account for variable lengths in the observation periods. Unless otherwise specified, Poisson models assume equal observation periods. This was not the case in our data, where the number of times that a user accessed a price comparison and/or e-coupon website in connection with a transaction is highly dependent on the user’s total number of transactions. Given that the participants in our sample executed anywhere between one and 78 transactions over the tracking period of six months, this aspect needed to be accounted for. One option was to transform the DV into a rate and use a linear regression model. However, the OLS regression assumption of conditional normality of the errors may be violated and the method might hence yield biased

results (Coxe et al., 2009). A generally preferable approach is to use an expansion of the Poisson model that includes an offset to control for exposure. This approach ensures that the correct probability distribution is maintained and that the error structure assumptions are fulfilled. Algebraically, the variable observation period is incorporated into the loglinear Poisson regression function by taking the natural logarithm of the exposure t and constraining its coefficient to 1, as derived below (Coxe et al., 2009). In our regression models for DV2a-c, we included the total number of transactions by each user as an exposure variable.

$$\ln(\hat{\mu}/t) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_p X_p$$

$$\ln(\hat{\mu}) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_p X_p + \ln(t)$$

where $\hat{\mu}$ is the predicted count on the response variable, X_1, X_2, \dots, X_p are the predictors, $\beta_1, \beta_2, \dots, \beta_p$ are the regression coefficients and t is the exposure.

Another common problem with count data is overdispersion, the situation in which the (conditional) variance exceeds the (conditional) mean (Cameron & Trivedi, 2009). In this case, it is still possible to obtain consistent coefficient estimates using a Poisson regression, but the standard errors will be deflated¹¹ and the t-statistics inflated (Cox, 1983). In our price comparison and e-coupon site use dataset, we observed that the data was strongly skewed to the right with a large number of excess zeroes. The comparably large differences between variances and means for DV2a-c, as shown in the descriptive statistics in Table 4, strengthened the impression of overdispersion. A likelihood ratio test using a negative binomial regression confirmed the suspicion. For all three DV2a-c, the overdispersion parameter alpha is different from zero and significant at $p < 0.001$.

Table 4. Descriptive statistics for DV2a-c

Variable	N	Mean	Std. Dev.	Var.	Min.	Max.
DV2a. Price comparison use	1195	.320	.882	.777	0	11
DV2b. Coupon use	1195	.228	.857	.734	0	10
DV2c. Coupon and price comparison use	1195	.065	.454	.207	0	9

Given the presence of overdispersion and excess zeroes in the sample, the most appropriate model to use is the zero-inflated Poisson (ZIP) model. The ZIP model is able to handle data with excess zeroes relative to the Poisson model by supplementing a count density with a

¹¹ The standard errors will only be deflated for data that fits the assumptions of a Poisson distribution and not for special cases, for example high incidence rates of zero.

binary process (Cameron & Trivedi, 2009). Vuong’s likelihood ratio test (1989) for model selection confirmed the use of a zero-inflated model over a Poisson model in all instances.

Results

Table 5 displays summary statistics and pairwise correlations for the variables in our study. No indications of multicollinearity could be found, which means that the independent variables were sufficiently unrelated and the standard errors were not biased as a result. The pairwise correlations between DV2a, DV2b and DV2c were the only ones that exceed 20%. This is not critical, however, because these DVs are not used within the same regressions and the correlation level is still low enough to warrant individual variables.

Table 5. Descriptive statistics and pairwise correlations

Variables	Mean	S.D.	1	2	3	4	5	6
1 Age	3.69	1.51	1					
2 Gender	0.50	0.50	.08 *	1				
3 Household size	3.23	1.46	-.15 *	.06 *	1			
4 Internet use intensity	2.21	0.73	-.07 *	-.05 *	.10 *	1		
5 Urban/rural	0.72	0.45	-.09 *	-.04 *	.01	.08 *	1	
6 Household income	2.65	1.37	.11 *	-.02	.02	-.05 *	.09 *	1
7 DV1a. Across-website div.	0.09	0.22	.07 *	.08 *	-.02	.06 *	-.00	.06 *
8 DV1b. Across-platform div.	0.14	0.28	.07 *	.09 *	-.03	.03	-.02	.04 *
9 DV1c. Share alternative platforms	0.25	0.98	.01	.03	-.02	-.02	.01	.04
10 DV2a. Use of price comp.†	0.32	0.88	.09 *	.03	.03	.09 *	.00	.06 *
11 DV2b. Use of e-coupons†	0.23	0.86	.00	.08 *	.03	.11 *	.03	.06 *
12 DV2c. Use of both p.c. and e-c.†	0.07	0.45	.01	.06 *	.05	.10 *	.01	.06

Variables	7	8	9	10	11	12
7 DV1a. Across-website div.	1					
8 DV1b. Across-platform div.	.20 *	1				
9 DV1c. Share alternative platforms	-.03	.10 *	1			
10 DV2a. Use of price comp.†	n/a	n/a	n/a	1		
11 DV2b. Use of e-coupons†	n/a	n/a	n/a	.35 *	1	
12 DV2c. Use of both p.c. and e-c.†	n/a	n/a	n/a	.54 *	.65 *	1

† Pairwise correlations for DV2a-c are based on the sub-sample n=1195; *p<0.05;

Note: Pairwise correlations between DV1a-c and DV2a-c are not comparable due to different sample configurations

Tables 6 and 7 present the results of our analysis. Models 1, 3, 5, 7, 9 and 11 are the control models for each of the DVs investigated. Model 2 indicates that income has a positive and strongly significant (p<0.001) effect on the across-website diversity measure. This finding supports H1a, in which we posit that users with higher incomes shop on a larger variety of websites within a given platform category. Model 4 indicates moderate support for H1b, in

which we predict that higher income users are also more likely to shop on a larger variety of platforms. This finding is corroborated by Model 6, which shows a positive and significant ($p < 0.01$) effect from income on the use of alternative e-commerce platforms, supporting H1c. Furthermore, our findings validate hypotheses H2a-c. Model 8 indicates some support for a positive relationship between income and the use of price comparison sites (H2a). Model 10 corroborates the hypothesis that users with higher incomes will be more likely to use e-coupons in connection with a transaction (H2b). Finally, we also find strong evidence for the notion that income has a positive effect on the simultaneous use of both price comparison and e-coupon sites prior to a purchase (H2c).

Table 3. Effects of household income on e-commerce platform use diversity

Variables	H1a. Across-website diversification		H1b. Across-platform diversification		H1c. Alternative platform use	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Age	.009 ***	.008 **	.012 **	.010 **	.020	.007
Gender ¹	.037 ***	.039 ***	.052 ***	.053 ***	.459 **	.473 ***
Household size	-.004	-.004	-.007	-.007	-.076	-.082
Internet use intensity	.023 ***	.024 ***	.018 *	.019 **	.036	.049
Urban/rural ²	-.000	-.004	-.012	-.014	.028	-.014
Household income		.011 ***		.008 *		.133 **
F	9.40 ***	9.86 ***	9.23 ***	8.41 ***		
Adj. R ²	.015	.019	.014	.016		
LR chi ²					12.57 *	19.16 *

Models 1-4 are calculated using linear regressions; models 5 and 6 are calculated using ordered logit regressions; regression results including standard errors are presented in the Appendix

N observations = 2819; $p^* < .05$, $**p < 0.01$, $p^{***} < 0.001$; 1) men = 0, women = 1; 2) rural = 0, urban = 1

Note 1: All regression models were also run with a squared age variable to test for a u-shaped effect, extant results are validated, goodness of fit statistics are slightly lower

Note 2: 236 out of 2568 households with more than one participating user in the sample, all models were also estimated for an adjusted sub-sample (N = 2332) containing only single user households to test for unobserved household-dependent effects, results are confirmed for all regression models

In addition to these findings relating to income, one further aspect warrants mention. Our results indicate that Internet use intensity is not across the board a significant predictor of e-commerce use behavior as might be expected. While it does positively influence transaction platform diversity (DV1a-b), there is no evidence of a significant effect on the specific use of alternative platforms, price comparisons, or e-coupons. This result is surprising because higher daily Internet use has been shown to lead to a higher digital literacy (Hargittai & Hinnant, 2008), which in turn influences the sophistication of technology use. In our data sample, however, we find that income is actually negatively correlated with Internet use

intensity ($p < 0.01$). This implies that use experience does not per se lead to more sophisticated use.

Table 7. Effects of household income on use of supporting e-commerce features

Variables	H2a. Price comparison		H2b. E-coupons		H2c. Combined usage	
	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
Age	-.022	-.036	-.100	-.119	-.005	-.463 *
Gender	.013	-.008	.070	.010	-.210	-.753 *
Household size	.091	.080	.011	.017	.154	.206
Internet use intensity	-.036	-.033	.268	.246	-.131	-.192
Urban/rural ¹	.054	.063	-.197	-.286	.656	-.268
Prior site visits	18.0	17.9	17.2	17.4	18.2	17.5
Household income		.084 *		.130 **		.271 **
Total transactions	-----exposure term-----					
LR χ^2	207.4 ***	211.8 ***	219.4 ***	226.7 ***	82.83 ***	88.96 ***
AIC	1304.1	1301.7	911.7	906.4	362.2	358.1
BIC	1370.2	1372.9	977.8	977.6	428.4	429.3

All models are calculated using zero-inflated poisson regressions; regression results including standard errors are presented in the Appendix

N observations = 1195; $p^* < .05$, $**p < 0.01$, $p^{***} < 0.001$; 1) men = 0, women = 1; 2) rural = 0, urban = 1

In summary, we find substantial support for our hypotheses that socio-economic status has a significant impact on how individuals use e-commerce. Our findings confirm that the socio-economically disadvantaged are less likely to fully exploit the opportunities that the e-commerce space has to offer, from the range of mainstream and alternative transaction platforms to supporting features such as price comparisons and e-coupons. Their inability to make use of these opportunities, which are tied to potential economic gains, means that the socio-economically disadvantaged are failing to maximize their consumer surplus online despite the fact that they are the most in need. Consequently, our study establishes that existing socio-economic disparities are perpetuated within the context of e-commerce and that digital inequality persists.

Discussion

This study set out to explore how individuals differ in their use of e-commerce as a function of their socio-economic status and, if digital inequality can be observed in the realm of e-commerce. Our findings have substantial implications for theory. Some findings are related to digital inequality research in particular, while others apply to information systems research in

general. Furthermore, we provide important insights for practitioners, both in the public policy sphere as well as in the business world.

Implications for theory

Digital inequality research

For digital inequality research, our findings first and foremost underscore that digital inequality is a prevalent societal issue, which not only has a first-order effect related to inequality in technology access but also comprises a second-order effect resulting from inequality related to differential ICT use. Despite undisputed advances in providing ICT access (OECD, 2013), ICT in general and the Internet in particular have not yet realized their full potential as equal opportunity platforms (Hargittai, 2010). In fact, as an unintended societal consequence, the Internet might even perpetuate socio-economic stratification. Some scholars maintain that this divide will disappear with increasing Internet access over time (Compaine, 2001). Our results, however, tell a different story: even at levels of comparable Internet access, individuals who are already socio-economically advantaged seem to exhibit different e-commerce use patterns than their disadvantaged peers, which may potentially result in greater benefits from e-commerce use. With the increasing pervasiveness of e-commerce applications in our everyday lives and the growing relevance of Internet based self-service solutions, for example for travel bookings, these differences in e-commerce use could further widen the economic welfare gap between the rich and the poor.

Moreover, this study is, to the best of our knowledge, one of the first to empirically test and validate the long hypothesized e-commerce divide. Digital inequality specifically in the context of e-commerce has to date garnered limited attention from academic research but is of key importance given its immediate economic implications. Prior research (Riggins & Dewan 2005) has only theorized about how socio-economic status might negatively impact e-commerce use. Counter to expectations, our findings indicate that socio-economic status does not primarily determine if or how much individuals shop online but – more importantly – *how* individuals make use of e-commerce opportunities. These insights represent an important step towards a more comprehensive understanding of digital inequality in the context of e-commerce.

In addition, our novel concept of use diversity could be particularly relevant to digital inequality research across different ICTs because it captures individual use patterns in multi-

channel, multi-application environments. The less diverse use patterns of socio-economically disadvantaged individuals found in the context of e-commerce may be indicative of behavior in a variety of technological contexts, in particular those that offer a broad range of use possibilities. Online job search, for instance, is another domain where diversity, i.e. using different applications such as online job portals, company homepages and professional networking sites, may be beneficial by increasing the likelihood of finding a job.

Information systems research

This study also has several important theoretical implications for information systems research in general. Most importantly, a major methodological contribution of our study is the introduction of clickstream data as an empirical basis for technology acceptance research. As Straub and Burton-Jones (2007) have noted, one of the most critical methodological issues underlying TAM is the high risk of common method variance as a result of common-rater effects and self-report bias. Typically, respondents are asked to indicate both their attitude towards a particular ICT, for instance how useful they find it, and whether they use or intend to use it. Consequently, the bivariate correlations between DV and IVs risk being severely skewed. The use of clickstream data allows these methodological limitations to be overcome. In addition, clickstream data tracks actual rather than intended behavior over a sustained period of time and hence avoids problems with time-variant intentions and the potential unreliability of self-reported behavioral attitudes (Podsakoff et al., 2003), a common issue in information systems research. Furthermore, asking users to reflect on use removed from the use experience itself fails to capture automatic use states or patterns that occur outside of individuals' awareness (Dimoka, Pavlou, & Davis, 2011; Ortiz de Guinea & Webster, 2013). While clickstream data is not without its limitations (Bucklin & Sismeiro, 2009), technology acceptance researchers in particular stand to benefit from integrating clickstream data of actual use with self-report surveys measuring behavioral antecedents.

Furthermore, we develop a novel and more holistic perspective on e-commerce use. Drawing on Benbasat and Barki (2007) and Burton-Jones and Straub (2006), we propose that the operationalization of e-commerce use needs to go beyond the notion of a simple purchase and must account for the context in which a transaction takes place, which is seldom one dimensional. The advantages of such an extended behavioral operationalization of use lie in a "more faithful representation of usage activities that users engage in, [and] stronger links with salient outcome variables" (Benbasat & Barki, 2007, p. 215). Our perspective on e-commerce

use contributes to the understanding of online shopping in a more holistic and nuanced manner, in particular with regard to economic utility-enhancing activities. By differentiating between several potentially utility-enhancing aspects of e-commerce (i.e., diverse transaction platforms, price comparison sites, coupon sites), the proposed view enables us not only to illuminate use behavior on an aggregate level but also to examine individual aspects. This approach yields a more thorough understanding of which specific aspects of use are particularly relevant within a certain context and can lead to more targeted measures. In fact, within the specific context of digital inequality, a nuanced operationalization of use like the one proposed is not just important but critical in order to uncover *how* individuals differ in the way they shop online.

Implications for public policy and online businesses

Above and beyond contributions to theory, our study has implications for policy makers and business practitioners alike. Understanding how socioeconomically advantaged and disadvantaged users differ in their use of e-commerce enables policy makers to potentially devise countermeasures and businesses to develop strategies to adequately cater to different societal groups.

On a public policy level, our study highlights that digital inequality continues to be a substantial societal issue, even in developed countries such as the United States. Despite the rapid increase in Internet access, Internet use behavior still differs between socio-economic groups and reinforces societal stratification. Given that the Internet can be a catalyst for economic development and – when used effectively – possesses the potential to equalize social disparities (Anderson et al., 1995), unleashing this potential should be a priority for public policy. More specifically, our findings highlight the importance of developing not only access-based initiatives but also of implementing use-oriented measures. Existing governmental initiatives targeting Internet use, such as the US National Broadband Plan, have largely focused on providing access. However, our study suggests that this is not sufficient to ensure the same online opportunities to all groups in society. The traditional assumption of homogeneous ability to use ICT needs to be replaced by a more nuanced understanding, leading to more tailored policies that take socio-economic status into account. Policy interventions focusing on Internet education and digital skills could help to bridge the current gap and could be added to the educational agenda in the context of broader ICT education at secondary schools, in particular in underprivileged districts. Furthermore, consumer

protection agencies could be empowered to raise awareness and promote knowledge dissemination about Internet use in general and e-commerce in particular.

Online businesses and providers of e-coupon and price comparison sites could use the insights on differential e-commerce use between socio-economic groups to make their services more attractive to the socio-economically disadvantaged, who currently might not be key customers. By effectively targeting currently alienated socio-economic groups, businesses can potentially expand their customer base and generate additional revenue. For instance, our theorizing highlights that the key hurdles – particularly for the socio-economically disadvantaged – associated with shopping on a broad range of platforms are complexity and the perceived risk of creating a unique personal account for each website. In some cases, such as with flash sale sites, users are required to sign-up before even being able to view the products on offer. An increased adoption of integrated single sign-on systems such as “Login with Amazon”, “Login with Facebook” and Google+ by online retailers could remove the frictions associated with accessing third-party websites. Instead of having to create and manage multiple unique accounts, users would be able to conveniently log into a variety of sites using only one set of credentials.

Limitations and Further Research

We acknowledge some theoretical and empirical limitations to our study, which call for further research. Further, we highlight additional promising avenues for research originating from our findings.

A common critique in the technology acceptance research field has been the focus on explaining a single behavior conceptualized in a narrow manner (Benbasat & Barki, 2007) at one point in time. Such a one-dimensional view does not reflect the multifaceted uses of technology and the dynamism inherent in technological change. In today’s fast-paced digitalized world, the realm of online functionalities and possibilities is constantly evolving. While our proposed view on e-commerce use, including platform use diversity and supporting e-commerce features use, aims to capture online shopping more fully in its complexity and variety than current constructs, it makes no claim to being collectively exhaustive as it focuses solely on potentially economically beneficial activities. Moreover, in the context of this study, we theorized on the potential economic value add of using e-commerce features and shopping diversely based on extant research, but did not empirically

test this relationship due to data restrictions. Thus, we urge subsequent research to refine and extend our concept of e-commerce use, and to validate the hypothesized economic benefits. In particular, e-commerce applications relating to services such as e-banking, insurance and peer-to-peer marketplaces for accommodation and travel are gaining importance and offer an interesting avenue for further research. An extended conceptualization of system use is, of course, not limited to the field of e-commerce. Applying a more in-depth conceptualization of system use to other technologies and information systems can provide a particularly rich basis for better understanding individual differences in use patterns and their implications. For example, social network use is a common subject of technology acceptance research that may benefit from more differentiated investigations into actual use patterns given the variety of possible ways to make use of social network sites. Use patterns could also be of particular interest within organizational settings to study how effectively or efficiently employees engage with information systems.

Further, the notion of use diversity developed in this study can provide an insightful lens for information systems scholars seeking to capture ICT use in a multi-technology, multi-application environment. Potential applications could lie, for example, in studies on information search and browsing patterns – areas in which the complexity of online behavior is the relevant research variable. To this end, the entropy measure of diversification proposed in this study may serve future researchers as a useful measurement approach for measuring use diversity across a range of settings. The concept of use diversity may also be of interest to digital inequality researchers, especially with regard to the broader issue of complexity management. Recent digital inequality research has sought to explain the differential abilities of socio-economic groups to use the Internet by studying skill-related aspects such as online navigation and information search skills (van Deursen & van Dijk, 2011). However, more fundamental, cognitive-psychological drivers such as the ability to multitask or handle information overload may in fact lie at heart of why the socio-economically disadvantaged may be less likely to fully leverage the breadth of Internet opportunities available. Future research may benefit from exploring the connection between diversity in use patterns and digital inequality in more detail, both from a psychological and a skills perspective.

The clickstream data used in our study has a significant advantage in providing a clear measurement of the variance in actual use by avoiding typical weaknesses of cross-sectional data such as self-report bias and common rater effects (Podsakoff et al., 2003). In our case,

this advantage comes with the trade-off of omitted respondent demographic information and the limitation that the motivations behind the observed behavior cannot be captured. Existing research on the impact of socio-economic status on the behavioral TAM dimensions allows us to theorize as to why the socio-economically disadvantaged are less likely to use certain functionalities. Empirical investigations into the behavioral antecedents of digital inequality within the specific context of e-commerce would contribute to further substantiating this theoretical basis. Moreover, while comScore undertakes substantial measures (as described previously) to prevent potential sample bias, a certain degree of pre-selection bias might still exist. In addition, a stronger conceptualization of socio-economic status may be achieved by incorporating additional factors such as education and profession, which often – but not necessarily always – correlate with income. We therefore encourage the replication of our findings using clickstream data in conjunction with a survey or structured interviews to enrich the understanding of the behavioral factors driving the differential behavior between advantaged and disadvantaged groups.

Moreover, the moderators that influence the effect of socio-economic status should be explored. Although we found no significant indications for the moderating effects of, for instance, gender, age, or the number of children in a household on our baseline associations, we encourage others to investigate these factors further. Correa, Straubhaar, Chen, and Spence (2013), for example, stress the positive impact that children have on their parents' adoption and use of the Internet. Innovation diffusion theory and research into the importance of social influence on technology adoption also highlight the critical effect of personal network exposure as a moderating variable, particularly with regard to the socio-economically disadvantaged (Hsieh et al., 2008). Understanding which factors can alleviate the impact of socio-economic status in the digital sphere has important implications not only for theory but also for policy making. For instance, the impact and effectiveness of interventional policy measures could be heightened if known moderating effects such as personal network exposure are appropriately leveraged. Future research could further elucidate the moderating impact of such situational factors on the structural determinants of digital inequality.

Furthermore, our research only captures online shopping behavior at home and in a voluntary environment. Given the spread of Internet-enabled mobile devices such as tablets and smartphones, online shopping is increasingly migrating from the traditional household PC to

other platforms and locations. Most notably, individuals are increasingly leveraging their mobile devices to undertake price comparisons and online transactions while in traditional brick-and-mortar stores or on the go (Shankar, Venkatesh, Hofacker, & Naik, 2010). Future research should take into account the omni-channel nature of digital functionalities such as e-commerce and investigate how use patterns differ across channels. Moreover, the differences in e-commerce use patterns observed occurred in a voluntary setting and were tracked only passively. Scholars should investigate whether differential use patterns persist if online use is mandatory as might be the case for some e-government uses.

Finally, we encourage further research to test the generalizability of our findings. Technology acceptance patterns have been found to be influenced, for example, by culture (Im, Hong, & Kang, 2011). It would be prudent to examine to what extent our findings from the US can be replicated in other countries with similar levels and a similar history of Internet access, such as many European nations. Cultural idiosyncrasies, such as German thriftiness for instance, may have a moderating effect on the pervasiveness of digital inequality in e-commerce. Furthermore, a longitudinal panel study across several years could yield interesting insights into how differences in e-commerce use patterns between socio-economic groups evolve over time and whether evidence of convergence can be found. Such a longitudinal perspective could allow extrinsic factors such as learning to be tested.

Conclusion

This study presents a new perspective on how ICT in general and e-commerce in particular relate to the societal phenomenon of digital inequality. Following the call by researchers to better understand the field of e-commerce in the context of digital inequality, we introduce a nuanced perspective on potentially, economically beneficial e-commerce use and investigate how individuals from different socio-economic backgrounds differ in their online shopping behavior. We empirically examine this behavior using clickstream data. Our findings reveal that despite equal access, significant differences in e-commerce use behavior between the socio-economically advantaged and disadvantaged exist. Although Internet applications such as e-commerce possess an equalizing power and could serve as a potent catalyst to reduce existing socio-economic disparities in both the online and the offline world, this potential is so far not being realized. In this respect, our research constitutes an important step towards a better understanding of how ICT can impact our society for better or worse and the development of measures to influence this impact.

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Appendix: Classification of Internet domains

The following list of websites encompasses the e-commerce related domains accessed by the users in the clickstream data sample over the period of 6 months. The domains were classified in one of the following disjoint categories: general retailers, specialized retailers, brand shops, auctions, daily deals, flash sales, price comparisons and e-coupons. The classification was undertaken by two independent raters, who received the same platform descriptions and selection criteria. The reports by the two raters coincided fully in their classification of the URLs.

Table 8. Classification of Internet domains

General retailer: Website offering a wide range of products not limited to one brand or one product type. Purchase transactions can be undertaken directly on the website at a fixed price (no bidding).		
aafes.com	hsn.com	qvc.com
amazon.com	jcpenny.com	samsclub.com
buy.com	kmart.com	seventhavenue.com
costco.com	kohls.com	shopnbc.com
fingerhut.com	lakeside.com	staples.com
ginnys.com	macys.com	target.com
google.com	newegg.com	tigerdirect.com
yahoo.com	overstock.com	walmart.com
Specialized retailer: Website specialized in one type of product (e.g., shoes) and with multiple brands on offer. Purchase transactions can be undertaken directly on the website at a fixed price (no bidding).		
123inkjets.com	dillards.com	nordstrom.com
1800contacts.com	drsfostersmith.com	officedepot.com
1800petmeds.com	drugstore.com	officemax.com
6pm.com	dsw.com	orientaltrading.com
americangirl.com	eastbay.com	puritan.com
amway.com	ecampus.com	quill.com
autopartwarehouse.com	eddiebauer.com	radioshack.com
basspro.com	endless.com	rei.com
bathandbodyworks.com	etsy.com	safeway.com
bedbathandbeyond.com	express.com	saksfifthavenue.com
bestbuy.com	finishline.com	shoebuy.com
bhphotovideo.com	footlocker.com	shoes.com
blair.com	fragrancenet.com	sierratradingpost.com
bloomingdales.com	frys.com	sportsauthority.com
bodybuilding.com	gamefly.com	stubhub.com
boostmobilestore.com	gamestop.com	tennis-warehouse.com
cabelas.com	gymboree.com	t-mobile.com
ccs.com	homedepot.com	toysrus.com
cduniverse.com	jr.com	tracfone-orders.com
checksunlimited.com	landsend.com	verizonwireless.com
childrensplace.com	lanebryant.com	visiondirect.com
christianbook.com	llbean.com	vitacost.com
collectionsetc.com	lowes.com	womanwithin.com
danscomp.com	metropcs.com	zales.com
diapers.com	midnightvelvet.com	zappos.com
dickssportinggoods.com	mycricket.com	

Brand shop: Website offering a range of products dedicated to one brand. Purchase transactions can be undertaken directly on the website at a fixed price (no bidding).

abercrombie.com	disneystore.com	norton.com
abercrombiekids.com	element5.com	ralphlauren.com
ae.com	epson.com	roamans.com
aeropostale.com	forever21.com	sears.com
aitsafe.com	gap.com	sephora.com
apple.com	hp.com	sony.com
att.com	intuit.com	sprint.com
avon.com	jcrew.com	swansonvitamins.com
barnesandnoble.com	kay.com	talbots.com
bizsiteservice.com	kingsizedirect.com	toshibadirect.com
bose.com	lenovo.com	victoriassecret.com
cartserver.com	mcafee.com	vistaprint.com
coach.com	melaleuca.com	wetseal.com
coldwatercreek.com	mlb.com	
dell.com	nflshop.com	

Auction site: Websites offering a wide range of products not limited to one brand or one product type. Purchase via auction/bidding process with the possibility of direct purchase at a fixed price.

cqout.com	govsales.gov	ubid.com
ebay.com	listia.com	webidz.com
ebid.com	onlineauction.com	webstore.com
epier.com	shopgoodwill.com	

Daily deal site: Website offering virtual vouchers for a limited time for a selection of discounted goods and services that are typically local and may be employed offline. A transaction entails the purchase of a voucher rather than the direct product or service.

groupon.com	livingsocial.com	eversave.com
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Flash sale site: Website offering a limited stock of discounted (often brand-name) products. Purchase transactions can be undertaken directly on the website at a fixed price (no bidding).

beyondtherack.com	hautelook.com	ideeli.com	ruelala.com
editorscloset.com	modnique.com		thefoundary.com
fab.com	myhabit.com		theoutnet.com
fashionvault.com	onekingslane.com		therealreal.com
gilt.com			yoox.com

Price comparison engine: Website with a search engine that aggregates product listings from different retailers. Products or services cannot be purchased directly on this website.

google.com/shopping	shopping.com	pronto.com
nextag.com	shopzilla.com	thefind.com
pricegrabber.com	become.com	bizrate.com

E-coupon sites: Website that aggregates free promotional savings codes that can be applied to a purchase transaction on another e-commerce website. Products or services cannot be purchased directly on this website.

groupon.com/coupons	slickdeals.com	eversave.com
retailmenot.com	ebates.com	smartsources.com
shopathome.com	fatwallet.com	couponcabin.com
coupons.com	bradsdeals.com	dealcatcher.com
livingsocial.com/coupons	savings.com	valpak.com

Appendix: Regression models including standard errors

Table 9. Effects of household income on e-commerce platform use diversity including standard errors

Variables	H1a. Across-website diversification		H1b. Across-platform diversification		H1c. Alternative platform use	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Age	.009 *** (.003)	.008 ** (.003)	.012 ** (.004)	.010 ** (.003)	.020 (.048)	.007 (.048)
Gender ¹	.037 *** (.008)	.039 *** (.008)	.052 *** (.011)	.053 *** (.011)	.459 ** (.146)	.473 *** (.146)
Household size	-.004 (.003)	-.004 (.003)	-.007 (.004)	-.007 (.004)	-.076 (.050)	-.082 (.050)
Internet use intensity	.023 *** (.006)	.024 *** (.006)	.018 * (.007)	.019 ** (.007)	.036 (.099)	.049 (.099)
Urban/rural ²	-.000 (.009)	-.004 (.009)	-.012 (.012)	-.014 (.012)	.028 (.159)	-.014 (.160)
Household income		.011 *** (.003)		.008 * (.003)		.133 ** (.051)
F	9.40 ***	9.86 ***	9.23 ***	8.41 ***		
Adj. R ²	.015	.019	.014	.016		
LR chi ²					12.57 *	19.16 *

Models 1-4 are calculated using linear regressions; models 5 and 6 are calculated using ordered logit regressions
 N observations = 2819; p* < .05, **p < 0.01, p*** < 0.001; 1) men = 0, women = 1; 2) rural = 0, urban = 1

Table 10. Effects of household income on use of supporting e-commerce features including standard errors

Variables	H2a. Price comparison		H2b. E-coupons		H2c. Combined usage							
	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12						
Age	-.022	(.051)	-.036	(.051)	-.100	(.067)	-.119	(.066)	-.005	(.248)	-.463 *	(.220)
Gender ¹	.013	(.146)	-.008	(.145)	.070	(.167)	.010	(.168)	-.210	(.390)	-.753 *	(.384)
Household size	.091	(.047)	.080	(.047)	.011	(.048)	.017	(.049)	.154	(.094)	.206	(.116)
Internet use intensity	-.036	(.102)	-.033	(.101)	.268	(.148)	.246	(.148)	-.131	(.366)	-.192	(.563)
Urban/rural ²	.054	(.166)	.063	(.166)	-.197	(.198)	-.286	(.200)	.656	(.606)	-.268	(.668)
Prior site visits	18.0	(651)	17.9	(626)	17.2	(373)	17.4	(394)	18.2	(966)	17.5	(662)
Household income		.084 *	(.040)			.130 **	(.048)			.271 **	(.106)	
Total transactions	-----exposure term-----											
LR chi ²	207.4 ***	211.8 ***	219.4 ***	226.7 ***	82.83 ***	88.96 ***						
AIC	1304.1	1301.7	911.7	906.4	362.2	358.1						
BIC	1370.2	1372.9	977.8	977.6	428.4	429.3						

All models are calculated using zero-inflated poisson regressions

N observations = 1195; p* < .05, **p < 0.01, p*** < 0.001; 1) men = 0, women = 1; 2) rural = 0, urban = 1

Mechanisms of engagement with, and disengagement from, Internet applications: A qualitative study of online job search

Annika Reinartz, Katharina Buhtz

Abstract

In the context of increasing digitization and persistent digital inequality, scholars have sought to uncover the mechanisms that explain why people engage with, or disengage from, Internet applications. We provide a new vantage to this societally relevant conversation by conducting a qualitative study among 16 job-seekers in Germany who differ substantially in how they use online job search applications. Adopting coping theory as the theoretical foundation of our emerging understanding, we develop a dynamic perspective of how an individual's resources – social capital, cultural capital, and habitus – as well as further contextual factors – perceived risk and trust in social capital – determine the appraisal of and the decision to use Internet applications or to abandon them. Our findings highlight the value of adopting a process-based view in order to gain a more thorough understanding of the mechanisms that lead to (dis-)engagement. In particular, our model suggests that social capital plays a more important role in engaging people with Internet applications than portrayed in previous studies. Our research carries important implications for information systems scholars and for policy makers seeking to bridge digital divides.

Keywords: Online job search, digital labor market, coping theory, capital theory, digital inequality, ICT adoption, ICT avoidance, ICT resistance, ICT use

Introduction

Exploring what drives individual responses to new technologies has long been at the heart of information systems research. As more and more aspects of people's lives shift online, understanding what drives individuals to use – or, more importantly still, *not* to use – digital technologies is now more relevant than ever. In fact, scholars have voiced concerns that taking part in digitization is becoming a prerequisite to fully participate in society (Hargittai, 2003) and identified “digital inequality” (DiMaggio et al., 2004) as one of the main challenges of the digitizing society. Digital inequality denotes the phenomenon that social inequalities may be amplified, rather than mitigated, through digitization because certain individuals profit less from digital opportunities due to limited access and limited abilities to *use* information and communication technologies (ICT). Scholars have emphasized that the persistence of digital inequality is problematic because Internet applications permeate almost all domains of life by enhancing or, increasingly, even substituting offline services in areas as fundamental to life chances as education, employment and health (W. Chen, Lee, Straubhaar, & Spence, 2014; Lindsay, 2005; Riggins & Dewan, 2005; Wei et al., 2011). As such, it is imperative to understand why and how individuals respond to Internet applications (Hsieh et al., 2011; Kvasny & Keil, 2006).

In this vein, information systems scholars have developed a wide range of models to explain human behavior towards technologies. One principal stream of research has leveraged a variance-based perspective to explore the antecedents of technology use and adoption, such as an individual's beliefs about how useful a technology is and how easy it is to use that technology (Venkatesh et al., 2003). Some of the best known and most commonly used technology adoption models have emerged from this variance-based perspective, such as the Technology Acceptance Model (Davis, 1989) and the Unified Theory of Acceptance and Use of Technology (Venkatesh et al., 2003, 2012). In contrast, another principal, albeit smaller, stream of research has adopted a process-based perspective to explore the mechanisms and causal processes that determine technology use and adaptation behavior (Maxwell, 2004; Orlikowski, 1996). Process-based approaches offer the opportunity to study user behavior towards a technology as a dynamic and ongoing decision process and are thereby uniquely suited to account for the rich and complex nature of behavioral responses (Schultze & Orlikowski, 2004).

Coping theory represents one of the most popular theoretical lenses through which to study user behavior from a process-based perspective. Coping theory is rooted in psychology and posits that individuals deal with arising internal and external demands, such as being faced with a new technology, through a two-step cognitive process of appraisal and coping effort (Lazarus & Folkman, 1984; Lazarus, 1966). Ultimately, this process decides whether and how individuals choose to engage with, or disengage¹² from, the technology. Information systems (IS) research has incorporated coping theory as a useful lens to explore user adaptation to new technologies. For example, Ortiz de Guinea and Webster (2013) found that individuals appraise expected and unexpected IT difficulties differently and cope through distinct emotional, cognitive and behavioral reactions, some of which occur as part of an automatic and others as part of an adaptive response.

While coping theory acknowledges the vital role of individual resources on the coping process, it remains relatively mute regarding the exact nature of these resources, particularly in the context of new technologies (Beaudry & Pinsonneault, 2005; Lazarus & Folkman, 1984). More specifically, it remains unclear which individual resources play a role at each stage of the coping process and how these resources interact with one another. To this end, capital theory can provide a theoretical vantage point from which to explore this question. Rooted in sociology, capital theory posits that human behavior is explicable through people's access to, or lack of, resources such as knowledge and skills, social support, and economic means (Becker, 1975; Bourdieu, 1984; Coleman, 1990). Within IS research, scholars have successfully adopted capital theory to explain individual differences in Internet use (Kvasny & Keil, 2006; Lam & Lee, 2006). Hsieh and colleagues (2011), for example, found that socio-economically disadvantaged individuals differ from more advantaged individuals in their use of Internet TV because, among other factors, they have less access to cultural capital.

This paper aims to deepen our current understanding of user behavior towards new technologies by adopting a coping theoretical lens to dissect the cognitive processes leading to (dis-)engagement and exploring the capital resources that influence this process. Coping theory is particularly suited to study technology adoption because it allows us to explore the cognitive processes and actions that occur prior to, during and after using a new technology. This perspective on user (dis-)engagement as the result of an iterative coping process

¹² In the remainder of this paper, we summarize “engagement or disengagement” with “(dis-)engagement”

provides a unique vantage point from which to capture the dynamic nature of user responses. Moreover, we hope to further enrich this perspective by drawing on capital theory to relate how resources affect different stages of the coping process. We propose that adopting a coping perspective and accounting for the relational impact of capital resources on the coping process can deepen our understanding of which mechanisms lead individuals to engage with, or disengage from, technologies.

To explore individual user behavior towards digital technologies we conducted a qualitative, inductive study of individuals' (dis-)engagement with Internet applications in the context of online job search. Based on 16 in-depth, semi-structured interviews with job-seekers from two regions in Germany we develop a coping model of user (dis-)engagement and relate how individual capital resources influence different stages of the coping process. The model allows us to better understand how coping mechanisms and capital resources interact to jointly determine whether an individual successfully engages with an Internet application or drops out at some point along the way. Most importantly, our emerging theory suggests that social capital has a game-changing impact at all stages of the coping process and can make the difference between engagement and disengagement.

Our study primarily contributes to the ongoing information systems research debate on a richer understanding of technology use and adoption (Burton-Jones & Grange, 2012; Hsieh et al., 2011; Venkatesh et al., 2007). In contrast to existing research, our model explicitly incorporates the dynamic nature of use while capturing the individual and contextual factors influencing it. Further, we challenge extant notions on the importance of different capital resources in information systems research by highlighting the game-changing role of social capital and introducing a more differentiated perspective on Internet skills. In addition, our study also contributes to digital inequality research by identifying the factors that lead to critical outcomes such as involuntary digital exclusion (Hargittai & Hinnant, 2008; Kvasny & Keil, 2006). Finally, our research has important implications for public policy by uncovering promising points for intervention.

Theoretical foundation

Coping theory and engagement with new technologies

Psychologists developed the cognitive-phenomenological theory of stress and coping (Coyne & Lazarus, 1980; Lazarus & Folkman, 1984; Lazarus, 1966) to explain how and why

individuals vary in their adaptation efforts when responding to a given change in their environment. Lazarus and Folkman (1984) define coping as “the cognitive and behavioral efforts exerted to manage specific external and/or internal demands that are appraised as taxing or exceeding the resources of the person”. Cognitive efforts comprise mental attempts of adaptation such as accepting or distancing oneself from an internal or external demand with the goal of changing the perceived significance of the situation; behavioral efforts comprise actions such as learning new skills or talking to others with the goal of changing the situation itself (Folkman & Lazarus, 1985; Lazarus & Folkman, 1984). External demands refer to demands originating from the socio-contextual environment of an individual while internal demands refer to those emanating from the individual itself, for instance, an individual’s aim to get promoted quickly (Lazarus & Folkman, 1984). Coping theory considers the interaction between the individual and the situation as a dynamic process, which can evolve and change as a result of developments in the individual’s behavior and the situation (Carver & Scheier, 1994).

Coping theory identifies two sub-processes of the coping process, namely the cognitive appraisal of a situation, and the coping effort itself, and considers the immediate outcomes of the process as well as a potential re-appraisal of the situation (Folkman, Lazarus, Dunkel-Schetter, DeLongis, & Gruen, 1986; Lazarus, 1966). The coping process is illustrated in Figure 1. The cognitive appraisal process comprises the primary and the secondary appraisal. During primary appraisal individuals assess if a change in the environment is of personal relevance to them and how they would be affected (Lazarus & Folkman, 1984; Lazarus, 1966). Coping theory suggests that an individual can appraise a specific event in three distinct ways: (1) as irrelevant, if the person perceives the event as not having any implications for the own well-being; (2) as a potential threat, if the individual fears to be harmed; or (3) as an opportunity, if the individual construes the event as potentially positive. Information systems research often categorizes changes in the environment either as an opportunity for the individual (Beaudry & Pinsonneault, 2005) – which implies perceived, potentially positive consequences, or as a threat -which implies perceived, potentially negative consequences (Carpenter, 1992). However, changes in the environment can be multi-faceted and comprise aspects of all possible primary appraisal outcomes, not just one (Lazarus & Folkman, 1984). During secondary appraisal individuals assess what can be done to cope with the situation given the individual resources available (Lazarus & Folkman, 1984). In other words, individuals evaluate their social, cognitive, psychological, physical,

and financial resources and determine the level of control they feel to have in the situation. It is important to note that these resources “refer not to what people do, but to what is available to them in developing their coping repertoires” (Pearlin & Chooler, 1978, p. 5). Consequently, the perceived level of control given the resources at hand influences and mobilizes the coping efforts employed by the individual (Lazarus & Folkman, 1984).

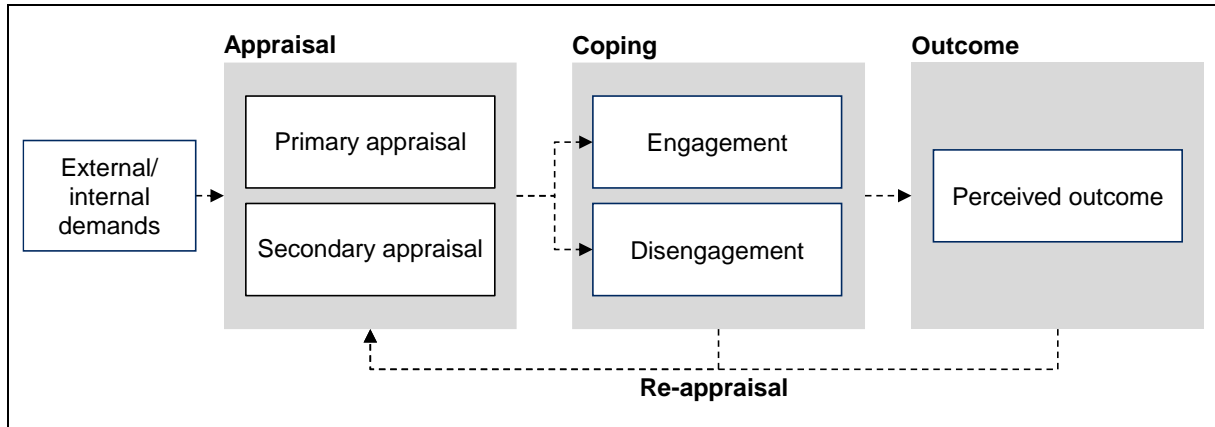


Figure 1. Coping process (adapted from Folkman et al. (1986, p.992-993))

Following the cognitive appraisal, individuals engage in coping efforts, i.e. take actions to deal with the change in their environment. While a vast range of specific coping strategies have been studied by psychologists (Scherer, 1999), coping efforts are often categorized as engagement and disengagement strategies¹³ (Skinner, Edge, Altman, & Sherwood, 2003). Fundamental to this categorization of coping efforts is “the contrast between ways of coping that bring the individual into closer contact with the stressful situation as opposed to ways of coping that allow the individual to withdraw” (Skinner et al., 2003). Accordingly, engagement strategies refer to actions taken by an individual that aim at reducing the person-environment tension by changing the situation itself. For example, a user might seek support in order to learn how to effectively use a new Internet application. In contrast, disengagement strategies comprise actions taken by an individual that aim at regulating emotional distress by changing one’s perception of the situation without changing the situation itself (Gutiérrez, Peri, Torres, Caseras, & Valdés, 2007). For example, a user might convince herself that a

¹³ In psychology, an alternative and widely used categorization is problem-focused and emotion-focused coping. For example, Beaudry and Pinsonneault (Beaudry & Pinsonneault, 2005) built on the distinction between problem-focused and emotion-focused coping to develop the coping model of user adaptation which comprises four coping strategies that contain elements of both problem-focused and emotion-focused acts. In line with Ortiz de Guinea and Webster (2013), we deliberately rather focus on a distinction between engagement and disengagement, given that these categories are exclusive (Carver & Connor-Smith, 2010) as opposed to being interrelated and complementary (Folkman & Lazarus, 1980, 1985). Additionally, Carver and Connor-Smith (2010) found the distinction between engagement and disengagement to be of highest importance in practice.

certain Internet application is not relevant for her. Depending on the cognitive appraisal of the situation, coping efforts can range from escaping the situation – e.g., by strategic ignorance (Merton, 1987) or by quitting a job (Begley, 1998) – to making an effort to leverage the situation – e.g., by seeking support in order to embrace new routines (Carver & Connor-Smith, 2010).

The coping process as a whole is iterative, meaning that a continual re-appraisal of the situation takes place based on the evolving interaction between the internal and external demands on the individual and the individual's resources. As such, the coping process is characterized by its dynamic and resource-dependent nature (Lazarus, 1966). Changes in the socio-contextual environment of the individual or in the personal, subjective relevance of the event can lead to a new appraisal of an event (Folkman & Lazarus, 1985). Furthermore, the chosen coping effort and the following experienced outcomes can result in a re-appraisal of the event (Beaudry & Pinsonneault, 2005). For instance, if an individual appraises a new technology at work as an opportunity to increase her performance, actively engages in learning the new skills required to operate the technology, but then perceives the outcomes of her efforts to be negative – e.g., because the skills are too complex to acquire or the subjective performance does not increase – she may change her prior appraisal and may no longer view the new technology as an opportunity.

Coping theory has proven to be an insightful lens in information systems research. More specifically, IS researchers have applied coping theory to better understand why and how individuals react to new technologies. For example, Lee and Larsen (2009) build on coping theory to study executives' decision to adopt anti-malware software. Similarly, Liang and Xue (2009) draw on coping theory to develop a dynamic perspective on how individuals behave to avoid malicious information technologies. Furthermore, in their Coping Model of User Adaptation (CMUA), Beaudry and Pinsonneault (2005) show that exploring the distinct stages of the coping process can be helpful in better understanding the cognitive processes individuals go through and the actions individuals take when deciding how to adapt to a new technology in an organizational context. The dynamic perspective of coping theory makes it particularly suitable to study complex individual use patterns that span over a period of time, such as (dis-)engagement with a new technology. Coping theory has also proven to be an insightful lens to explain individual behavior in both mandatory and quasi-mandatory settings, where individuals are not forced but expected to make use of a new technology

(Beaudry & Pinsonneault, 2010), as is the case with many Internet applications today as they increasingly substitute offline alternatives.

The influence of capital resources on engagement with new technologies

Coping theory suggests that individual resources play an important role in how individuals appraise and cope with a novel situation (Lazarus and Folkman 1984), such as being faced with a new technology. Yet, it remains relatively mute regarding the exact nature of these resources, particularly in the context of new technologies. Here, IS literature can provide meaningful insights regarding which individual resources typically influence the adoption and use of a new technology. More specifically, IS scholars seeking to adopt a resource-based view to explain individual behavior towards new technologies have built on capital theory (Hsieh et al., 2011; Lam & Lee, 2006; Lindsay, 2005).

Capital theory is rooted in sociology and builds on the notion of capital – i.e. the accumulated and objectively available resources held by an individual (Bourdieu, 1986) – to explain human behavior within societal structures (Becker, 1975; Coleman, 1990). In this, scholars view capital and its distribution as the set of constraints under which society and individuals act (Bourdieu, 1986). As put forth by Bourdieu (1986) and Coleman (1990), two forms of capital are particularly notable from a sociological perspective, namely cultural and social capital. “Cultural capital” is defined as resources that are internal to individuals in the form of skills, knowledge, and capabilities that enable human activities (Coleman, 1990). “Social capital”, in contrast, commonly refers to the “resources embedded in a social structure that are mobilized in purposive action” (N. Lin, 2001), such as relatives, friends, or social institutions, such as governments and schools. In addition to cultural and social capital, sociologists also recognize an individual’s disposition – or “habitus” – as a key differentiating psychological resource for human behavior, and thus, as a type of capital (Bourdieu, 1990; Henry, 2004). These forms of capital and their application in IS research are summarized in Table 1.

In capital theory, one of the most intriguing features is the notion of conversion (Bourdieu, 1986; Coleman, 1990), which posits that one type of capital can be converted into or enhance another type (Silva, 2006). For example, cultural capital can be enhanced through the resources available within an individual’s social network (Bourdieu, 1984): users who lack the skills or competence to engage meaningfully with an Internet application may overcome

this barrier by receiving support from someone from their social network. In other words, different forms of capital do not act in isolation, but rather interact with each other.

Table 1. Forms of capital and their application in IS

Capital	Definition	Application in IS	Supporting literature
Cultural capital	The resources that are internal to individuals in the form of skills, knowledge, and capabilities that enable human activities (Coleman, 1990).	<ul style="list-style-type: none"> • Skills (formal, content) • Knowledge • Self-efficacy/ individual confidence 	Gui & Argentin 2011; Hargittai & Hsieh 2011; Kvasny & Keil 2006, Hu et al. 2007; Reay 2004
Social capital	The resources embedded in an individual's social structure that can be mobilized in purposive action (N. Lin, 2001)	<ul style="list-style-type: none"> • Family, friends, relatives, peers • Support from managers, co-workers, employees • Social institutions, e.g. government, schools 	Wasko & Faraj, 2005; Hsieh et al. 2011; Chiu et al. 2006; Kvasny & Keil 2006; Liao & Chou, 2012
Habitus	An individual's disposition towards an action or artefact (Bourdieu 1990; Henry 2004)	<ul style="list-style-type: none"> • Perceived usefulness • Hedonic evaluation 	Davis 1989; Norris 2001; Venkatesh et al. 2003

Information systems research scholars have successfully borrowed and adapted constructs from capital theory to better understand variations in individual behaviors towards new technologies, under the premise that ICT use, similar to other human behaviors, is subject to capital constraints (De Haan, 2004; Rogers, 2003). For example, researchers have shown that the notion of cultural capital is indispensable for understanding *how* individuals use ICT (Gui & Argentin, 2011; Hargittai & Hsieh, 2011). Kvasny and Keil (2006) find that deficiencies in skills, knowledge and competencies limit an individual's ability to use cultural goods like ICT in the manner demanded by labor markets, governments, corporations and other institutions. Other ICT scholars have extended the notion of cultural capital to also embrace resources such as individual confidence and self-efficacy (Hsieh et al., 2011; Hu, Huhmann, & Hyman, 2007). These researchers found, for example, that such capital empowers an individual to activate available knowledge for action (Reay, 2004). Furthermore, social capital and related constructs, such as subjective norms, feature prominently in research on technology use (e.g. TAM, UTAUT) (Davis, 1989; Venkatesh et al., 2003). For instance, Chiu et al. (2006) explore the critical role of social capital on knowledge sharing in virtual communities. Additionally, scholars view an individual's general disposition or habitus towards ICT as one of the central determinants of individual tendency to engage with ICT (Davis, 1989; Norris, 2001). For instance, (Davis et al., 1992) found that perceived usefulness and enjoyment significantly determine the intention to use, and usage of, computers in the workplace. Overall, IS research portrays habitus, cultural and social capital as influential in

people's engagement with ICT (Hsieh et al., 2011; Kvasny & Keil, 2006; Warschauer, 2003). Economic capital, which for a long time has reduced many people's access to ICT (De Haan, 2004), has become less of a bottleneck for ICT consumption in developed countries.

Leveraging the resource-based view of capital theory can help us to better understand which resources influence different stages of the appraisal and coping process resulting in engagement with, or disengagement from, Internet applications. Extant research suggests that the contextual and individual resources available to the individual, in form of habitus, cultural and social capital, can influence the appraisal and coping process by enhancing or limiting the individual's scope of action (Hsieh et al., 2011). For example, within the secondary appraisal phase, an individual under stress may evaluate his or her competence, social support, and the material resources at hand in order to readapt to the circumstances and to reestablish equilibrium between herself/himself and the environment (Schwarzer and Luszczynska 2012). Yet several aspects remain unclear. For one, the conversion property of capital raises the question of how individuals leverage and convert their existing capital resources into the forms of capital that are particularly instrumental for their engagement with Internet applications, and what these are. For another, since the choice to engage with, or disengage from, an Internet application can be seen as an iterative decision process rather than a singular moment in time, different capital resources may be crucial at different stages of the decision process – yet it is unclear *which* resources are decisive and *when*. In this vein, we adopt a semi-exploratory approach to uncover the mechanisms that lead individuals to (dis-)engage with Internet applications and explore which types of capital resources play a critical role at different stages of the (dis-)engagement process.

Methodology

Given the exploratory, process-oriented character of our research question and the complex and ambiguous nature of the mechanisms leading to (dis-)engagement (Selwyn, 2003), we employ a theory-informed qualitative, process-focused case-research design (Eisenhardt, 1989; Langley, 1999; Yin, 2003). In this, we follow Conboy et al. (2012, p.117), who emphasize the ability of qualitative research to “extract key information [...] from a highly complex, uncertain, turbulent, multi-faceted context” and we answer repeated calls for more qualitative studies in information systems research (Venkatesh et al., 2013).

Case study context: Job search in the German labor market

To induce an integrated middle-range theory (Merton, 1967) of the cognitive processes around user (dis-)engagement with Internet applications, we studied how job-seekers in Germany used Internet applications for their job search. The context of online job search is a uniquely suited empirical setting for our study for at least four reasons. First, how to search for jobs has dramatically changed over the last decade and the shift into the online sphere confronts individuals with the need to cope with multiple new Internet applications. Second, online job search constitutes a unique opportunity to study a critical case of (dis-)engagement with Internet applications, since individuals are highly involved and typically suffer from stress and uncertainty given the immediate social and economic consequences of unemployment – circumstances under which coping plays an important role. Third, the process of searching for a job spans over a certain period of time and as such promises to reveal individual variances in cognitive appraisals and outcome-dependent re-appraisal processes. Fourth, the German Federal Employment Agency (GFEA) plays a central role in the job search and placement process and is in personal contact with every individual who is or is facing unemployment. This provides a unique opportunity to study the influence of institutional social capital on user engagement.

In Germany, the means by which companies search for candidates to fill vacancies have changed dramatically with the rise of the Internet. While, in 2003, around 40% of vacancies of the 1000 largest German companies were still advertised in print media, this number has diminished to 12% in 2014 (Weitzel et al., 2015). Today, over 90% of the companies use online channels to advertise vacancies and search for employees (BITKOM, 2010; Weitzel et al., 2015). More importantly, the shift towards online channels has impacted the way actual placements are generated. For the 1000 largest companies, around 85% of placements are now generated through online channels (Weitzel et al., 2015). Even medium-sized companies nowadays generate 46% of their placements online, despite the fact that they rely more strongly on personal recommendations and the GFEA in their search for work force.

Generally, there are three main types of online job search applications: (1) company homepages, which job-seekers use to look for advertised vacancies, to search for information about potential employers, and to directly apply via an application interface. (2) Online job portals, which job-seekers visit to search for posted job offers or to post a “want” ad themselves. There are general online job portals, such as monster.de, as well as industry-

specific job portals, such as fashionunited.de. Job-seekers can narrow down their search using filter functions, for instance to focus on specific professions or locations. (3) Online social networking sites, which job-seekers may use to publish a professional profile, search for jobs and network. Most prevalent are professional social networking sites such as LinkedIn or Xing, however companies are also increasingly using popular social networking sites such as Facebook and Twitter to create awareness for vacancies.

While the online channel plays an increasingly important role in job search, offline channels such as print media, personal connections and the GFEA still play a role in the job search process. The first two are especially used by smaller companies to fill vacancies. A particularity of the German labor market is the GFEA, which acts as an agent between individuals seeking a job and employers seeking to fill vacancies. Individuals who become or are likely to become unemployed in the near future are obliged to attend a consultation meeting with an employment agent and fulfill certain requirements, e.g. to send out a minimum number of applications per months, in order to be eligible for financial aid. Conversely, companies can inform the GFEA about vacancies they want to fill. The matching process is then facilitated by the GFEA. The GFEA has adapted to the digitization of the job search sector and today offers a comprehensive online job portal, the possibility for job-seekers to publish a professional profile online, as well as a broad range of work-related information on their homepage.

Data collection

In order to gain insight on how individuals engage with job-related Internet applications we collected a broad set of data – comprising interviews, self-tests of online job search applications, on-site observations and archival data – over a period of nine months from August 2014 to April 2015, as presented in Table 2. The multiple data sources served to triangulate and improve the trustworthiness of our analyses (Miles et al., 2013; Yin, 2003). First, we gathered statistics on the German online labor market and interviewed a recruiter of a large German company in order to develop an overview of the online job search applications available and used by employers. The authors obtained additional information about specific applications through self-tests. A visit of the GFEA and a face-to-face interview with one of the employment agents, which included a system demonstration, led to a good preliminary understanding of the interaction between the GFEA and job-seekers, as well as the level of information conveyed in a typical consultation meeting. We

complemented this information by studying the user manuals on the GFEA's online job portal. Particularly the Internet application self-tests and the personal encounters with the GFEA enabled the authors to assume a participant observer role by merging into the context of searching a job for themselves.

Table 2. Data collection

Type of source	Data collected
Interviews	<ul style="list-style-type: none">• 16 semi-structured interviews with individuals in the process of or recently looking for a job• One interview with recruiter of a large German company• One interview with GFEA employment agent
Self-tests	<ul style="list-style-type: none">• Self-test of the ten most popular German online job portals• Self-test of the two most prevalent social network sites (Xing and LinkedIn)
On-site observations	<ul style="list-style-type: none">• Visit of four branches of the GFEA• GFEA system demonstration and study of GFEA user manuals
Archival data	<ul style="list-style-type: none">• Statistics of the German Federal Employment Agency• Research reports on recruiting trends covering 2003-2014• Blogs and press releases on online job search applications covering 2010-2014

Second, and core to our data collection efforts, we conducted 16 semi-structured interviews with individuals who were currently or had recently been looking for a job. In line with Patton (2002), we used an interview guide approach, because it is more open and flexible than a standardized interview approach while at the same time ensuring comprehensive and systematic data collection. The interview guide is presented in Appendix A. All interviews were audio-taped and generally lasted 45-60 minutes. Additionally, demographic data and Internet use experience was collected from each interviewee. The interview protocol walked the interviewees back through the experience of searching for a job and we sought to minimize informant recall bias by using anchor questions (Collopy, 1996; Hufnagel & Conca, 1994).

A criterion-based, purposeful sampling (Patton, 2002) was used for this study in that we selected only participants who were currently or had recently been seeking a job in order to maximize "information-rich" cases (1990, p. 169). Following Miles et al. (2013) and Trost (1986), we tried to maximize variation by sampling participants from different educational backgrounds, age groups, gender and urban/rural places of residence. For example, Josh (29) was released after five years in prison and was in the process of seeking an apprenticeship to become an electrician in Berlin, while Lisa (59) lost her job at the age of 57 and was struggling to find a position as an office clerk around rural Düren. Participant information is

displayed in Table 3. Sampling was done iteratively (Miles et al., 2013) to allow for emerging patterns in the data to be challenged (Clarke, 2005; Strauss & Corbin, 1990). Interviews were conducted and simultaneously analyzed until additional interviews only repeated already identified themes, indicating a point of theoretical saturation (Yin, 2003). All interviews were transcribed *in vivo*, yielding 182 pages of field notes.

Table 3. Interviewee demographics¹⁴

Name	Gender	Age	Highest attained degree of education	Focus of job search	City	Internet use frequency
Judy	Female	32	Vocational training	Media design	Berlin	Daily
Paul	Male	37	Vocational training	Social work	Berlin	Daily
Cait	Female	44	Bachelor degree	Social work and stage/costume design	Berlin	Daily
Lisa	Female	59	Vocational training	Office clerk or field service	Düren	Several times per week
John	Male	26	Vocational training	Shop assistance	Berlin	Daily
Pete	Male	44	Master degree	Project management	Berlin	Daily
Dave	Male	33	Master degree	Software programming	Berlin	Daily
Matt	Male	39	Master degree	Art history	Berlin	Daily
Anna	Female	33	Vocational training	Shop assistance or interior decoration	Berlin	Several times per week
Henry	Male	28	Vocational training	Automotive sales	Düren	Daily
Kevin	Male	43	Vocational training	Retail sales	Berlin	Daily
Mary	Female	63	Vocational training	Florist or caretaking	Düren	Never
Mike	Male	24	Vocational training	Social care work	Düren	Daily
Carl	Male	39	Certificate of Secondary Education	Construction work	Berlin	Daily
Tom	Male	23	Certificate of Secondary Education	Goldsmith or security guard	Düren	Daily
Josh	Male	29	Certificate of Secondary Education	Messenger or electrician	Berlin	Daily

Data analysis

Content analysis was conducted in an iterative process based on coding techniques proposed by Strauss and Corbin (1990). This approach enables the researcher to verify existing theoretical concepts and to discover new, emerging concepts at the same time (Lincoln & Denzin, 2000). Coding was conducted in two steps¹⁵: open coding and axial coding. First, in the open coding phase, transcripts were analyzed line by line and coded based on an a priori

¹⁴ Displayed in the temporal order of interviews. Names were altered to keep participant information anonymous.

¹⁵ Complete coding guidelines can be obtained from the authors

developed coding book informed by the theoretical constructs of coping and capital theory (Strauss & Corbin, 1990). This was combined with a purely inductive open-ended analysis, allowing for new themes to emerge. As proposed by Miles et al. (2013), two of the researchers coded pairs of interviews independently from each other and compared their results. On average, inter-coder reliability between the two raters was 92%. In total, 53 deviating classifications were discussed and resolved. This approach was repeated for each set of interviews throughout the complete coding process to ensure full inter-coder agreement.

Second, axial coding was applied in order to disaggregate and reassemble data in order to focus on the relationships between and within categories (Strauss & Corbin, 1990). In order to establish these relationships – e.g. context conditions, causal conditions – codes were grouped in sub-categories and categories around emerging relational themes. The coding assignment was continuously revised, abstracted, and consolidated in an iterative process until full inter-code agreement was achieved on all dimensions. The entire coding process generated a total of 656 coded *in vivo* quotes, 239 first-order codes and 48 second-order codes clustered within 8 overarching categories. The coding structure as well as examples of the coding procedure is provided in Appendix B.

Results

Figure 2 visualizes our emerging understanding of the coping mechanisms that lead to (dis-)engagement with Internet applications and the impact of individual capital resources at different stages of the process, as induced from our interviews. Below, we present our model along the steps leading to engagement or disengagement. We start by illuminating the individual's appraisal of Internet applications, which begins with his or her awareness and is followed by the primary and the secondary appraisal. We then reflect about coping, outcomes, and re-appraisal of Internet applications. At each stage, we illuminate the emerging relational impact of individual capital resources on appraisal and coping, and, where applicable, present additional factors induced from the data, such as perceived risk. By extension, we discuss how the individual's trust in social capital moderates the influence of social capital on the appraisal of Internet applications. It should be acknowledged that, in practice, the different stages of the coping process, in particular the appraisal phase, are not always explicitly distinct but rather part of a fluid, iterative cognitive process. In the interest

of clarity, we present the results in a relatively deductive style even though they were generated inductively (Gioia & Chittipeddi, 1991).

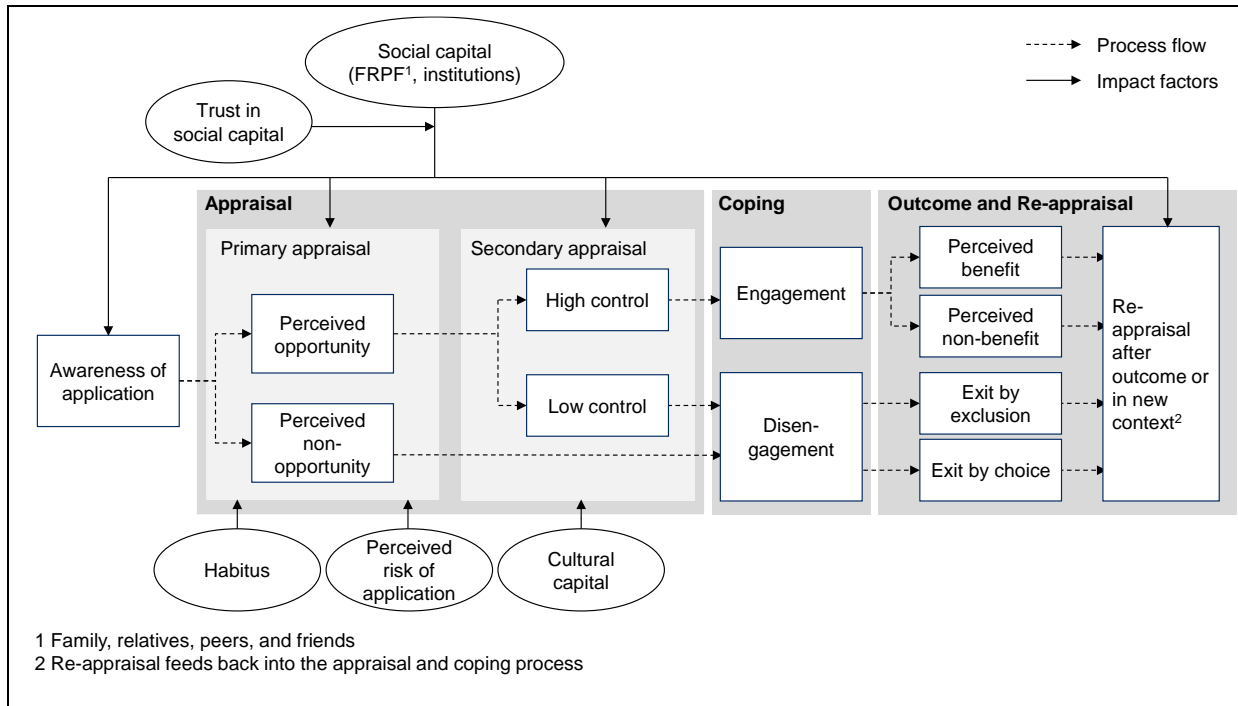


Figure 2. The impact of individual resources on the coping process leading to (dis-)engagement with Internet applications

Awareness of Internet applications

Awareness of Internet applications is by definition a prerequisite for appraising an application as an opportunity or non-opportunity. Interestingly, we observed that the quality of awareness for online job search applications differed greatly among our interviewees. For instance Pete, a graphics project manager, was aware of a large range of job portals such as Monster.de and professional networking sites such as Xing.de, and was well informed about the differences between these applications. He noted, “*There are really different offers on Morgenpost.de compared to Gigajobs.de, that’s why I use them both [...] and I also use the ‘Eye’, a highly specialized site in the field of web design.*” In contrast, Josh, who wants to become an electrician, knew Google but no specifically job-related Internet applications.

Our interviews indicate that limited awareness not only constrains people’s opportunity consideration set but may also affect their primary appraisal. In this regard, we found that some respondents, because they were only tangentially aware of online job search applications, drew inadvertent conclusions about their usefulness. Matt, for instance, knew little about the professional networking site Xing and, based on this limited information,

believed that it was not suitable for him as a “*young professional directly from college with little experience.*” In other words, he did not recognize that, in reality, Xing is a professional platform for both young and experienced professionals, which led him to believe that it is not an opportunity for him.

Moreover, we observed that respondents with tangential awareness of online job search applications felt insecure whether to evaluate an application as an opportunity or non-opportunity because they felt they lacked the informational basis to do so. For example, Paul mentioned that the only application he knew where it is possible to have a profile is Xing, but because he did not feel well versed in this field of applications, he refrained from engaging with it: “*Unfortunately, I don’t know any other professional networking sites besides Xing. As such, I don’t even know what other possibilities there are. If I knew more options, I would potentially try one.*”

Next, our observations reveal that the interviewees reverted to two sources of awareness, namely they themselves and their social capital. Some interviewees became aware as a combination of their own active search and serendipity. Dave, for example, became aware of a specialized job portal for front-end developers by “*stumbling on some blog posts which mentioned that people twitter jobs [...] Then, I looked on Twitter for jobs and found this job portal.*” In contrast, others – the majority in fact – referred to the vital role of social capital – their family, friends, and peers, as well as educational and employment institutions – in making them aware of online job search applications. This was particularly the case for those interviewees who lacked the ability or motivation to search for new applications by themselves. For example, Judy was unemployed for the first time and only knew a few online job search applications. Therefore she relied heavily on support from friends, which is how she became aware of eBay Classifieds as a potential search channel: “*I didn’t know about it beforehand. I heard about it from a friend, who said: why don’t you look on eBay Classifieds? I would never have thought of it myself, to be honest.*”

Intriguingly, our findings also indicate that the impact of social capital is not exclusively positive but that social capital is in fact a double edged sword. In this regard, some interviewees noted that the people in their social network could not help them in using online job search applications. Henry, for example, talked with colleagues about his difficulties in finding a job as an automotive sales rep but said that they “*only had the same ideas*” as himself. In other words, our findings suggest that the more the awareness structure among

someone's social capital resembles his or her own awareness structure, the less likely it is that the individual will receive new stimuli. These findings are in line with Granovetter's (1973) notions of weak ties, which suggests that a heterogeneous network of acquaintances may be more helpful in many cases than a homogeneous network of close friends. Additionally, we observed that institutional social capital, which could be expected to counter this effect, often exacerbates the potential downsides by further constraining the set of opportunity considerations. John, for example, voiced his disappointment that the GFEA "*only recommends its proprietary job portal*" and fails to inform about the breadth of online job search options available. We found that this had a particularly severe impact on those individuals who relied heavily on the advice from institutions like the GFEA and whose awareness and subsequent engagement was almost exclusively determined by, and limited to, the impulses they received.

In summary, awareness of Internet applications not only differs greatly among individuals, but also impacts the primary appraisal, particularly by limiting the opportunity consideration set or promoting the assessment as non-opportunity. Moreover, not just the individual itself but, more importantly, social capital can extend the awareness for online applications. The role of institutional social capital is especially critical in this context as individuals with homogeneous social capital networks can only get new impulses from social capital outside of their network. Particularly because institutional social capital has a formal role and individuals perceive it as highly legitimate to follow its advice, institutional social capital can turn dysfunctional if it creates awareness only for a small set of applications.

Primary appraisal of Internet applications

As part of their primary appraisal, individuals assess whether they believe an Internet application is relevant for them or not. Two main categories of primary appraisal emerged from our interviews, which we termed *perceived opportunity* and *perceived non-opportunity*¹⁶. Individuals who perceived an online job search application as appropriate, interesting, or useful considered it as an opportunity, which means that their engagement depended on their subsequent secondary appraisal. Conversely, individuals who did not

¹⁶ The findings indicate that in a quasi-mandatory setting – where an individual is not forced but expected to use a technology – such as job search, individuals appraise applications either as an opportunity or as a non-opportunity. While some individuals express feeling obliged by social conventions or institutions to use Internet applications for their job search, they do not perceive these expectations as a "threat" (Lazarus & Folkman, 1984), given that viable offline alternatives exist.

perceive an application to be relevant to them appraised it as a non-opportunity and disengaged from it. Our interviewees mentioned three factors that particularly influenced their primary appraisal as a perceived opportunity or non-opportunity: habitus, perceived risk, and social capital.

Individual habitus comprises the perceived usefulness of an Internet application and the degree to which individuals enjoy using an Internet application, i.e. their hedonic evaluation. Our findings indicate that in the context of online job search, the effect of habitus on primary appraisal manifested itself almost exclusively in terms of how useful respondents believed an Internet application would be for their job search in terms of value add and opportunity cost. Pete, for example, was willing to pay extra for a premium account on a professional networking site because he perceived the additional information he could access and the messaging service as highly valuable. Moreover, referring to Stepstone, he noted, *“I like[d] the forwarding option [...] and what was cool, was that when you click on a job, you are shown other, similar positions.”* Hedonic aspects, in turn, played a very minor role in respondents’ primary appraisal, which is not surprising in the context of a predominantly utilitarian application such as online job search. Overall, in their appraisal, active respondents like Pete often compared different applications to determine which they found more useful (or enjoyable). We induced from this observation that the consideration set initiated through awareness determines the frame of reference within which individuals appraise applications as opportunity or non-opportunity.

Perceived risk emerged as a second important factor for primary appraisal. Matt, for instance, recounted how he searched for a job on several job portals that seemed promising but required a free registration to access the job descriptions. He decided not to pursue them further because *“I was bothered by the personal data that I had to provide at the start [and because] I didn’t want to disclose all my personal information.”* Our observations indicate that all but two respondents were concerned about data security issues. Individuals who generally disliked sharing personal data online were particularly sensitive to this aspect and more likely to appraise an application as a non-opportunity if it required them to provide data. Another factor that respondents were worried about was the reliability of online job ads. In particular, some respondents had made bad experiences with ads that were not up-to-date and, in turn, gravitated towards viewing job portals as a non-opportunity that provided imprecise or incomplete information.

More apparently even than habitus and perceived risk, the primary appraisal of online job search applications was impacted by social capital. In fact, the majority of respondents relied on input from their social network, particularly when appraising a new application for the first time. Our data indicates that the more proximate and tangible an individual's social resources, the stronger their influence on the primary appraisal. Mike, for example, decided to try out the GFEA job portal because *"it's what everyone knows, [...] it's what everyone uses,"* thereby catering to subjective norms of his social environment. Beyond this, many interviewees indicated that actual positive experiences with the application by relatives and friends had an even greater effect. Lisa, for instance, decided to try out a professional networking site after she *"heard from a friend, who tried it and found a job over it."* Similarly, Matt explained that he has *"some friends [who] use Xing, and one friend even received a top job offer through it,"* which led him to appraise it as an opportunity. And Kevin, for example, followed the suggestions of a friend who *"explained the whole [online job search] system to me and told me: you can look here and then try this [portal]."*

As with awareness, the influence of social capital seemed to be not uniformly positive. In this context, Pete acknowledged that *"most of [his] friends and acquaintances use the same [online job search] strategies as [him],"* which is why he did not rely on them for new impulses but rather tried to find his own way. Those respondents who relied strongly on the advice they received from others ran the risk of being limited by that advice. Judy, for instance, considered only those three applications as opportunities that were explicitly recommended to her by the GFEA and her friend, thereby limiting her consideration set: *"I really just used the 3 platforms I mentioned: Google, the GFEA portal and eBay Classifieds."*

In summary, our findings indicate that the primary appraisal of an Internet application is determined not just by habitus but also by perceived risk and social capital. Perceived risk may counter aspects like perceived usefulness and enjoyment and lead an individual to appraise an application as a non-opportunity. More interestingly, social capital seems to play a pivotal role in determining which applications potential users perceive as an opportunity, in fact, to an extent that goes beyond subjective norm. It may, however, not just extend but also limit the set of applications that is appraised positively.

Secondary appraisal of Internet applications

Besides appraising whether they considered an Internet application an opportunity for their job search, our interviewees also assessed the degree to which they perceived they could

exert control over the application. Henry, for example, felt confident about compiling documents and sending out online applications and noted *“that is easy for me”* but, he struggled to navigate multiple job portals and to *“find fitting job postings in this excess supply.”* The interviews revealed that the interviewees primarily referred to two forms of capital when assessing their level of control over an application: first, cultural capital comprising medium-related skills, content-related skills and self-efficacy; and second, social capital.

Secondary appraisal and cultural capital

Medium-related skills encompass basic operational skills, such as operating a browser or search engine, as well as formal skills, such as the ability to navigate within and between websites by using hyperlinks and menus (van Deursen & van Dijk, 2011). Interestingly, it emerged from the interviews that only very few participants did not exhibit the required medium-related skills to formally operate various online job search applications. In other words, medium-related skills did not seem to be an inhibiting factor and sufficed to gain a feeling of control over simple applications and tasks.

In contrast, when it came to not just formally operating, but effectively *using* online job search applications in a goal-oriented manner, content-related skills emerged as a crucial factor in determining how much control the interviewees perceived. Content-related skills comprise information skills, such as defining meaningful search queries and evaluating information, as well as strategic skills, that is, the ability to efficiently and effectively take advantage of Internet applications to reach a particular goal, such as finding job (van Deursen & van Dijk, 2011). The interviews highlighted the critical role of these content-related skills for being able to navigate the multiple opportunities of online job search. Many respondents reported that they valued the increased range of options made available through online job search applications but also felt that it had become increasingly complex. Pete, for instance, struggled with the multitude of job ads available on the job portal site Stepstone.de: *“I find myself sitting in front of Stepstone for over an hour and I feel like it’s not getting better. I feel like it’s getting more and more complex.”* Similarly Paul, a social worker, noted that he found it *“very difficult to filter out the really fitting job postings”* amongst the deluge of postings his search generated. The interviews highlighted that the sheer amount of information available online necessitates the ability to keep an overview and intelligently select and assess the options at hand.

Our observations indicated that particularly those interviewees with limited content-related skills easily felt confused and overloaded in their online job search, which led to frustration and ultimately disengagement. Those who lacked the ability or strategy to actively steer their online job search process tended to get lost in the sea of information and options and spend a lot of time drifting aimlessly without getting to any results. Cait, for example, reflected that even though she perceived online job postings as an opportunity, she was unable to effectively make use of them: *“It interests me to see what’s on offer online, so I start looking, and I look a lot. I think it’s good that it exists, but I have trouble disciplining myself. I can completely lose myself.”* Because she was unable to gain control of the situation she eventually disengaged and retreated to using only those few applications she felt comfortable with.

Interestingly, even respondents with a high level of content-related skills became frustrated when they felt constrained by an application structure or interface and had the impression that they could not meaningfully control the application. As a result, they either disengaged or they used their skills to deal with the problem and found a workaround. For example Dave, a software programmer, refused to use the GFEA job portal menu because, as he stated, he perceived it to be *“a total mess compared to other job portals.”* However, he was able to find a workaround: *“I prefer to type into Google what I am looking for and then find the sublink for a certain page of the GFEA job portal – to navigate through their menu is just not reasonable.”* Other interviewees critiqued that the pre-configured job categories did not match their own search needs.

Lastly in this regard, our interviews showed that, apart from skills, self-efficacy can act as a differentiating factor and compensate for, or enhance, the impact of skills. In our coding, we borrowed the term “self-efficacy” (Bandura & Locke, 2003) to denote an individual’s belief in his/her capabilities to use an Internet application. We observed that respondents who lacked the medium- or content-related skills to leverage an application were able to overcome this limitation if they had high self-efficacy. Conversely, respondents with low self-efficacy felt inhibited to try an application despite potentially having the skills to do so. For instance, Anna exhibited rather limited skills, however this did not stop her from exploring new applications: *“I am still trying to figure out what I can use. From time to time I just go to the GFEA site and look for occupational re-trainings or even just educational offers like an English course.”*

Secondary appraisal and social capital

Importantly, our findings suggest that social capital can also have a critical impact on secondary appraisal, particularly by changing a feeling of low control to one of high control. Tom, for instance, struggled with the online application process for a position but did not disengage because he had friends to support him: *“I found it too complicated, I couldn’t get to grips with it myself, so I mostly did it together with friends.”* Apparently, in cases like Tom’s, social capital compensates for an individual’s low cultural capital by providing an external source of knowledge and support. Interestingly, we observed that in some cases *theoretical* access to social capital sufficed to secure engagement. For example, when asked to reflect on whether he would be able to send out an online application, Mike did not immediately reject the idea—despite not knowing how to go about it—because he knew whom to ask for help: *“I think I would ask my dad. I think he would be able to help me because he uses computers a lot at his work.”*

Our observations indicate that institutional social capital takes on a particularly important role where personal social capital, such as family and friends, reaches its limits. Respondents with high control of their online job search or personal networks that offered help did not need and typically did not seek institutional support. In contrast, many respondents with low control and personal networks that could not offer much help wished for stronger institutional advice in terms of which job portals to search on or how to create a professional profile. Lisa, for instance, could not draw on much help within her personal social network and had hoped to receive more guidance from her job agent: *“When [the GFEA agent] tells you: here is a list, you need to send out 20 applications, 5 a week, just look them up and give them a call – I find that too little help. That’s not enough.”*

Similar to primary appraisal, social capital can have not just functional but also dysfunctional effects. By trying to facilitate the online job search process by taking over tasks rather than supporting capability building, institutional social capital can promote dependency. Many respondents indicated that they would have preferred to get enabled and *“leave the institution with the feeling that you can go home, sit down and know where to look and what to do”* (Lisa) rather than have institutions take over the tasks for them. In some cases, the expectation of help from and reliance on institutions was so strong that individuals became very passive in their own (online) job search, as was the case for Judy: *“Maybe I should have*

done something completely different, [...] but the employment agent didn't mention anything. So I thought: ok, it's probably not possible. [...] It was a bit naive."

In summary, it seems that during secondary appraisal individuals perceive to have high control over Internet applications if they exhibit a sufficient level of content-related skills and self-efficacy while medium-related skills rather seem to be a hygiene factor widely observable among the interviewees. Interestingly, social capital can compensate for an individual's limited skills or self-efficacy by giving advice, teaching and constituting a (theoretical) fallback option for support, thereby translating a feeling of low control to high control. Particularly in the case of institutional capital there seems to be a fine line between facilitating online job search and promoting dependency by taking over tasks for the individual.

Coping, outcomes and re-appraisal of Internet applications

Based on their appraisal of an application, our respondents engaged with or disengaged from the respective application. In case of engagement, respondents coped by using the online job search application while drawing on the capital resources available to them. Lisa, for example, managed to send out applications by email after reaching out to her friend for support. In case of disengagement, we found that respondents did not use the application and focused their behavioral and cognitive efforts on re-framing the situation to justify their disengagement rather than undertaking steps to make engagement possible. Mary, for instance, justified her decision to not use the Internet for her job search by saying *"I do not need it [...] I also don't see when I am supposed to use it."*

We observed two possible outcomes of engagement: perceived benefit and perceived non-benefit. Our findings suggest that respondents evaluated the outcome of their engagement primarily based on their satisfaction with the content (e.g. did the job postings match their expectations), their satisfaction with the interface of the application (e.g. did it facilitate the job search), and whether they eventually found a job through the Internet application. For instance, Mike mentioned that he *"searched on meinestadt.de, but I did not find anything. Therefore I did not continue to search there."* Similarly, Dave evaluated the outcome of using a job portal as follows: *"You find a lot of information on this site but [...] the page interface is structured in such a way that I would not use it to search for jobs again."*

A number of respondents disengaged from an Internet application as a result of a deliberate withdrawal – in other words, an exit by choice. We observed that some individuals subjectively perceived an online job search application to be a non-opportunity in the primary appraisal phase – even though they may actually have benefited from using the application – and chose to disengage. Others objectively would not have benefited from the application, like Carl, who works in construction where personal connections are more important than the Internet for finding work: *“I always found a job. Always through connections, compatriots: you know somebody and he knows you. Never the Internet.”*

More importantly, however, we observed that some respondents appraised an application as a perceived opportunity, but lacked the resources to gain sufficient control of it and disengaged as a result – in other words an inadvertent withdrawal, or exit by exclusion. Cait, for example, felt that certain applications could help her in her job search but was so overwhelmed by these applications that she could not continue engaging with them: *“The Internet certainly helps to find them [social work institutions]. [...] But I really do not like it, I really feel that I am not good at it, I get cold feet, my head starts spinning, and often I spend a lot of time online but I do not find anything truly relevant for me.”* The key difference between an exit by exclusion and an exit by choice lies in the willingness to try and engage with the Internet application, and the subsequent failure to do so due to low control. An exit by exclusion may not always be apparent because individuals tend to focus their behavioral and cognitive efforts on re-framing the situation to justify their disengagement. Based on our observations, they most commonly do so by rescinding their primary appraisal and professing that the application in question is not actually useful.

The findings suggest that the nature of the outcome influences the re-appraisal of the application and, consequently, future use by reinforcing behavioral patterns in case of beneficial outcomes and by fostering disengagement in case of non-beneficial outcomes. In many cases the first experience with an application was already decisive for future use. John, for example, stated: *“I hardly used Google because I already knew meinestadt.de from six years ago. So far it has worked well for me.”* We further observed that, independent of the perceived outcome, external impulses could play a key role in triggering the re-appraisal of an application – particularly those stemming from respondents’ social capital. Paul, for instance, initially disengaged from using online profiles on professional networking sites but re-appraised the application positively following an impulse from a friend: *“A friend just*

purchased a premium Xing account and directly received several requests. So when I search again, I might just try it as well.”

In summary, having reached the end of the coping process, we see the overarching mechanisms of engagement and disengagement that emerge as a result of the appraisal process and the influence of various capital resources thereupon. Individuals who perceive an Internet application as an opportunity and have the means to control it typically engage, resulting in either a perceived benefit or non-benefit. Meanwhile, those individuals who are unable to control the application meaningfully or perceive it as a non-opportunity tend to disengage, resulting in an exit by exclusion or exit by choice respectively. Crucially, the decisive role in determining which mechanism plays out typically falls to an individual's resources, such as social or cultural capital.

The moderating effect of trust on social capital

Our findings suggest that social capital can have both a limiting and enhancing effect on an individual's awareness and appraisal of Internet applications. The directional impact of social capital, however, appears to be moderated by an individual's trust in it. We observed that many respondents implicitly or explicitly evaluated whether they considered their social capital a trustworthy source of support. This evaluation, in turn, influenced to which degree these respondents were receptive for impulses coming from these social capital sources. These findings support the notion that trust constitutes as an integral part within the relational dimension of social capital, as posited by Nahapiet and Ghoshal (1998). We will focus on institutional social capital since the topic of trust appeared to be more crucial with regard to institutions rather than family and friends. We observed that respondents primarily considered five factors when evaluating the trustworthiness of institutional social capital: perceived competence, perceived authenticity, perceived image, perceived pressure, and perceived appreciation. While the majority of respondents reported negative experiences it is important to note that these five factors can also have a positive impact on trust.

Several respondents perceived employment agency institutions to lack the competencies that they considered to be important in supporting their job search, such as knowledge about different professions and online job search applications. Even though they mostly drew their impressions from one or two personal encounters with employment agents or even just hearsay, they tended to transfer their impressions onto the whole institution, including its online offerings and its advice. For example, Mike recounted an initial consultation meeting

at the GFEA in which “*the job agent had no idea of occupational titles and I had to explain everything.*” He found that “*quite dubious*” and, convinced that the job agent was incompetent, was very skeptical of the suggestions he received.

Furthermore, we observed that a number of respondents were concerned that the employment agents were not sincere in their assignment to help them find a job. Kevin, for instance, felt that the employment agents were “*just sitting there and really do not care,*” while Tom had the impression that “*those professional trainings they offer [...] are just means of deferral*” to keep him out of the unemployment statistics. Moreover, John expressed doubts regarding the agency’s willingness to truly help him with his job search because he felt that the agents were incentivized to only recommend their proprietary online job portal: “*They just say ‘search the web’, ‘use our job portal’; they do not say ‘search on this or this specific website’ [...] I do not know how it actually works, if they still get their rewards from the state when they place somebody through an Internet portal other than their own...Of course they only recommend their own job portal.*” All these doubts about the employment agency’s authenticity made the affected respondents less receptive for impulses coming from that source.

Independent from actual personal experiences, we found that some respondents already had a preconceived notion of the GFEA based on their perception of its public image. In particular, these respondents believed that companies primarily use the GFEA online job portal to advertise low skilled jobs, which is why they perceived the GFEA’s online job portal as a non-opportunity for themselves. Kevin, for example, stated: “*I do not know any firms which use the GFEA to search for qualified people, only the desperate. Over the last 20 years a certain cliché has evolved about the GFEA that you only get the ones you do not want. I believe that everybody who seriously wants to find a job will not find a cool job through the GFEA.*” As a result of this preconceived notion, many were afraid that their application would be evaluated less favorably by employers if it was facilitated through the GFEA’s online job portal.

We further observed that a few interviewees expressed feeling pressured by the employment agency. Lisa and her husband, for example, struggled to meet the application targets set by their job agent because it took them a long time to get acquainted with online job search, given that they are in their late 50s and were doing this for the first time. Instead of receiving support, they were reprimanded, which left them even more insecure and eventually made them retreat to using only newspapers for their job search. As Lisa puts it: “*There are many*

people who get rebuked for not having done anything, but in fact, most of them do not even know what to do or where to search for jobs and how it actually works." This suggests that particularly for those individuals with low control of their online job search, lack of support and pressure by an employment agent can deepen the feeling of low control rather than help bridge it.

Lastly, our observations indicate that the perceived appreciation experienced by respondents in their consultation meetings with job agents influenced the degree to which they trusted them. For example, Kevin decided that he would *"not involve the GFEA again when searching for a job"* because he was asked to apply for a job which he – as he put it – *"could do with one hand tied behind his back."* Similarly, Cait did not feel appreciated in her first consultation meeting: *"First they told me: everything you did was wrong. You do not have a degree, and I cannot even place those with a degree and your background. I will find you a job as a waitress."* Many respondents felt offended and written off when the agents recommended jobs that they perceived to be way below their skill level.

While this narrative appears to be dominated by negative experiences, it is important to note that this is not surprising given the burdensome context of unemployment and a natural tendency to voice concerns rather than praise. Nevertheless, some interviewees also shared positive experiences. Matt, for example, valued the objectivity and sincerity of employment agents who told him *"clearly and objectively"* to consider a professional reorientation and Henry perceived the GFEA and their online offerings to be of great help for his job search: *"The job agent could not have received me more friendly or kindly, she was really helpful."* Respondents with positive experiences, like Matt and Henry, showed a greater level of trust in institutional social capital and were more receptive for impulses coming from that source.

Discussion

In this study, we sought to better understand individual (dis-)engagement with Internet applications. By leveraging coping theory as a theoretical foundation, we embrace the dynamic nature of the decision to engage with, or disengage from, a technology and unveil how individual resources impact different stages of this iterative process. Most importantly, our findings show that the pathways through which individuals appraise Internet applications are significantly influenced by the capital resources available to them. In particular, our model reveals that social capital is effective at every step of the cognitive appraisal process, while habitus, perceived risk and cultural capital only impact a single stage. In fact, social

capital can trigger awareness, change individual dispositions, and be converted into cultural capital. As such, it plays a game-changing role that can determine individual engagement or disengagement. Moreover, we find that the power of social capital to foster engagement is a function of the trust that the individual has in his or her social capital.

Our findings on why, and through which mechanisms, individuals engage with, or disengage from, Internet applications particularly contribute to research on technology use and adoption (Burton-Jones & Grange, 2012; Hsieh et al., 2011; Venkatesh et al., 2012). Responding to calls to investigate alternative theoretical perspectives on technology acceptance in order to broaden the field's understanding towards a wider constellation of behavioral responses (Abraham et al., 2013; Schwarz & Chin, 2007; Venkatesh et al., 2007) and for a greater dialogue between divisions of related research (Yu, 2011), we take a dynamic perspective on technology use and non-use by building on coping theory and relating aspects of capital theory to the individual resources influencing different stages of the coping process. We further enrich the resulting model with the constructs of awareness, perceived risk of Internet applications, trust in social capital, and a differentiated perspective on skills and show how these play a critical role at different stages of the coping process. In contrast to most extant research on technology acceptance (TAM, UTAUT, etc.), this study explicitly incorporates the dynamic nature of user (dis-)engagement, yielding a more multi-faceted understanding of technology use. In particular, the developed model uncovers how different forms of resources can enhance and substitute each other at *every* step of the cognitive appraisal process. This extends our understanding of the role resources play at different stages of the coping process, which has previously considered capital resources to be most relevant for secondary appraisal (Lazarus & Folkman, 1984). In line with calls for further research on capital conversion (Hsieh et al., 2011), we also contribute to capital theory by highlighting how and when different forms of capital can be converted into resources that are instrumental to (dis-)engagement with Internet applications. Grounding (dis-)engagement with Internet applications within a cognitive appraisal process and identifying the impact of different types of resources at different stages of this process helps to better understand and predict individual user behavior and ways to influence it.

Furthermore, this research reveals the game changing role social capital and in particular institutional social capital can play for individual engagement with Internet applications. So far, little research has been dedicated to understanding how and under which circumstances social capital can be converted into forms of capital instrumental to technology acceptance

(Hsieh et al., 2011). This study sheds light on how social capital can compensate for risk factors that favor disengagement, such as limited awareness and low control, as well as the preconditions in terms of trust that need to be present. In contrast to most technology use research that acknowledges trust as an important factor but examines it with regard to the focal technology (e.g. Gefen et al. 2008), our findings suggest that trust also plays an important moderating role on the effectiveness of social capital. Furthermore, our results show that social capital does not necessarily only foster engagement but can indeed also impede engagement, for instance by limiting the consideration set of appraised options. IS researchers should take care to consider this potentially adverse impact of social capital on engagement rather than portraying social capital as uniformly positive. Moreover, our research provides new and contrarian insights into the role institutional social capital can play on technology acceptance. Social capital relating to friends, family and peers is a well-known factor in traditional technology acceptance models, however, institutional social capital has often not been explicitly considered (e.g. Venkatesh and Brown 2001; Venkatesh et al. 2012) or has been found to play only a minor or insignificant role for technology use (e.g. Hsieh et al. 2008). Our model shows that institutional social capital can indeed impact technology use provided that a trusted set-up exists that enables directed measures to be implemented, e.g. through government agencies or schools.

Following calls for more in-depth qualitative research (Selwyn, 2003; Venkatesh et al., 2013), this study also contributes to broadening and complementing the methodological foundation for understanding the phenomenon of technology use and non-use. Qualitative research still constitutes an underused method for investigating technology use yet is necessary to meaningfully extend and enrich our understanding of the underlying mechanisms of use and non-use. This study underlines the necessity of a qualitative approach in order to grasp the complexity, the dynamism and the multitude of pathways that may lead to technology (dis-)engagement – aspects that are unlikely to be captured in the same richness and depth through traditional, survey-based research.

In addition, by drawing on sociology communication research we introduce a new, more differentiated perspective on Internet skills – comprising medium- and content-related skills (van Deursen & van Dijk, 2011) – into the technology use discussion. Skills have been acknowledged as an important factor for technology use and have mostly been conceptualized as part of constructs such as perceived ease of use or perceived behavioral control (Venkatesh et al., 2003). A more differentiated view on skills is necessary to

understand how exactly skills foster or impede technology use. This notion is especially important given that both the skill levels in the population and the skill requirements for effective Internet use are constantly evolving. Our findings show that medium-related skills are in fact widely present yet content-related skills are required to effectively navigate and evaluate the manifold online options available to accomplish a certain task.

Finally, this study also contributes to research on digital inequality and to the debate on how digital gaps can be bridged (Hargittai & Hinnant, 2008; Kvasny & Keil, 2006). Our research highlights the factors that lead to undesirable outcomes, such as inadvertent digital exclusion, and helps to explain why digital inequality is still a prevalent issue even in developed countries with widespread Internet access. Most notably, our findings emphasize that limited awareness, insufficient content-related skills, and lack of social support are nowadays much more critical factors for digital exclusion than Internet access and medium-related skills, which have been the focus of extant digital inequality research. Further, our study shows that institutional social capital plays a particularly important role for the digitally disadvantaged since these individuals rely strongly on support from family and friends (Hsieh et al., 2011), yet typically have fairly homogeneous personal social networks (Granovetter, 1973; Yu, 2011). This limits the potential value add they can draw from their personal social capital and calls attention to the importance of governmental institutions in helping individuals overcome this barrier. Particularly the insights on how institutional capital may be able to influence the cognitive appraisal of Internet applications – e.g. by raising awareness and supporting capability building – represent an important contribution to the stream of research focusing on how digital gaps may be bridged through governmental interventions.

This study also has important implications for public policy and managerial practice. With the ongoing digitization, it becomes imperative for governments to ensure digital inclusion both as a social mandate and – against the backdrop of increasing e-government services – in their own interest. In particular, this study can help policy makers to better understand why people take or do not take part in the ongoing digitization and most importantly, to define targeted policy interventions aimed at fostering digital inclusion. These policy measures need to focus enablement in order to meaningfully empower the digitally disadvantaged to independently use Internet applications. Policy makers can leverage the pivotal role of institutional social capital in their intervention planning, e.g. by further integrating digital education into curriculums and by identifying governmental institutions that are best suited to convey targeted support to individuals. Additionally, our research shows that trainings should

ideally raise targeted awareness and teach not just medium-related skills but, more importantly, content-related skills, in an application-oriented manner. Our findings also underline that institutions need to build particularly competence-based trust, e.g. strengthen their employees' abilities and motivation in supporting the job search, in order to contribute meaningfully to bridging digital divides. Our findings have further reaching implications for a whole range of Internet-based applications besides job search, not least of all e-government. As the supply of e-government services increases, policy makers may have an added incentive to ensure digital inclusion.

Our insights are also relevant for online businesses managers looking to understand and optimize user engagement on their platforms. The developed model can support them in identifying factors impeding engagement and devising targeted countermeasures. Especially for less well-versed individuals, for example, a structured and intuitive interface as well as the offer of on-website support can be decisive for engagement. Similarly, taking measures to decrease perceived risk, such as communicating data security measures more prominently, can help to increase engagement. Our case study specifically highlights the implications for corporate human resources departments and online job search application vendors, yet our findings apply more generally to any form of data-sensitive online platform.

Limitations and future research

This study also has some limitations. While the overall theoretical model is not limited to online job search applications but should be applicable to other settings, the case study approach may nonetheless have led to some context-specific findings. The extent of the involvement and influence of institutional social capital is likely to be particularly high for the type of Internet application studied, especially in a high social welfare state like Germany. For other types of Internet applications, other forms of capital may play a more prominent role, such as hedonic influences or economic capital. Moreover, even though we thoroughly tried to check for alternative explanations in the interviews, some behavioral observations may be attributable to unobserved factors, such as the interviewee's emotional state of mind. More research is needed to validate the applicability of our model with regard to different Internet applications, particularly in voluntary contexts, and in different countries, ideally through large-scale investigations.

Three additional avenues for future research emerge from this study. First, the impact of social capital – particularly institutional social capital – on individual engagement warrants

further study. Our findings indicate that institutional social capital can play a significant role at all stages of the appraisal process yet does not have a uniformly positive influence. Scholars and policy makers stand to profit from further research on how to improve the effectiveness and acceptance of institutional measures promoting online technology use in general and e-government applications in particular.

Second, this study focuses on the appraisal phase of the coping process and only differentiates between two coping strategies, namely engagement and disengagement. Extant coping research in the field of psychology offers a large range of adaptation strategies. Some of these have been investigated within the information systems field, albeit mostly in organizational settings. The majority of consumer technology use, however, takes place in voluntary, non-organizational settings. For information systems scholars interested in strengthening the interdisciplinary foundation of the field, developing a more fine-grained distinction of coping strategies in non-organizational settings could serve as a promising research avenue.

Finally, the field of information systems stands to profit from further research on technology skills. Extant research has catalogued and clustered types of Internet-related skills (van Deursen & van Dijk, 2011), yet little is known how this translates into specific use outcomes. Particularly content-related skills warrant further study, given their significance in influencing control within an increasingly complex online environment. A more comprehensive understanding is needed of how content-related skills are acquired and how they can be taught in order to help individuals overcome skill deficits.

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Appendix A: Interview guide

Table 4. Interview guide	
Area of inquiry	Key questions
Respondent background	Please tell me about your professional and educational background. How old are you? Please tell me about how much you use the Internet in general. Please tell me about how long you have been searching for a job and the kind of job you are looking for.
Job search process (incident-based interviewing)	How are you going about searching for a job? What channels are you using to search for work? Have you used the Internet to search for work? If so, which Internet-based applications have you used to search for work?
Follow-up questions: Awareness	How did you learn about this application? Which other similar applications do you know? Which have you used? Which applications do you know of, but have never used?
Follow-up questions: Appraisal	What did you think about this application prior to using it? Why did you decide to use / not use this application? How do you feel about other similar applications? Why? What do you like / not like about the application that motivated you to use / not use it?
Follow-up questions: Coping, outcome, and re-appraisal	Did you use / not use the application? How did you feel about using this application? What did you think about this application after using it? What did you like / not like about using the application? Why did you decide not to use the application? What was the outcome of using the application? Would you use the application again? Why?

Appendix B: Coding scheme and coding examples

Table 5. Coding scheme	
Overarching category	Second-order codes
Awareness	Individuals which rate high on self-engagement and self-efficacy can foster creation of own awareness
	Insufficient initial awareness favors appraisal as non-opportunity
	Insufficient initial awareness limits opportunity consideration set while more awareness broadens opportunity consideration set
	Social capital can create awareness for online applications and either limit or extend the individuals consideration set
Primary appraisal	An individual's evaluation of the process of an online application influences its primary appraisal
	An individual's perceived usefulness of an online application influences its appraisal as opportunity or non-opportunity
	External contextual aspects influence the primary appraisal
	Perceived consideration set determines frame of reference for comparing and appraising of online possibilities
	Personal situation influences motivation and primary appraisal
	Primary appraisal as perceived opportunity results in engagement
	Social capital can limit or extend the set of online applications that are appraised as opportunities in the primary appraisal phase
Secondary appraisal	Cognitive dissonance: self-perceived control and denial of help despite obvious lack of control
	Content-related skills, medium-related skills and self-efficacy are a necessary requirements if applications are used for the first time
	Dissatisfaction with application interface can result in frustration/disengagement for high skill users whereas ability to control application meaningfully increases level of engagement and perceived benefit
	For "easy tasks", well-structured and well-known tasks, already medium-related skills can lead to a feeling of high control
	For more complex tasks content-related skills are required in order to experience a feeling of high control, especially in the case of low self-efficacy medium-related skills are not sufficient
	Perceived complexity fosters disengagement, in particular for low cultural capital individuals
	Self-efficacy and medium/content-related skills enable high control and engagement
	Sufficient content-related skills are necessary to navigate the multiple opportunities of online job search - a lack of these skills leads to a feeling of confusion/overload, low control (being lost), dissatisfaction and disengagement
	Sufficient medium-related skills or a high level of self-efficacy and resilience are necessary to experience a feeling of high control especially in order to tackle drawbacks of online features - not being able to do so leads to disengagement
Coping, outcome, and re-appraisal	Engagement with beneficial outcomes leads to a positive re-appraisal which reinforces behavioral patterns
	Engagement with perceived non-beneficial outcomes leads to frustration and a negative re-appraisal
	Social capital can influence the re-appraisal of online job search applications and motivate people to engage
	When evaluating the perceived benefits of online applications users compare them to each other

Overarching category	Second-order codes
Perceived risk	In case of perceived reliability risk an application is appraised as non-opportunity
	Perceived authenticity risk can lead to an appraisal as non-opportunity
	Perceived personal data security risk can lead to an appraisal as non-opportunity
Social capital and control	High control individuals do not need and do not seek help for their job search from social capital - while low control individuals wish for more exchange about the topic
	Individuals rely on and expect help from social capital institutions
	Individuals wish for more help from social capital (institutions) - especially those with low control of the job search situation/application feel lost and become disengaged if they don't get it
	Social capital can change a feeling of low control to a feeling of high control for low cultural capital individuals
	Social capital can foster engagement by facilitating processes and taking over medium-related skill tasks, however this might disable individuals from learning these skills and might eventually lead to a level of low control
	Support from social capital is evaluated to be most effective at the beginning of job search/ unemployment
	To experience a feeling of high control in a situation of low cultural capital social capital needs to be (theoretically) accessible - especially in the case of low skills and low self-efficacy
Social capital and trust	People do not feel properly prepared for online job search by educational institutions
	People evaluate social capital and this evaluation influences to which degree to which they are receptive for impulses coming from that source
	People use their (offline) social connections to find jobs
	Perceived appreciation by a social capital institution impacts the degree to which an individual trusts this institution
	Perceived authenticity and sincerity of social capital institutions important for an individual in order to build trust
	Perceived competence of social capital institutions influences the degree to which individuals trust this institution
	Perceived image of social capital institution impacts an individual's trust in that institution
	Perceived pressure enforced by social capital institution impacts the degree to which individuals trust or feel intimidated by this institution
	Perceived reliability and expectation to get help from social capital influences the degree to which an individual trusts this social capital

Table 6. Coding examples

Second- and first-order codes	Representative quotations
Overarching category: Secondary Appraisal	
<i>SO1. For more complex tasks content-related skills are required in order to experience a feeling of high control, especially in the case of low self-efficacy medium-related skills are not sufficient</i>	
FO1. If it is unclear how to obtain a good result the individual feels a level of low control	1.1. I don't know whether I would use an application such as Xing, because I have no idea whether people on there are interested in social work and if social workers are even using it 1.2. If I were to use (the application), I would have to catch up first, because I don't know how it works exactly. I imagine that would be difficult. 1.3. I wouldn't even know where to start in building my own profile, so I don't bother...
FO2. For individuals with low self-efficacy, medium-related skills can not compensate for insufficient content-related skills (and vice versa)	2.1. If I wanted to create a professional profile and used a service such as Xing, there are probably templates one can use – I feel confident that that's something I could manage even though I don't exactly know how it works. 2.2. To do that all by myself and to create a profile on my own – I mean I don't know who would look at it – but I'm not sure I would manage.
<i>SO2. Dissatisfaction with application interface can result in frustration/disengagement for high skill users whereas ability to control application meaningfully increases level of engagement and perceived benefit</i>	
FO3. Dissatisfaction with application interface can result in frustration and disengagement for high skill users	3.1. Rather than navigating through the menu of the GFEA portal, which is really frustrating, I prefer to use Google to find what I am looking for, for example the sublink to the job site. 3.2. You find a ton of information, but their website is structured exactly like my university website – in such an impractical way that I would never use it to search for something

Bridging digital inequality: What can public policy makers do to ensure equal benefit from online opportunities?

Katharina Buhtz, Annika Reinartz

Abstract

The global penetration of digital technologies has grown rapidly over the last two decades and has been the source of many opportunities. Yet as more and more aspects of our lives shift online, concerns are being voiced that being online is becoming a prerequisite to fully participate in society and that some people may be digitally excluded. This so-called "digital inequality" carries the risk of potentially exacerbating social inequality and, despite improvements in access, remains a relevant phenomenon to this day. The present article illuminates how digital inequality has evolved over time and how it manifests itself in different domains such as education and employment. Building on a qualitative case study of online job search, the key factors leading to disengagement and digital exclusion are outlined. Based on these, recommendations targeted at public policy makers are derived, which may help to ensure that everyone can benefit equally from online opportunities.

Keywords: Digital inequality, technology acceptance, public policy implications, technology (dis-)engagement

Introduction

The global penetration of the Internet has grown rapidly over the last two decades. Today, Internet-based information and communication technologies (ICT) permeate our daily lives. The most recent Pew Internet Life Project survey, for example, found that in 2014 90% of American adults and as many as 95% of American teens used the Internet. In addition, 64% of American adults own Internet-enabled smartphones. Similarly, 89% of Germans use the Internet, 76% daily (EUROSTAT, 2014). In line with this development, more and more products and services are shifting online to enhance or even substitute offline services: everything from groceries to cars to personal coachings can be bought and booked online. We can talk to e-doctors, find the best personal loan, search for health information, and find jobs online. We can attend online educational classes and learn from Youtube tutorials. We can stay connected with our social and professional networks via Whatsapp, Facebook or LinkedIn. With the rise and diffusion of smartphones, all of us can now access these services anywhere, anytime.

Yet as more and more aspects of our lives shift online, concerns are being voiced that in order to participate fully in society, “being online” is not enough – individuals have to be able to leverage the advantages that digital technologies offer. Very recently, Barack Obama warned that “in this digital age, when you can apply for a job, take a course, pay your bills ... with a tap of your phone, the Internet is not a luxury. It’s a necessity” (Superville, 2015). Moreover, a recent study by the German Institute for Trust and Security on the Internet (DIVSI) on Internet participation cautions that we may be facing a “new form of digital disparity” (2015, p. 7), one in which those individuals who are able to leverage online educational and economic opportunities stand to profit, while those who are not able to risk being sidelined, a phenomenon termed ‘digital inequality’. If not addressed, digital inequality may exacerbate social inequality by “improving the prospects of those who are already in privileged positions while denying opportunities for advancement to the underprivileged” (Hargittai, 2003). Policy makers need to understand what drives digital inequality and how smart policies can address this issue in order to ensure that all individuals can partake and benefit fully from the digital revolution.

In this vein, this practitioner-oriented paper aims to inform policy makers about the phenomenon of digital inequality, potential domains for digital opportunities that merit special policy attention, and success factors in devising measures to bridge the gap. It builds

on key insights from a qualitative case study of online job search in Germany to illustrate the mechanisms and factors that inhibit individuals from leveraging digital opportunities and the role governmental institutions can play in this context. In so doing, this paper contributes to conveying some of the key insights on digital inequality from academic research – extant, as well as new insights developed through own research – to a practitioner audience.

The issue of the digital inequality

The Organization for Economic Cooperation and Development (OECD) defines digital inequality as the “gap between individuals, households, businesses and geographic areas at different socio-economic levels with regard to both their opportunities to access ICT and to their use of the Internet for a wide variety of activities”(OECD, 2006). More specifically, four levels of digital inequality exist: inequalities with respect to ICT access, ICT adoption, ICT appropriation and ICT use outcomes (Figure 1).

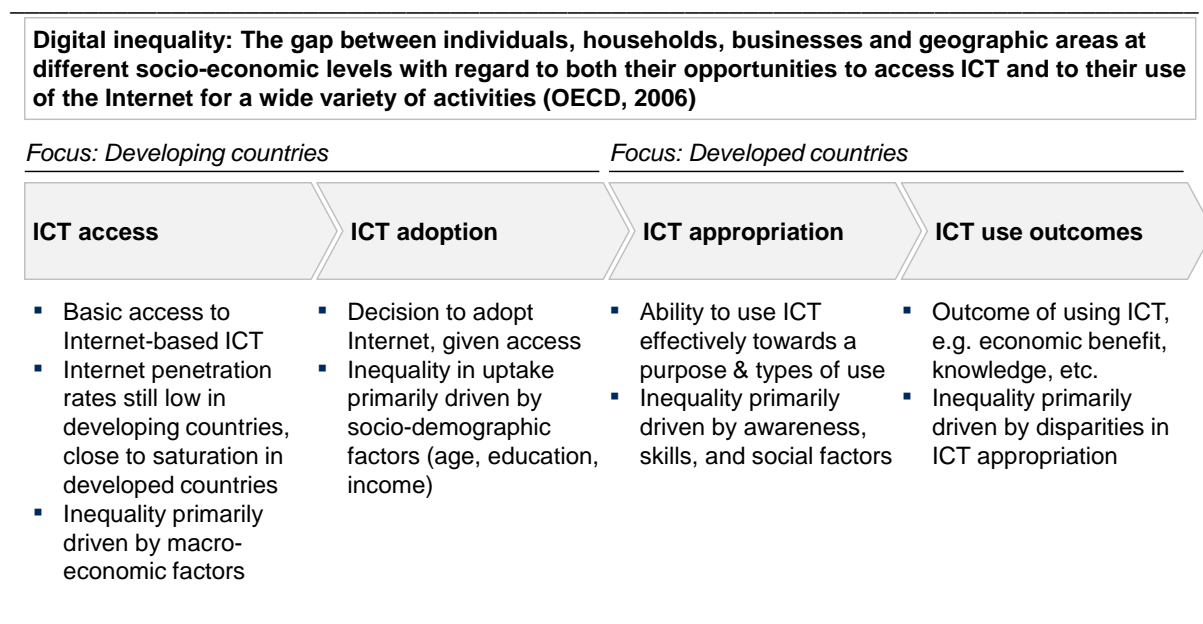


Figure 1. Levels of digital inequality along the ICT adoption cycle

Digital inequality with respect to ICT access and adoption

Limited access or limited possibilities to use the Internet are at the root of the digital inequality issue. In fact, the high Internet penetration rates particularly in developed countries hide the fact that there are still 4,2 billion individuals worldwide who remain offline – by circumstance or by choice (ITU, 2015). As shown in Figure 2, in particular large parts of the developing world still remain unconnected or unable to use the Internet. While Internet penetration rates in developed countries such as the U.S., the Netherlands or

Germany are approaching full coverage, many sub-Saharan, African countries struggle with Internet penetration rates as low as one or two percent, e.g. Eritrea, Burundi or Somalia (ITU, 2015). Generally, disparities in ICT penetration can not only be observed between developing and developed countries (Dewan et al., 2010) but also within groups of similar country clusters like the European Union (Cruz-Jesus et al., 2012), e.g., with less than 60% of Italians and Greeks being connected to the Internet in 2014. Research found that a country's wealth, level of education, demographic situation, infrastructure, cost factors and governmental regulation have a major impact on Internet penetration.

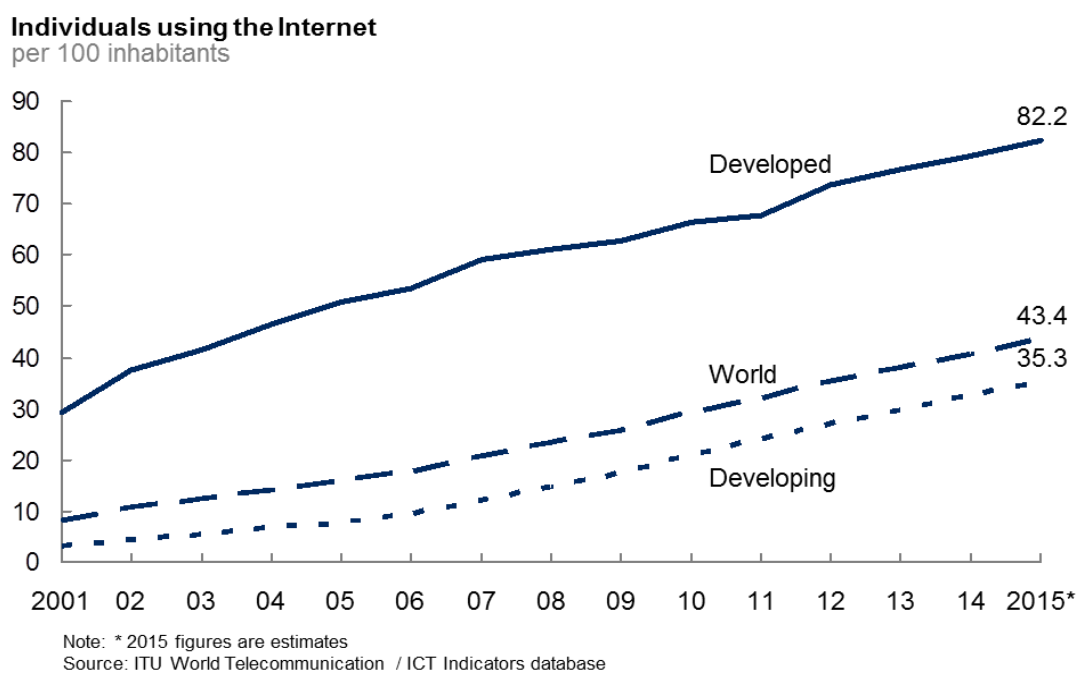


Figure 2. Individuals using the Internet per 100 inhabitants

Furthermore, a range of socio-demographic factors have been found to impact digital inequality within a certain society, with age and socio-economic status being the most significant determinants (Boase, 2010; Hsieh et al., 2011). For instance, the D21 Digital Index for Germany illustrates that despite high overall penetration rates, major differences exist in Internet use between individuals of different income, education, and age. While almost 94% of those with a monthly income higher than 3000 Euros used the Internet, only 54% of those with a monthly income lower than 1000 Euros were online in 2014. Similarly, 98% of those younger than 30 years were Internet users in 2014, while the user rate drops to 64% and 29% for those being older than 60 years and 70 years respectively. These statistics

show that in developed countries like Germany differences in Internet adoption exist among certain groups, however, the overall internet penetration level still remains high.

Digital inequality with respect to ICT appropriation and use outcomes

In developed countries with high Internet penetration rates, digital inequality primarily manifests itself in differences in ICT appropriation and ICT use outcomes. More specifically, individuals differ in how they appropriate ICTs and the degree to which they are able to leverage digital opportunities for their own benefit. Van Deursen and Van Dijk (van Deursen & van Dijk, 2010) found that skills play an instrumental role in determining how effectively individuals are able to appropriate digital technologies and differentiate between medium-related skills (i.e. operating a device) and content-related skills (i.e. navigating multiple websites in a goal-directed manner). Others have found that the socio-economically disadvantaged use digital technologies less for ‘capital-enhancing’ activities, such as reading news or health information online (Hargittai & Hinnant, 2008). These apparent differences in ICT appropriation highlight that merely providing access to digital technologies does not ensure that individuals are able to profit equally from them.

In fact, unequal ICT appropriation often translates into unequal outcomes, which can affect individuals in multiple ways. It has been suggested, for instance, that digital inequality may lead to an economic opportunity divide resulting from the digitally disadvantaged’s lesser ability to leverage Internet-based education, training, and employment opportunities (Mossberger et al., 2003). Similarly, researchers found that not being able to effectively use ICTs can have detrimental effects on academic achievements, health outcomes and social outcomes (W. Chen et al., 2014; Hampton, 2010; K.-K. Wei et al., 2011). The benefits of using – and the repercussions of not using – digital technologies are becoming increasingly apparent. Online job platforms, for instance, are projected to increase employment globally by 72 million full-time-equivalent positions by more effectively connecting individuals with work opportunities (Manyika et al. 2015). Individuals who are unable to fully appropriate digital technologies such as these may find themselves disadvantaged, both online and offline. As digital technologies pervade more and more areas of daily life, this issue only becomes more relevant.

Digital opportunities and their potential to decrease inequality

Against the backdrop of the ongoing digitization, we believe that there are a number of focal domains in which individuals are particularly likely to profit from digital opportunities – or be disadvantaged if they do not engage. Out of a range of applications, we identified six online domains that we believe to be particularly promising in enhancing one’s life chances: education, e-commerce, employment, e-government and public services, health, and finance and insurance. Figure 3 outlines the main digital opportunities that exist in each of these domains. In addition, we explore the domains of education and e-commerce in more detail in the following paragraphs and, in the next section, build on proprietary data from a qualitative case study of online job search in Germany to provide a comprehensive perspective on digital opportunities and mechanisms of (dis-)engagement in the employment domain.

One focal domain is education, where e-learning is revolutionizing the access to and cost of schooling and education. Analysts project that global revenues from online learning will reach USD 51 billion by 2016 (Ambient Insight Research, 2013).

- *What are the benefits?* E-learning can dramatically increase the availability of formal and informal educational content to underserved population segments. Digital inequality particularly affects individuals with lower incomes and lower educational backgrounds, who often cannot afford to pursue higher education. Online education, for example in the form of massive online open courses (MOOC), is openly accessible to anyone with an Internet connection, offers accredited courses at low or no cost, and allows flexible, remote learning which is easily compatible with part-time work. Through this model, MOOCs open up (higher) education particularly to non-traditional students and reach a wider share of the population. More generally, students can achieve better educational outcomes by leveraging digital content such as online dictionaries, language or math coaches, and Youtube tutorials. Particularly if parents are not able to support their children in their studies, e-learning resources can be of great help.
- *What are the challenges?* For socio-economically disadvantaged individuals, e-learning and MOOCs provide a promising avenue through which they can improve their educational achievements – and, as a consequence, economic – prospects. Yet for those who are digitally disadvantaged, the barrier to using these platforms may seem high, particularly when confronted with video conferences, online assignments, and community discussion forums as an integral medium of online learning. Internet access at home and

connectivity speed may also be barriers to use. Policy makers and educational providers must ensure that the barriers to participation are kept as low as possible, for instance by offering view on demand rather than live streaming tutorials, which can be an issue where Internet connectivity is low, and providing adequate support structures.

Domain	Digital tools enable users to...	Examples of platforms or services
Education	<ul style="list-style-type: none"> Provide cheaper, more convenient, flexible access to e-learning services and content Opens up formal education and accredited courses to non-traditional students 	MOOCs (e.g. Coursera, Udacity, Edx), Wikipedia, Youtube tutorials, online dictionaries, online coaches, Skillshare, Babbel
E-commerce	<ul style="list-style-type: none"> Information advantage through easier access, ability to compare products and services, and greater price transparency Profit from increased convenience and supply 	Online shopping portals (Amazon), price comparison sites (Nextag), daily deal sites (Groupon), flash sale sites (Yoox, Gilt)
Employment	<ul style="list-style-type: none"> Search for work opportunities based on extended matching attributes Provide transparency into company reputation, skills, and other traits Facilitate application process Connect via professional networks 	Monster, LinkedIn, Careerbuilder, Vault, Xing, company websites
E-government/ public services	<ul style="list-style-type: none"> Facilitate communication & collaboration Enable transactions of key services Simplify information access 	Online tax returns, business registration, scheduling of appointments at public agencies
Health	<ul style="list-style-type: none"> Gain information about healthy lifestyles, diseases, health-related offerings and services Discuss, research and share health-related issues Conveniently leverage fitness and health tutorials and coaching 	Runtastic, Oscar Health, e-doctors, Youtube tutorials, medical forums, patient-centered online follow-up care, TK Gesundheitscoach
Finance and insurance	<ul style="list-style-type: none"> Achieve savings through online comparison of services prices and product offers Circumvent bank fees (e.g. for offline services) Gain access to alternative/ non-traditional sources of credit, savings, and insurance 	Paypal, Transferwise, Zencap, Weltsparen, e-only banks (DKB), Auxmoney, Money Saving Expert

Figure 3: Digital opportunities and their potential to decrease inequalities

Another focal domain in which digital technologies provide a critical advantage is e-commerce. In a broad sense, e-commerce can be understood as the range of products and services that can be purchased online.

- *What are the benefits?* E-commerce platforms offer consumers significant opportunities in terms of variety, economic savings, and convenience. Online retailers such as Amazon, for instance, offer millions of items, whereas a typical Wal-Mart Supercenter only carries around 125,000 distinct items (Barr, 2013). Moreover, greater price transparency and competition mean that online prices are, on average, ten percent lower than offline prices (Manyika & Roxburgh, 2011). Quick and convenient access to a vast amount of information about products and services, such as customer reviews, further helps to reduce the information asymmetry consumers are typically subject to.

- *What are the challenges?* The e-commerce world is complex, with a multitude of price comparison, daily deal and flash sale sites that offer discounts, as well as an overwhelming amount of information to filter through. Awareness of the manifold opportunities to profit from online discounts is the most common barrier for the digitally disadvantaged, along with the real and perceived risk of fraud. Policy makers must promote greater transparency regarding what e-commerce platforms exist, how to find and take advantage of the informational and economic opportunities available online, and the things to watch out for to minimize the risk of fraud. Online consumer awareness trainings may be one avenue through which this could be achieved.

The case of online job search

Background on online job search

Online job search stands out as a one domain where digital inequality is likely to affect individuals the most. How to search for jobs has dramatically changed over the last decade and the shift into the online sphere confronts individuals with the need to cope with multiple new Internet applications. While, in 2003, around 40% of vacancies in the 1000 largest German companies were still advertised in print media, this number diminished to 12% in 2014 (Weitzel et al., 2015). Today, over 90% of the companies use online channels to advertise vacancies and search for employees (BITKOM, 2010; Weitzel et al., 2015). Increasingly, firms are even shifting from online to mobile platforms for recruiting. Mobile platforms are expected to soon serve as the primary mechanism for communicating with job-seekers, pushing open jobs to applicant communities and attracting candidates. In fact, 28% of US companies report that they already see a large share of candidates applying for positions via mobile devices. Similarly, social professional networks are gaining momentum as key sources for finding talent for white-collar jobs, contributing a 46% share in the US (LinkedIn, 2015). A recent study by the McKinsey Global Institute (Manyika et al., 2015) estimates that, overall, up to 540 million individuals could profit from online talent platforms by 2025 through faster and more effective matching of open positions with job-seekers, a shift from informal to formal employment and the creation of marketplaces for contingency (freelance) work. For the labor market as a whole and for many individuals this potential is encouraging. At the same time, it highlights how imperative it is to ensure that the digitally disadvantaged are able to partake in this shift as offline channels increasingly are not only complemented but substituted by online and mobile channels. If the digitally disadvantaged

are not able to partake in this shift, they run the risk of being acutely disadvantaged in their job chances and socio-economic wellbeing.

Description of our study

Given its position as a focal domain of digital inequality, we undertook a qualitative case study of online job search in Germany in order to uncover which underlying mechanisms lead individuals to engage with, or disengage from, this Internet-based technology. We collected a broad set of data—comprising interviews, self-tests of online job search applications, on-site observations and archival data—over a period of nine months from August 2014 to April 2015. Core to our data collection efforts were 16 semi-structured interviews with individuals who were currently or had recently been looking for a job. A criterion-based, purposeful sampling (Patton, 2002) was used for this study in that we selected only participants who were currently or had recently been seeking a job and we tried to maximize variation by sampling participants from different educational backgrounds, age groups, gender and urban/rural places of residence. As such we were able to gain insights both from digitally advantaged and digitally disadvantaged individuals. Data collected through the interviews with job-seekers was triangulated and enhanced by interviews with corporate recruiters and employment agents at the German Federal Employment Agency (GFEA). In total, we collected 182 pages of field notes which we subsequently evaluated using a semi-exploratory content analysis.

Key findings

The interviews revealed that the factors that lead to engagement with, or disengagement from, online job search applications differ significantly between the digitally advantaged and disadvantaged. Individuals considering whether to engage or disengage with an application typically pass through a cognitive process that starts with awareness of the salient application, an appraisal of the application as a perceived opportunity or non-opportunity, and an evaluation of the extent to which the individual can control and purposively use the application (Figure 4). Factors such as individual disposition (e.g. motivation), digital skills and social support can affect this process. These factors can vary starkly between digitally advantaged and disadvantaged users and influence the pathway to engagement or disengagement (refer to Figure V-5 for a summary).

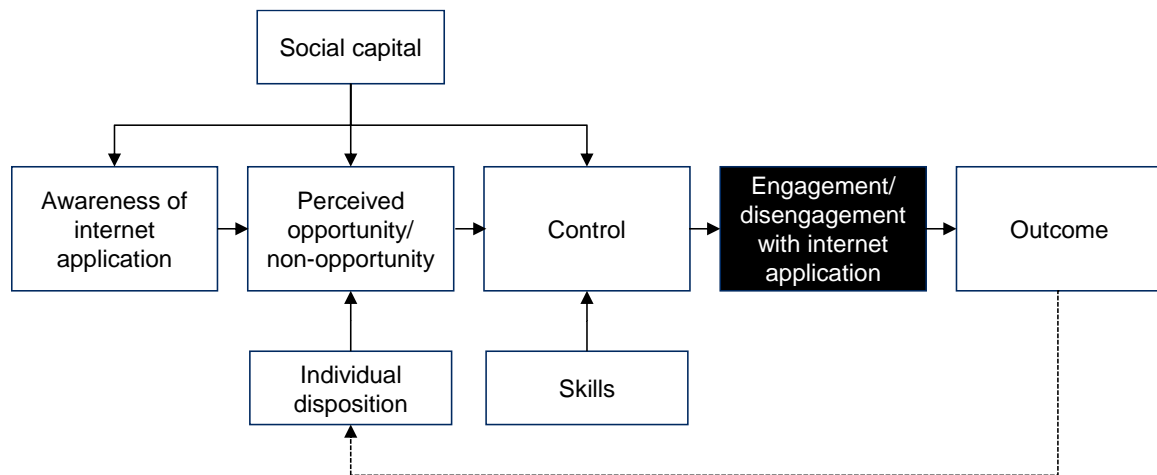


Figure 4. Process of (dis-)engagement with Internet applications

The key factors that result in an involuntary exit by exclusion for the digitally disadvantaged are a combination of limited online skills and often inadequate social support. While it may come as no surprise that skills are an issue for the digitally disadvantaged, a closer look is worthwhile as our observations suggest that not medium-related skills (how to operate and navigate across websites) are the issue, but rather content-related skills related to using an application in an effective, goal-oriented manner. Specifically, the digitally disadvantaged struggled with tasks such as defining meaningful search queries for jobs, filtering and evaluating results, and coping with the perceived complexity of searching for jobs online. Many felt easily confused and overloaded, which led to frustration and disengagement despite the fact that they would have liked to use the application. This is what we term “exit by exclusion” – the case that digitally disadvantaged users perceive an application to be relevant and useful, but lack the skills and control to use it meaningfully.

Digitally disadvantaged users	Digitally advantaged users
<ul style="list-style-type: none">▪ Limited awareness of salient applications and functionalities▪ Low content-related skills (and self-efficacy) as a critical barrier to use▪ Largely homogenous social network that can offer only limited support▪ High reliance on institutional support (where available)▪ High risk of exit by exclusion due to low control of internet application	<ul style="list-style-type: none">▪ Perceived usefulness and navigability of user interface key to engagement▪ Low reliance on social network and institutional support▪ Skills rarely a limiting factor▪ Satisfactory outcome of engagement critical for positive re-appraisal and continued use

Figure 5. Typical user characteristics according to digital proficiency

Social support – or “social capital” – can play a vital role in preventing this critical outcome. Social capital denotes the support an individual can draw from their social network – from family, friends, colleagues, but also from institutions. In the context of job search, these may include secondary or tertiary educational institutions, state institutions such as the GFEA, as well as private or non-profit support organizations that aim to facilitate the job search. We find strong indications that for the digitally disadvantaged social capital has a game-changing impact at all stages of the process leading to engagement. Social capital can trigger awareness for job search applications and influence the consideration set of applications an individual perceives as useful. Most importantly however, social capital can have a transformative effect on an individual’s perceived ability to control an application. It can compensate for an individual’s limited skills or self-efficacy by giving advice, teaching and constituting a (theoretical) fallback option for support, thereby translating a feeling of low control to high control and making the difference between disengagement and engagement. Digitally disadvantaged individuals profit immensely from having digitally advantaged referents in their support network whom they can draw on for help. Unfortunately, the tendency for social networks to be homogeneous often limits the potential support the digitally disadvantaged can draw from family and friends. This highlights the importance of social institutional capital as a means to overcome this barrier and as a source of critical impulses in cases where individuals’ private networks reach their limits. However, a word of caution is appropriate, as misdirected institutional support can prove dysfunctional. Rather than trying to facilitate online job search by taking over tasks for digitally disadvantaged individuals – thereby

promoting dependency – institutions should focus on capability building and enabling individuals to act independently online.

Bridging the gap – what needs to happen?

The question that emerges is how to bridge the existing digital inequality gap. The issue has garnered much public and political scrutiny, particularly in the early 2000s, and a large number of government initiatives have sprung up as a result. In Germany, Internet access is even legally enshrined as a basic right since 2013 due to its central importance as a part of life. Yet often these initiatives are misdirected. Many federal and municipal initiatives are designed to remove economic barriers and focus on providing low-cost or free high-speed Internet access despite the fact that penetration rates in developed countries are close to saturation and few structural differences (apart from old age) remain in terms of access. As we have seen, however, merely having access to digital technologies does not ensure that individuals are able to effectively use and leverage these digital technologies. Here, skills and social capital play a decisive role. Initiatives aiming to successfully bridge the gap must place a much stronger focus on nurturing effective use among the digitally disadvantaged and providing the appropriate support structures to that end. In the following, we identify a number of key insights for initiative success from our case study that are summarized in Figure 6.

Embedded institutional support structures	<ul style="list-style-type: none"> ▪ Embed digital education in teaching plan – learning about and with technology ▪ Train-the-Trainer – on the job, continued education for teachers ▪ Provide necessary infrastructure to schools – ensuring access to hard- and software, etc. ▪ Include municipal and community institutions – provision of free or low-cost training
Focus on skill-building and enablement	<ul style="list-style-type: none"> ▪ Provide skill-building – targeted differentiation between formal and strategic skills ▪ Enable the trainee – aiming at empowerment of user through experience and learning ▪ Reduce barriers to initial and continued use – encourage own digital engagement from day one but offer assistance as a fallback option
Application-oriented implementation	<ul style="list-style-type: none"> ▪ Bundle skill trainings with applications of relevance – training e.g. based on job search, online education or e-health applications ▪ Create awareness and share information – using skill trainings to explain the variety and specific relevance of applications in one field
Targeted initiatives	<ul style="list-style-type: none"> ▪ Segment and target users based on structural deficits and/or digital needs – specific targeting to increase motivation, acceptance, and relevance for the participants ▪ Offer modular trainings – increasing motivation and acceptance e.g., of those who are technically well-versed but struggle with certain skills or certain applications

Figure 6. Key insights on designing initiatives to bridge digital inequality

- ***Embedded institutional support structures:*** Institutionalized support structures are key to helping the digitally disadvantaged overcome the limitations of homogeneous social networks and the ensuing structural deficits. Institutional support can act on many levels. At a federal or state level, government initiatives should focus on firmly anchoring digital education in primary and secondary school curricula to address digital inequality at its roots. This entails three main aspects: a) structurally embed digital education in teaching plans across subjects and ages with the aim to not just learn about digital technology, but also learn with it; b) train-the-trainer: provide teachers with the necessary training and offer on-the-job, continued education; and c) ensure schools have access to the necessary infrastructure (hard- and software, digital learning aids, administration and support) required to disseminate the knowledge. Municipal and community-based support structures, in turn, should target the specific local needs of their populace. Public libraries and community learning centers, for instance, already serve as important digital access points for the digitally disadvantaged and should be activated to provide free or low-cost public trainings and targeted seminars. Where government-led initiatives are lacking, of course, non-profit organizations may take their place.
- ***Focus on skill-building and enablement:*** Initiatives directed at bridging digital inequality should focus on targeted skill-building in order to empower the digitally disadvantaged. Targeted skill-building will need to differentiate between formal, operational skills and content-related, strategic skills that entail the requisite capabilities to use digital technologies effectively and independently. While the former are easier to teach and thus subject of most trainings, they are generally not the critical issue. Formal curricula and digital learning aids could support the wider implementation of content-related strategic skills. Trainings may benefit by drawing inspiration from consumer awareness programs which aim to enable individuals to evaluate given information, create an awareness for potential upsides and risks, and empower smart decision making. All these “soft” capabilities translate well into the digital context.
- ***Application-oriented implementation:*** The mechanism through which skill-building initiatives are likely to be most effective is through application-oriented implementation. The key is to bundle digital skills trainings with specific applications that are relevant to the digitally disadvantaged, such as online job search, online education, and e-government services. By doing so, the outcomes of digital education become immediately tangible for the digitally disadvantaged as they learn how to leverage digital tools for specific tasks.

Application-oriented initiatives also enable a more cost-efficient and effective support structure founded on a selective needs-basis.

- **Targeted initiatives:** The digitally disadvantaged are often lumped together into one pot with digital initiatives trying to cater to all in the same manner. In reality, the digitally disadvantaged vary significantly in terms of underlying structural deficits (e.g. education, income, age, etc.) and (digital) needs. Initiatives aiming to bridge the digital inequality gap need to account for these different user groups and provide targeted support measures. This will allow structural barriers to be addressed more directly and at the same time ensure that specific digital skills are provided where they are most needed and valued.

Conclusion

The phenomenon of digital inequality has evolved over time, yet remains a salient and important issue today. Many structural barriers continue to exist which influence how individuals use digital technologies and to what extent they are able to benefit from them. As digital technologies become ever more prevalent in our daily lives and increasingly substitute offline alternatives, the socio-economic repercussions of not being able to properly engage with these technologies become more severe. In domains such as employment and education, the benefits of digital technologies – and the consequences of digital inequality – are more salient. Initiatives aiming to bridge the digital inequality gap should focus on institutional support structures, skill-building and enablement, application-oriented implementation, and targeted, needs-based measures. Digital technology will continue to evolve and only by proactively addressing digital inequality from early on can we ensure that everyone is able to reap the benefits of the digital revolution.

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Concluding remarks

This thesis set out to expand our knowledge on the complex and societally relevant phenomenon of digital inequality. With more and more aspects of our lives moving online, it is becoming a prerequisite to participate in digitization in order to fully partake in society. Thus, it is imperative to understand what creates digital inequality, in other words, to understand what determines if individuals can profit from digital opportunities in their ‘real life’ or not. This is why this thesis aimed specifically at exploring the less researched fields of *how* individuals use ICTs and *which mechanisms and factors* influence individual use and non-use of ICTs in the context of digital inequality. Given the high societal relevance of the debate on digital inequality, this thesis also sought to infer implications not only for academic research but also for practitioners, in particular public policy makers.

With these goals in mind, the interdisciplinary literature review on digital inequality laid the theoretical foundation of this research and synthesized what we already know and lined out a substantial research agenda on what we do not yet know about digital inequality. The findings show that digital inequality is rarely studied as a multi-stage phenomenon, that research lacks insights and a strong theoretical foundation with respect to ICT appropriation and ICT use outcomes, and that research is relying on a narrow scope of methods and has not yet integrated the latest technological developments. Altogether, these aspects limit the generalizability, comparability and explanatory power of digital inequality research.

The empirical study on second-order digital inequality in the context of e-commerce sought to advance our understanding in the less researched field of *how* individuals use ICT to their own advantage and explores how individuals use e-commerce as a function of their socio-economic status. This is particularly relevant, given that the socio-economically disadvantaged are most often those that are also digitally disadvantaged but have the greatest potential to profit from digital opportunities. The findings reveal that despite equal access, the socio-economically advantaged use e-commerce more effectively in both dimensions and that contrary to expectations, socio-economic status does not primarily impact *how much* individuals buy online, but rather *how* they search for and buy products.

The qualitative study on the mechanisms that lead to (dis-)engagement with new Internet applications sought to deepen our current understanding of individual user behavior towards

new Internet applications. Disengagement from Internet applications is becoming increasingly problematic because Internet applications permeate many domains of life by enhancing or substituting offline services in areas as fundamental to life chances as education, employment and health (W. Chen et al., 2014; Lindsay, 2005; Riggins & Dewan, 2005; K.-K. Wei et al., 2011). In this study, a model is developed that – in contrast to existing research – explicitly embraces the dynamic nature of ICT use and highlights how adopting a process-based view can help to gain a more thorough understanding of the mechanisms that lead to (dis-)engagement. In particular, the model suggests that social capital plays a more important role in engaging people with Internet applications than portrayed in previous studies.

Finally, this thesis concludes with a practical perspective on digital inequality and digital opportunities. It highlights that public policy makers should focus their efforts on digital domains for which the expected impact for society and the individual is likely to be the greatest, such as employment, health, and education. Additionally, public policy makers seeking to bridge digital inequality should make sure that initiatives are embedded in institutional support structures, focus on skill-building and enablement, and comprise application-oriented training and targeted initiatives.

Altogether, this thesis provides substantial theoretical and methodological contributions to research on digital inequality and information systems, in particular technology adoption and use. Beyond contributions to theory, this thesis also entails important implications for practitioners.

First and foremost, this thesis contributes to research on digital inequality by highlighting and empirically proving that digital inequality is still a prevalent societal issue even in countries with widespread Internet access. To the best of our knowledge, this study is the first to empirically test and validate the long hypothesized e-commerce divide. Most notably, this thesis advances our understanding in the little researched fields of ICT appropriation and ICT use outcomes by studying which mechanisms and factors influence the individual appropriation of e-commerce and the use (outcomes) of online job search applications. Deepening our understanding of ICT appropriation and ICT use outcomes is particularly relevant, because whether individuals can appropriate ICTs to their advantage eventually determines whether digital inequality reinforces social disparities in the ‘real’ world. In particular, the findings emphasize that limited awareness of ICTs, insufficient content-related

skills, and a lack of social support are nowadays much more critical factors for digital exclusion than Internet access and medium-related skills, which have been the focus of extant digital inequality research. Further, this thesis underscores the pivotal role of institutional social capital for the digitally disadvantaged since these individuals rely strongly on support from family and friends (Hsieh et al., 2011), yet typically have fairly homogeneous personal social networks (Granovetter, 1973; Yu, 2011). This study also illuminates how and under which circumstances social capital can be converted into forms of capital instrumental to technology acceptance, an area that has so far received little research attention (Hsieh et al., 2011). The findings show how social capital can compensate for risk factors that favor disengagement, such as limited awareness and low control, as well as the preconditions in terms of trust that need to be present.

Second, this thesis also provides substantial contributions to research on information systems and in particular to the field of technology use and adoption. In contrast to existing research, the empirical studies on (dis-)engagement with internet applications explicitly takes a dynamic perspective on technology use and non-use by building on coping theory and relating aspects of capital theory to the individual resources influencing different stages of the coping process. The findings show that the pathways through which individuals appraise Internet applications are significantly influenced by the capital resources available to them and that social capital is effective at every step of the cognitive appraisal process, while habitus, perceived risk and cultural capital only impact a single stage. As such, the study responds to calls to investigate alternative theoretical perspectives on technology acceptance in order to broaden the field's understanding towards a wider constellation of behavioral responses (Abraham et al., 2013; Schwarz & Chin, 2007; Venkatesh et al., 2007). Similarly, the other empirical study contributes by developing a novel and more holistic perspective on e-commerce use that goes beyond the notion of a simple purchase and accounts for the context in which a transaction takes place, which is seldom one dimensional. Our perspective on e-commerce use contributes to the understanding of online shopping in a more holistic and nuanced manner, in particular with regard to economic utility-enhancing activities. In addition, by drawing on sociology communication research we introduce a new, more differentiated perspective on Internet skills – comprising medium- and content-related skills (van Deursen & van Dijk, 2011) – into the technology use discussion. This is particularly relevant, given that the findings in this thesis show that medium-related skills – that have often been mentioned as one of the most important barriers to technology use – are in fact

widely present yet content-related skills are required to effectively navigate and evaluate the manifold online options available to accomplish a certain task.

Third, the thesis also contributes by strengthening the methodological foundation of research on technology adoption and use and digital inequality. Most importantly, this thesis introduced clickstream data as an empirical basis for research on technology adoption and use. The use of clickstream data allows to overcome the high risk of common method variance as a result of common-rater effects and self-report bias, one of the most critical methodological issues underlying TAM (Straub & Burton-Jones, 2007). Clickstream data also tracks actual rather than intended behavior and hence avoids problems with time-variant intentions and the potential unreliability of self-reported behavioral attitudes (Podsakoff et al., 2003), a common issue in information systems research. Furthermore, following calls for more in-depth qualitative research (Selwyn, 2003; Venkatesh et al., 2013), this thesis also contributes to strengthening the methodological validity and explanatory power of digital inequality research. Qualitative research still constitutes an underused method in the field of digital inequality yet is necessary to meaningfully extend and enrich our understanding of the underlying mechanisms of use and non-use. The thesis underlines the necessity of a qualitative approach in order to grasp the complexity, the dynamism and the multitude of pathways that may lead to technology (dis-)engagement - aspects that are unlikely to be captured in the same depth and richness through traditional, survey-based research.

Fourth, the findings of this thesis also entail important implications for public policy makers and online businesses. On a public policy level, this research highlights that digital inequality continues to be a substantial societal issue, even in developed countries such as the US and Germany. Bridging digital inequality and materializing the potential of digital opportunities to decrease social disparities should be a priority for public policy. The findings presented in this thesis also highlight, that in particular in developed countries, public policy should focus on bridging digital inequality in domains that are fundamental to life chances such as employment and should build on use-oriented as opposed to access-oriented ICT initiatives. Additionally, initiatives should be tailored to the specific target group and ensure that skill trainings are bundled with applications that are particularly relevant for the digitally disadvantaged, e.g. online job search applications. Furthermore, this research underlines the critical role of governmental institutions with respect to influencing, guiding and enabling the digitally disadvantaged. Moreover, the findings also carry implications for online businesses.

In particular in the light of growing online self-service technologies, it is crucial for companies to understand what impedes individuals from using certain online applications. Better knowledge of the mechanisms and factors that influence the decision to use an Internet application can help online businesses to more effectively target digitally less savvy societal groups, such as the growing group of senior citizens, in order to expand their customer base and generate additional revenues.

In conclusion, digital inequality is still a prevailing and highly relevant societal issue that will continue to evolve with the growing pervasiveness of technologies. This thesis sought to advance our understanding of the digital inequality phenomenon, yet, there remains a lot to be studied. I hope that this thesis will serve as a vantage point for other researchers interested in this field to further broaden our understanding of digital inequality.

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Supplement A: Second-order digital inequality: The case of e-commerce (as published in The Proceedings of the ICIS 2014)

Second-Order Digital Inequality: The Case of E-Commerce

Completed Research Paper

Abstract

“Second-order digital inequality” describes that certain individuals profit less from digital opportunities not only due to limited access but also due to limited abilities to use information and communication technologies (ICT). This study extends research on second-order digital inequality to the realm of e-commerce. We introduce a novel conceptualization of effective, potentially beneficial, e-commerce use that encompasses two dimensions: (1) the diversity of e-commerce platforms used by an individual; (2) the degree to which an individual uses supporting e-commerce features. Building on technology acceptance theory and social psychology, we argue that socio-economically disadvantaged individuals are less likely to use e-commerce effectively than socio-economically advantaged individuals. We empirically test our hypotheses on clickstream data that tracks the online behavior of 2819 US e-commerce users for six months. Our findings reveal that, despite equal access, the socio-economically advantaged use e-commerce more effectively regarding both dimensions. Implications for research and practice are discussed.

Keywords: Digital inequality, e-commerce, digital divide, e-commerce platforms, e-commerce functionalities, technology acceptance

Introduction

Ever since its inception, scholars have discussed the impact of the Internet on society (DiMaggio et al., 2001). Proponents of the Internet argued it could provide people access to new ways of creating value and thus foster societal wealth and wellbeing (Hargittai, 1999; Madon, 2000). Some authors even suggested that new Internet-based technologies would level the playing field between societal strata and reduce social inequality (Anderson et al., 1995). In contrast, others contended that rather than reducing economic disparities within and across societies, the Internet could in fact lead to “increasing inequalities, improving the prospects of those who are already in privileged positions while denying opportunities for advancement to the underprivileged” (Hargittai, 2003).

Within the debate on the social ramifications of the Internet, the phenomenon of “digital inequality” has received substantial attention (Hargittai & Hinnant, 2008; Hsieh et al., 2008; Kvasny & Keil, 2006; Riggins & Dewan, 2005). Digital inequality refers to the difference between individuals regarding their access to, and ability to use, information and communication technologies (ICT) (DiMaggio et al., 2004). Early studies observed so called “first-order” digital inequality by showing that the socio-economically disadvantaged typically have less access to ICT than their advantaged peers (DiMaggio et al., 2001; Katz & Rice, 2002). More recently, scholars have turned their attention to “second-order” digital inequality by noting that individuals also differ with regard to the way they *use* ICT depending on their socio-economic status (DiMaggio & Hargittai, 2001). Scholars have explored digital inequality, focusing on central and potentially beneficial Internet uses such as information search (van Deursen, 2012), e-government participation (Bélanger & Carter, 2009) and capital-enhancing websites (Zillien & Hargittai, 2009). They cautioned that, due to digital inequality, less privileged individuals may be less able to profit from the opportunities the Internet has to offer (Mossberger et al., 2003).

Recently, e-commerce has emerged as an additional area of opportunity creation within the digital inequality discussion. With worldwide online sales exceeding \$1 trillion (eMarketer 2013), e-commerce captures a substantial share of the global business. More importantly, a wide range of e-commerce platform formats and features have evolved that help individuals to optimize the economic outcome of their purchases. For instance, e-coupons, price comparisons, or auctions are means by which individuals can shop cheaper than in the brick-and-mortar world. In other words, users who are able to shop more effectively by leveraging e-commerce functionalities potentially generate a substantial economic surplus (Dewan and Riggins 2005). Thus, e-commerce might be particularly beneficial for the socio-economically disadvantaged.

Despite the potential benefits of e-commerce for online shoppers, almost no scholarly attention has so far been devoted to digital inequality in the context of e-commerce. Prior research (Akhter, 2003; P. E. N. Howard et al., 2001; Zillien & Hargittai, 2009) suggests that, contrary to homo economicus expectations, those with the least economic resources are less likely to fully leverage the breadth of opportunities available to realize savings when shopping online. These findings imply that economic inequality in the “offline” world might be further perpetuated in the “online” universe. However, extant digital inequality research has mainly focused on selective aspects of e-commerce and there has been little consideration of the general role of e-commerce as a potential amplifier or compensator of inequality. So far there is only little empirical evidence on the existence of digital inequality within e-commerce and only a limited theoretical conceptualization of what actually constitutes inequality with regard to e-commerce use. In this vein, scholars called out for research that better conceptualizes and studies digital inequality in the context of e-commerce (Riggins & Dewan, 2005).

We seek to address this research gap by exploring how individuals vary in how they use e-commerce as a function of their socio-economic status and, in turn, whether e-commerce amplifies or attenuates digital inequality. We focus specifically on the influence of an individual’s socio-economic status on two aspects of e-commerce use that promise economic gains, namely (1) the extent to which an individual is able to leverage the *diversity of e-commerce platforms* available within the product purchasing step (e.g., general retailers, daily deals, flash sales); and (2) the degree to which an individual employs *supporting features* such as e-coupons and price comparisons within the information search step to further benefit from e-commerce. We draw on technology acceptance theory and social psychology to hypothesize that socio-economically disadvantaged online shoppers tend to shop less diversely and will be less likely to make use of supporting e-commerce features. We test these hypotheses on a unique set of clickstream data which tracks the online behavior of 2,819 US participants for 6 months in 2012.

Our study most importantly contributes to digital inequality research by highlighting that second-order digital inequality is a prevalent societal issue and persists within the context of e-commerce. We further add to the broader context of information systems research by introducing an innovative conceptualization and operationalization of e-commerce system use that may be extended to other technologies. Moreover, using clickstream data as empirical basis of our research represents a novel approach to investigate technology acceptance based on actual rather than intended behavior. Finally, our research has important implications for public policy and managerial practice. Understanding how socio-economic status impacts e-commerce use may influence policy making with regard to digital skills, ICT education and consumer protection and might help businesses to effectively target different societal groups.

Theory and Hypotheses

Digital Inequality: The Perpetuation of Socio-economic Status Online

“Digital inequality” denotes the difference between individuals in terms of their access to, and the ability to use, ICT which in turn restrains them from realizing opportunities offered through those technologies (DiMaggio et al., 2004). While digital inequality has been observed with regard to various demographic dimensions such as gender, race, and age (Chaudhuri et al., 2005; Rice & Katz, 2003), the phenomenon has been particularly highlighted in the context of socio-economic differences between individuals as reflected in their income and education (J.-Y. Jung et al., 2001). Mossberger et al. (2003), for instance, found that individuals with lower income and education are restricted in their job prospects due to their relative lack of access and skills to use ICT in a working environment.

Digital inequality constitutes a complex and multi-faceted societal challenge on the global level as well as within national societies (OECD, 2013; UN, 2013). Researchers have argued that digital inequality is a perpetuation of underlying social disparities in the “real” world (Kvasny & Keil, 2006; Norris, 2001; Warschauer, 2003b). It has been cautioned that, comparable to the so-called “Matthew effect” (Merton, 1973), peoples’ initial advantages in technology access may translate into increasing relative returns over time, thereby further widening the gap between the more and the less privileged parts of society.

Scholars have devoted increasing attention to digital inequality and its underlying mechanisms. Earlier research focused on the first-level “digital divide” (DiMaggio & Hargittai, 2001) which denotes differences in people’s access to ICT and its sociological implications such as exclusion from online education (Katz & Rice, 2002). More recent studies noted that access to Internet is losing importance, with broadband penetration in developed countries almost at saturation levels (e.g., 80% in 2012 in the U.S.; OECD 2013). Correspondingly, recent research seeks to shed light on the so-called “second-level” digital inequality (Hargittai 2002: p.1): rather than studying *whether* individuals use the Internet or not, the debate now focuses on exploring differences in *how* people use the Internet to create opportunities for themselves. Mossberger et al. (2003) suggested three different manifestations of digital inequality: first, a skills divide related to the individual ability to handle computers and the Internet and to get access to information; second, an economic opportunity divide resulting from people’s inability to participate in Internet-based education, training, and employment opportunities; and third, a democratic divide due to the inability to engage in e-government. In this vein, digital inequality scholars have explored aspects such as general Internet skills (Hargittai, 2010) and the adoption of e-government (e.g., Helbig et al. 2009). For instance, van Deursen and van Dijk (2010) studied Internet skills in the Dutch population and observed that lower education predicted lower Internet skills. In our study, we focus on one aspect related to ICT, which has also been proposed to be affected by, and to affect, digital inequality (Riggins & Dewan, 2005): the use of e-commerce.

E-commerce and the Potential Economic Benefits of Platform Use Diversity and Supporting E-commerce Features

E-commerce in the business-to-consumer context has been defined as the trade of products and services online (Olson & Olson, 2000). The U.S. Department of Commerce (2014) estimates that, in 2013, U.S. citizens spent US\$ 263 billion for products and services online and that online sales will reach US\$ 370 billion by 2017 (Inc, 2013). In 2014 alone, e-commerce sales are expected to increase by an additional 14% as opposed to sales in 2013 (Centre for Retail Research 2014).

Given the growing importance of e-commerce, scholars in information science have studied various aspects of people’s use of e-commerce. For instance, behavioral research in e-commerce illuminates

which factors motivate individuals to engage in online shopping in general (Gefen et al., 2003; Gefen & Straub, 2000; Pavlou & Fygenson, 2006). Other researchers have investigated specific e-commerce functions such as auctions and e-coupons (Bosnjak, Obermeier, & Tuten, 2006; K. Jung & Lee, 2010).

In the context of our study it is important to define what actually constitutes effective —i.e., potentially beneficial from an economic point of view—e-commerce use. Buyer decision making models break down the purchasing process into a number of steps (Engel et al. 1973), of which information search and the product purchasing decision are considered to be the most important within the online context (Gefen and Straub 2000). When considering the product purchasing step, the continuous evolution of the e-commerce landscape over the last decade needs to be taken into account. Today, consumers can choose among a diverse variety of formats and vendors from which to buy a product. For instance, the rapid proliferation of innovative formats such as auctions, daily deal or flash sale sites provide consumers with an increasing range of alternatives to traditional online retailers such as Amazon.com and the opportunity to save money by finding the best deal. Likewise, in the information search step consumers can choose between different e-commerce features to optimize prices (in addition to getting general product information), predominantly through price comparisons and e-coupons. Consequently, a conceptualization of effective e-commerce use should account for the heterogeneous information search and product purchase options available that offer individuals the potential to achieve economic benefits and thus go beyond the traditional use concept of a simple transaction made online.

In this study, we focus on two specific aspects of e-commerce use, both of which are particularly likely to create economic benefits for users in either the information search or the product purchasing phase (1) the extent to which an individual is able to leverage the diversity of e-commerce platforms available within the product purchasing step (e.g., general retailers, daily deals, flash sales); and (2) the degree to which an individual employs supporting features such as e-coupons and price comparisons within the information search step to further benefit from e-commerce. We define “*e-commerce platform use diversity*” as the variety of e-commerce platforms an individual uses when shopping online. This definition entails two particular aspects. First, it accounts for the general degree to which an individual makes use of different e-commerce websites and platforms when shopping online. Online shoppers can access a wide range of e-commerce platforms, for example general retailers such as Amazon.com, specialized retailers such as Zappos.com, and brand shops such as Nike.com. Research within offline retail has shown that a larger number and variety of store visits per week leads to an economic advantage (Carlson & Gieseke, 1983): those individuals shopping for groceries who make more trips to different stores achieve lower prices on average because of price dispersion between stores. Similar patterns of price dispersion can be observed online (Ba et al., 2012). Correspondingly, online shoppers who selectively switch between e-commerce websites and leverage the breadth of platforms available are more likely to achieve economic gains.

A second particular aspect entailed in the definition of platform use diversity is the users’ participation in ‘alternative’ e-commerce formats such as auctions (e.g. Ebay.com), flash sales (e.g. Gilt.com), and daily deal sites (e.g. Groupon.com). Prior research shows that especially alternative e-commerce formats offer significant cost savings for users. For instance, Bapna et al. (2008) estimate that the consumer surplus from auctions on Ebay.com exceeded US\$ 7 billion in 2003. Similarly, daily deal and flash sale websites offer heavily discounted deals for a limited time (Boon, 2013; Martinez & Kim, 2012), improving users’ odds to achieve lower prices than in other sales channels.

We define “*supporting e-commerce features use*” as an individual’s use of price comparisons and e-coupons in connection with an online transaction. Price comparison websites such as Shopping.com or Bizrate.com increase consumer power by creating price transparency and by offering additional product information. Research has shown that the potential savings resulting from the use of price comparison websites can be significant (Rezabakhsh et al., 2006). For instance, Baye et al. (2004) examined four million prices for 1000 consumer electronics products and found that, despite increased transparency, price dispersion ranged from an average of 3.5 percent up to 23 percent. Moreover, consumers can achieve additional savings by leveraging websites that offer free promotional e-coupons such as Retailmenot.com or Coupons.com. E-coupons are digital codes which entail a price reduction for a given product or website (K. Jung & Lee, 2010). Thus, using e-coupons enables users to capture a higher economic gain per transaction on a given platform.

Digital Inequality in E-commerce Use

Extant studies have repeatedly called for research on digital inequality in the context of different ICT use applications (DiMaggio et al., 2004, 2001; Hargittai & Hinnant, 2008; Zillien & Hargittai, 2009)

and e-commerce in particular (Akhter, 2003; D. L. Hoffman et al., 2006). Specifically, Dewan and Riggins (2005) introduced the notion of an “e-commerce divide,” which they defined as “certain people’s inability to make use of more advanced e-commerce online functionalities and services” (2005: p. 318). They argue that even in the case of equal Internet access, socio-economically disadvantaged individuals might be less able to seize the multiple opportunities to achieve economic gains that are offered by e-commerce.

The notion of an “e-commerce divide” carries a number of intriguing theoretical implications. First, such a divide contradicts assumptions about rational behavior, opportunity cost and the decreasing marginal value of money. Under such assumptions, one would expect the motivation to save cost through e-commerce to be strongest for those individuals with the least financial resources and that those who earn the least would incur less opportunity cost when investing time online. Ultimately, this would prevent the emergence of an e-commerce divide. Second, the existence of an e-commerce divide seems counterintuitive since e-commerce theoretically carries the potential to reduce—rather than reinforce—disparities regarding consumption possibilities in the offline world (Anderson et al., 1995). While, in the brick-and-mortar universe, product availability, access, and pricing are highly dependent on the consumer’s place of residence and typically favor those consumers who live in well developed areas, in the online world the product offering and prices are principally identical for everybody. In addition, the costs to search for products and prices on the Internet are lower compared to the offline world, for instance due to automated price comparisons. In the offline world, information search is costly, which might prevent those from lower income classes to extensively search for the best product at the best price. Altogether, the notion of an “e-commerce divide” contradicts *homo economicus* assumptions about consumer behavior and the theoretical “equalizing power” of e-commerce. Thus, it seems particularly interesting to explore whether and why e-commerce eventually attenuates or fortifies digital inequality.

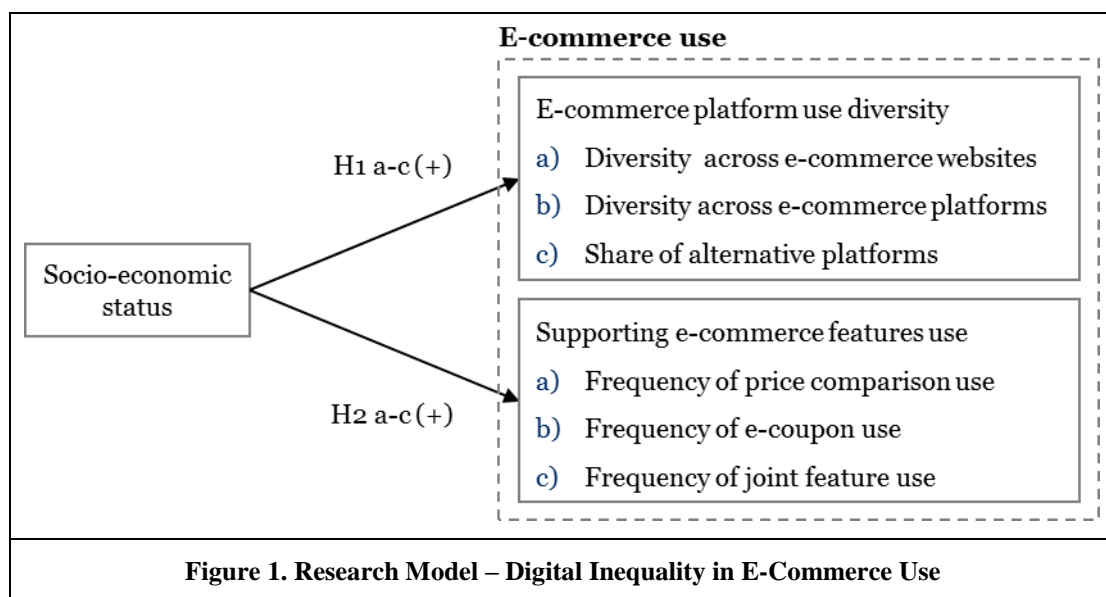
To build hypotheses on the relation between an individual’s socio-economic status and his or her tendency to use a diverse set of e-commerce platforms and supporting e-commerce features, we draw on Davis’ (1989) technology acceptance model (TAM). TAM is a widely accepted model in information systems research (Benbasat & Barki, 2007; Taylor & Todd, 1995; Venkatesh & Davis, 2000; Venkatesh et al., 2003) and has been extended to robustly predict various facets of consumers’ use behavior in the context of e-commerce (Gefen & Straub, 2000; Koufaris, 2002; Pavlou, 2003) such as online auctions (Stern et al., 2008) and e-coupons (Kang et al., 2006). TAM originally predicts an individual’s intention to use new technologies as a function of two factors (Davis, 1989): perceived ease of use, which describes the subjective degree of effort required to use a technology; and perceived usefulness, which refers to the individual’s perception of the utilitarian gains that can be derived from using a technology. In our study, we will use the equivalent term of utilitarian motivation in lieu of perceived usefulness to denote an individual’s motivational disposition (see Hsieh et al., 2008).

In line with prior e-commerce research (e.g., Ahn et al. 2007; Pavlou 2003), we apply an extended, context-specific TAM. In their quest to continuously refine the TAM and adapt it to the context of e-commerce, scholars have dedicated particular attention to perceived risk as an additional precursor of an individual’s e-commerce use (Gefen et al., 2008). The individual’s perception of risk is quintessential when studying e-commerce use because the consumer and the Internet store are physically separated and therefore online transactions have an inherently impersonal nature (Bhatnagar & Ghose, 2004; D. Kim & Benbasat, 2003; Pavlou, 2003). Glover and Benbasat (2010) describe the perceived risk of online shopping as an aggregate of an individual’s subjective assessment of three dimension of risk: first, the risk of information misuse, e.g. abuse of personal or financial data; second, the risk related to product benefits, e.g., the risk that a product will not arrive; and third, the risk of functionality inefficiency, e.g. that returning a product will be too difficult.

Further, scholars introduced the construct of hedonic motivation as a complementing element to increase the predictive power of TAM in the context of e-commerce (Ahn et al., 2007; Ha & Stoel, 2009). In this context, hedonic motivation is the degree to which an individual can derive enjoyment from online shopping (Childers et al., 2001). In contrast to utilitarian motivation, which describes the outcome driven extrinsic motivational factors for using a technology, hedonic motivation refers to the intrinsic motivation reinforced only by “the process of performing the activity per se” (Davis et al. 1992: p.112). Researchers investigating online consumer behavior have shown that hedonic aspects of online shopping are different from those in the brick-and-mortar universe, but equally important. For instance, sensory stimulation offered through a website, the playfulness of a website, and the ability to share e-commerce experiences with others improve the odds that consumers perceive online shopping

as more enjoyable and show more intention to shop online (e.g., Ahn et al. 2007; Childers et al. 2001; Lin et al. 2005; Moon and Kim 2001).

The central idea of our study is that, because of their socio-economic status, individuals tend to differ in their use of e-commerce. The socio-economically disadvantaged will differ from their advantaged peers in terms of their perceived ease use, i.e. the degree to which they are affected by e-commerce complexity. Moreover, less privileged individuals are likely to differ from the more privileged in their motivational dispositions, i.e., regarding the relative importance of hedonic and utilitarian stimuli. Lastly, they are likely to be distinct regarding the degree to which they perceive e-commerce as risky. We argue that these dispositions, in turn, lead to status-induced differences in how individuals behave regarding their e-commerce platform use diversity and their use of supporting e-commerce features. . The general logic of our theorizing is illustrated in Table 1 by using TAM constructs to link socio-economic status and e-commerce use. We display our research model in Figure 1 and describe it in the following passages.



Digital Inequality Regarding E-commerce Platform Use Diversity

Three rationales lead us to argue that socio-economic status is linked to platform use diversity. First, the increased complexity of using multiple e-commerce platforms is likely to affect the perceived ease of use of the socio-economically advantaged individuals to a lesser degree than the perceived ease of use of the socio-economically disadvantaged. Technology complexity has long been identified as a major barrier to ICT use, including e-commerce (Rice & Katz, 2003). However, social psychology suggests that the socio-economical differences cause people to vary in how they perceive complexity: privileged individuals typically have better access to skills and techniques that allow them to cope more easily and flexibly with challenges (Fan & Eaton, 2001), which is one reason why they are less affected by stress creating factors (L. W. Hoffman, 2003), including environmental complexity. Relatedly, scholars studying individual digital skills found a divide between socio-economic classes regarding the skills required to accomplish certain Internet tasks. For instance, van Deursen (2012) uncovered that individuals with a lower level of education were less able to access health information on the Internet. In this vein, we argue that the perceived ease of use for using a diverse set of e-commerce platforms is likely to be higher for the socio-economically advantaged given their general disposition to cope more flexibly with complexity as well as their higher level of education and Internet skills. Therefore, we anticipate that the socio-economically disadvantaged are likely to shop less diverse than the socio-economically advantaged.

TAM construct	Definition	Relative importance of construct depending on socio-economic status	Support for identified relative importance from existing literature	Illustration of specific TAM construct influence on e-commerce use (examples)	
				Platform use diversity	Supporting e-commerce features
Perceived ease of use (PEOU)	Subjective degree of effort required to shop online (Davis, 1989)	Relatively <i>higher</i> for the <i>socio-economic advantaged</i>	Van Deursen (2012), Fan and Eaton (2001), Hoffman (2003), Rice and Katz (2003)	(+) Requires PEOU to manage e.g. multiple interface complexity	(+) Requires PEOU, e.g. evaluate price comparison search results
Utilitarian motivation	Individual perception of gains that can be derived from shopping online (Davis, 1989)	Relatively <i>higher</i> for the <i>socio-economic advantaged</i>	Bonfadelli (2002), van Deursen and van Dijk (2010), Hargittai and Hinnant (2008), Norris (2001)	(+) Provides utilitarian benefit of cost savings, e.g. through using auctions or daily deals	(+) Provides utilitarian benefit of cost savings, e.g. thorough price transparency
Hedonic motivation	Degree to which an individual can derive enjoyment from online shopping (Childers et al., 2001)	Relatively <i>higher</i> for the <i>socio-economic disadvantaged</i>	Aneshensel (1992), Hsieh et al. (2008), Mathwick et al. (2001), Parker and Endler (1996)	(+) Provides hedonic benefits like e.g. novelty, thrill and feeling of escaping reality	(+) Hedonic benefits limited, e.g. to the joy of searching
Perceived Risk	Individual assessment of the risks associated with online shopping related to information misuse, product benefits and functionality inefficiency (Glover & Benbasat, 2010)	Relatively <i>higher</i> for <i>socio-economic disadvantaged</i>	Schechter (2007), McLeod and Kessler (1990), Bhatnagar and Ghose (2004), Shaw (1996)	(-) Increases risk, e.g. through multiple disclosure of personal and financial data	Not applicable

Table 1. Using TAM constructs to link socio-economic status and e-commerce use

Second, socio-economic status is likely to influence the motivational dispositions of individuals (Holbrook & Hirschmann, 1982; Holbrook, 1986), in particular their utilitarian and hedonic motivation, which in turn makes the socio-economically disadvantaged less likely to shop on a diverse range of platforms. Findings from digital literacy research suggest that obtaining utilitarian benefits is likely to be relatively more important for the socio-economically advantaged as opposed to their disadvantaged peers. For instance, Hargittai and Hinnant (2008) investigated the Internet use behavior of young adults and found that those with less education and from lower income backgrounds used the web to a lesser degree to read news or gather information on finance, health, politics or products. Further, Bonfadelli (2002) studied the Internet use behavior of more than 1400 individuals and found that those with less formal education used the Internet mostly for entertainment, while those study participants with more education used the Internet rather for informational and serviced-related purposes. Some scholars argue that the better education of the socio-economically advantaged puts them in a better position to assess and acknowledge the usefulness of ICT functionalities (Norris, 2001). Other authors see the relatively lower importance of utilitarian benefits as a consequence of a lack of digital skills required to fully leverage existing utility maximizing opportunities (van Deursen & van Dijk, 2010).

A high level of utilitarian motivation, in turn, positively influences an individual's inclination to shop on a diverse range of e-commerce platforms. Shopping on different platforms provides utilitarian benefits, such as a greater potential to save costs and profit from better product availability as a result of visiting a range of shopping platforms rather than just one. Similarly, the use of alternative platforms such as auctions, daily deals and flash sales offers significant cost savings (Bapna et al. 2008; Boon 2013; Martinez and Kim 2012) and thus provides utilitarian benefits. Given the relatively higher importance of utilitarian benefits for the socio-economically advantaged, they will most likely exhibit more diverse shopping patterns than socio-economically disadvantaged individuals.

Vice-versa, consumer research and social psychology suggest that obtaining hedonic benefits is likely to be relatively more important for the socio-economically disadvantaged than for their more advantaged peers. Less privileged individuals were found to be generally more exposed to stressors (Aneshensel, 1992) and hence more in need of hedonically achieved stress relief, which is, for instance, provided by shopping (Arnold & Reynolds, 2003). Moreover, socio-economically disadvantaged individuals exhibit a greater tendency to cope with life difficulties by escaping into different worlds (Parker & Endler, 1996). This form of social escapism has already been found to be a hedonic motivational driver of online shopping behavior (Y.-K. Kim, 2002; Monsuwé et al., 2004; Overby & Lee, 2006). Internet-based entertainment provides a further opportunity especially for the socio-economic disadvantaged to "get away from it all" (Mathwick et al. 2001: p.44). As such, it is not surprising that earlier work on digital inequality finds that socio-economically disadvantaged individuals are more strongly attracted by hedonic elements of ICT use than their more advantaged peers (Hsieh et al., 2008).

Diverse online shopping patterns may also be driven by hedonic motivation. In particular, hedonic benefits such as novelty (Arnold and Reynolds 2003), a feeling of escaping reality (Mathwick et al. 2001) or thrill in the case of auctions (Turel et al. 2011) may be further augmented through diverse e-commerce use. Consequently, from a hedonic motivation point of view, the socio-economically disadvantaged may be more inclined to shop on a large range of platforms. However, we believe that hedonic motivators are less relevant in the context of our study than utilitarian motivators given that scholars found utilitarian motivation to have a much stronger impact on ICT use than hedonic motivation. Notably, this relationship has been substantiated not only in the case of workplace ICT use (Davis et al. 1992), where it might be expected, but also in the case of a leisure activity such as e-commerce (e.g., Ahn et al., 2007; Childers et al., 2001). These findings reflect that people predominantly use ICT in an instrumental way to achieve a certain outcome, corresponding to utilitarian motivation, rather than for reasons of performing the activity per se, which corresponds to hedonic motivation. So even though shopping on a large range of platforms may convey some hedonic benefits, the utilitarian benefits are expected to be the stronger driver of diverse shopping behavior. As such, socio-economically advantaged individuals, who are more strongly motivated by utilitarian benefits, will most likely exhibit more diverse shopping patterns than their disadvantaged peers who are more strongly motivated by hedonic shopping benefits.

Third, socio-economically disadvantaged individuals are less likely to shop on a large range of platforms since their risk perception of a given e-commerce activity is likely to be relatively higher than those of their advantaged peers. Economists generally postulate that people with higher income are less risk-averse (Schechter, 2007). Additionally, psychologists found that individuals from lower

income classes show a more intensive emotional vulnerability with regard to financial losses (J D McLeod & Kessler, 1990). In the specific context of e-commerce, Bhatnagar and Ghose (2004) segmented consumers based on their risk and benefit perception of online shopping and found that the perceived product risk as well as the perceived security risk were highest in the lowest income class.

A high level of perceived risk associated with online shopping, in turn, inhibits diverse shopping behavior on multiple platforms. With the transfer of transactions from the offline to the online world, the risk associated with buying a product has undeniably risen and constitutes a major influencing factor on e-commerce behavior (Pavlou, 2003). The required multiple disclosure of private and financial data on different e-commerce sites associated with a diverse shopping behavior further increases the probability of personal data misuse. This might discourage risk-averse individuals from engaging in diverse e-commerce use. This behavior is likely to be reinforced as soon as an individual has built a trust-based relationship with one e-vendor through repeated transactions, making risk-averse individuals even more reluctant to switch to another e-vendor (Gefen, 2002). Given the relatively higher risk perception of online shopping of the socio-economically disadvantaged, they might thus be less inclined to shop on a large range of platforms compared to the socio-economically advantaged.

Based on the differential behavior regarding perceived ease of use, hedonic and utilitarian motivation, and perceived risk, we formally propose:

H1a-c: The higher an individual's socio-economic status the more diverse will be the individual's transaction behavior when shopping online: (a) in terms of e-commerce websites used, (b) e-commerce platforms used, and (c) share of alternative platforms used.

Digital Inequality Regarding Supporting E-commerce Features Use

In line with the argumentation above, perceived ease of use and differences in motivational dispositions will lead to differential use of supporting e-commerce features of the socio-economically advantaged and disadvantaged. Perceived risk is assumed to not influence the use of supporting e-commerce features since price comparison and e-coupon websites do not usually require the disclosure of personal data and the use of these features does not constitute a transaction.

Building on findings that perceived ease of use of accepting a technology is relatively lower for the socio-economically disadvantaged, it seems likely that they will experience greater difficulty in using supporting e-commerce features. The use of supporting e-commerce features adds complexity to online shopping. While it is relatively easy for an individual to access price comparison websites, a certain level of information evaluation skills is required to sort out search results and to select a vendor imposing a potential complexity barrier (van Deursen & van Dijk, 2010). In line with traditional coupon research (Levedahl, 1988) we assume that the complexity of searching for e-coupons on a broad variety of websites and testing e-coupon validity constitutes an additional barrier. Building on the argumentation above we argue that due to missing skills and a lower ability to handle complexity, using supporting e-commerce features will be more difficult for the socio-economically disadvantaged.

Given that the socio-economically disadvantaged are also likely to be relatively less motivated by utilitarian benefits, which are important drivers of supporting e-commerce features use, they are likely to use price comparisons and e-coupons less frequently when shopping online. The use of price comparison websites and e-coupons mainly grants utilitarian benefits while hedonic elements are rare. Price comparisons generate utilitarian value through increased price transparency and the potential to save cost (Bock et al., 2007). The use of e-coupons is generally viewed as a means to generate additional savings at the point of sale and thus also mainly exhibits utilitarian shopping benefits (K. Jung & Lee, 2010). For both price comparisons and e-coupons, factors related to hedonic motivation are limited. As theorized above, the socio-economically disadvantaged are relatively less motivated by utilitarian shopping benefits. Thus, we posit the socio-economically disadvantaged to be less motivated to use supporting e-commerce features. Building on the reasoning above, we formally propose:

H2a-b: The higher an individual's socio-economic status the higher will be the frequency of (a) price comparison use and (b) e-coupon use when shopping online.

An individual who not only uses either price comparisons or e-coupons but both features conjointly is likely to achieve even higher gains but at the same time will be faced with higher task complexity. Thus:

H2c: The higher an individual's socio-economic status the higher will be the frequency of joint price comparison and e-coupon use when shopping online.

Methodology

Data Sample

We test our hypotheses on a unique set of clickstream data courtesy of comScore. Clickstream data represents a record of an individual's online activities. It tracks the user's navigation path online, collecting information, for example, on the websites the user visits, the actions carried out on each site as well as e-commerce transaction details such as domain name, product and price. In contrast to site-centric data, which only assimilates information for a given website, syndicated clickstream data is "user-centric" (Padmanabhan et al., 2001), as it chronicles the online activities of users across multiple websites.

Clickstream data is a particularly powerful empirical basis for studying facets of Internet use. It is frequently applied in the field of online marketing in order to evaluate browsing behavior, effectiveness of online advertising and online shopping patterns (Bucklin & Sismeiro, 2009). With regard to the latter, the focus has largely been on predicting purchase conversion, understanding factors driving successful transactions and investigating auction pricing mechanisms (Moe, 2006; Y.-H. Park & Bradlow, 2005).

Using clickstream data as an empirical basis has several key advantages. First, it avoids typical weaknesses of cross sectional data such as self-report bias and common rater effects (Podsakoff et al., 2003) by tracking actual behavior. Second, a clickstream dataset typically covers a period of several months. The longitudinal nature of the data means that the risk of a sustained behavioral bias by the user is minimal. Third, user-centric clickstream data in particular encompasses a very large and detailed set of information that would be difficult to aggregate using survey-based measures. For the purpose of our study, which attempts to understand e-commerce use in a more in-depth and nuanced manner, clickstream data provides the level of detail needed to accurately capture use.

Our dataset comprises 19958 Internet users from 10000 households in the US whose Internet activities were tracked for a period of 6 months from May to October 2012. Participants are part of an opt-in comScore consumer sample which is compiled using industry standard methodologies such as random digit dial (RDD) recruitment and through membership incentives. In order to normalize self-selection bias in the opt-in sample, comScore employs a technique called "iterative proportional fitting". In this process they use an enumeration survey and calibration panel sample with participants only recruited via (Cook and Pettit, 2009). Obtained measures are used to calculate a weighting scheme for the opt-in panel in order to ensure population representativeness and normalize the main sources of self-selection bias such as proportionally attracting more heavy users (comScore, 2014).

In order to ensure sample validity, a number of restrictions were applied. Transactional data observations were limited to four product categories: apparel & accessories, consumer electronics, home supplies & living, and health & beauty. Other purchases, such as music downloads, digital subscriptions and food orders, were excluded. The rationale behind this selection was to define a homogeneous comparison basis that only includes products which can be purchased online on several different platforms and for which price comparisons and e-coupons are available. In addition, only participants with complete demographic data, a minimum age of 18 years and at least one e-commerce transaction in the observation period were included. The resulting sub-sample encompasses 2819 users and 14260 transactions.

The data set includes user-level browsing and transaction-related data points from the top 200 mainstream e-commerce websites in the US and the largest alternative e-commerce, e-coupon and price comparison websites. As we are concerned with e-commerce platforms rather than with individual websites, we classified the URLs in one of the following disjoint categories: general retailers, specialized retailers, brand shops, auctions, daily deals, flash sales, price comparison and e-coupons. The classification was undertaken by two independent raters who received the same platform descriptions and selection criteria. The reports by the two raters coincided fully in their classification of the URLs.

The sample exhibits an approximate 50/50 gender split across all income groups and an age distribution of 24%-28% for ages 18-24, 25-34; 14-19% for ages 35-44, 45-54; <10% for ages 55-64, 64+. The age distribution is consistent with findings on the age distribution of the actual online shopping population in the US (Inc, 2013). Over 80% of the participants use the Internet for personal purposes for at least 5 hours a week (Table 2). Notably, the average number of transactions for each income class is fairly equal across groups and users from the lowest income class spend a proportionally higher percentage of their income online compared to participants from higher income classes. As such a general familiarity with e-commerce can be expected for all income groups.

	Household income ('000 US\$)				
	<25	25 - 49	50-74	75 - 99	>=100
Internet use					
<5 hours / week	15.1%	18.4%	19.5%	20.5%	20.8%
5-16 hours / week	44.9%	40.1%	43.1%	40.5%	44.3%
>16 hours / week	40.0%	41.5%	37.4%	39.0%	34.9%
Transactional data					
Ø number of transactions	4.6	4.8	5.4	5.1	5.7
Ø overall spend (US\$)	163.4	167.4	201.3	202.6	230.7

Table 2. Effects of Household Income on E-Commerce Platform Use Diversity

Measurement Development

Dependent Variables: E-commerce Use

To study the aspects of e-commerce platform diversity and the use of supporting e-commerce features, we develop a total of six dependent variables (DV). We operationalize the DVs in the following manner:

DV1a-b: Across-website & across-platform diversity. We adapt an entropy measure of diversification (Jacquemin & Berry, 1979) from the field of corporate diversification in order to evaluate a user's spread of transaction activity across different e-commerce platforms. The key advantage of this diversification index is that it combines the benefits of a frequency-type measure with the added insight of a classification scheme (Palepu, 1985). Due to this feature, the total diversification can be further disaggregated into (DV1a) across-website and (DV1b) across-platform diversity. It is calculated as follows:

$$DT = DR + DU = \sum_{j=1}^M P^j \left(\sum_{i \in j} P_i^j \ln \frac{1}{P_i^j} \right) + \left(\sum_{j=1}^M P^j \ln \frac{1}{P^j} \right)$$

Where: *DT* = total diversification; *DR* = across-website diversification; *DU* = across-platform diversification; *j* = 1,...,*M* = e-commerce platforms; *P^j* = share of transactions on platform *j*; *P_i^j* = share of transactions on domain *i* within platform *j*

Across-website diversity captures the spread of a user's transaction activity across websites on a given e-commerce platform, for example specialized retailers. A user who, for instance, buys a pair of shoes each at online footwear retailers footlocker.com and zappos.com will score higher than a comparable user who buys both pairs at zappos.com. Across-platform diversity in turn measures the spread of a user's transaction activity across the six e-commerce platforms defined for the purpose of this study. A user who, illustratively, purchases two pairs of Nike sneakers, one on nike.com – a brand shop – and the other on Amazon.com – a general retailer –, will again have a higher diversification score than a comparable user who purchases both pairs on amazon.com. Furthermore, both measures take into account a user's total number of transactions within and across platforms, thereby controlling for pure volume-driven diversity.

DV1c: Share of transactions on alternative platforms. In order to validate the spread of transactions between mainstream (general retailer, specialized retailer, brand shop) and alternative e-commerce platforms (daily deals, flash sales, auctions), we develop a second measure of diversity by calculating the share of transactions on alternative e-commerce sites. Taking into account the data distribution, we cluster the results in 6 categories (0, 0.1%-25%, 25-49.9%, 50-74.9%, 75-99.9%, 100%) in order to enable a meaningful interpretation and differentiation between non-users, occasional users and those for whom alternative platforms are an integral part of their shopping behavior.

DV2a-c: Use of supporting e-commerce features. Searching for e-coupons and product prices can be seen as part of an information search taking place before a transaction (Pavlou & Fygenson, 2006). Following previous research (Johnson et al., 2004), we define a pre-purchase period to cover the longitudinal aspect of searching and to avoid inadvertently including non-transaction-related searches at the same time. The pre-purchase period covers 3 days prior to the transaction. This appears reasonable given the need for prices and e-coupons to be transaction-related and up-to-date. Search theory (Diamond, 1989) suggests that a search will only be executed if its marginal benefit is expected to exceed its marginal cost. Thus, use of supporting e-commerce features is only measured for transactions with a value of at least US\$ 50 to ensure a sufficiently high incentive for all income groups to search. Applying this condition results in a sub-sample of 1195 users. Three aspects related to supporting e-commerce features are measured:

(1) *DV2a*: The number of transactions for which the participant accessed price comparison sites within a period of 3 days prior to the transaction; (2) *DV2b*: The number of transactions for which the participant accessed e-coupon sites within a period of 3 days prior to the transaction; (3) *DV2c*: The number of transactions for which the participant accessed both price comparison and e-coupon sites within a period of 3 days prior to the transaction.

Independent Variable: Socio-economic Status

Socio-economic status is generally defined based on household income and education (J.-Y. Jung et al., 2001; Lenhart, 2002). Since income and education have been shown to be highly correlated, income is used as a proxy for socio-economic status in this study (Chiou-Wei & Inman, 2008). Participants' household income is operationalized as an ordinal scale (1-5) in US\$25,000 increments.

Control Variables

We control for the demographic variables age, gender and household size. Age and household size are operationalized as continuous variables, and gender as a binary variable (men=0, women=1). Furthermore, we take into account potential rural-urban disparities in online shopping behavior that may be driven by differences in access, availability of products and social norms (Lennon et al., 2007). This is included as a binary variable (urban=1, rural=0). In addition, we also control for Internet use intensity (measured on a three-point scale ranging from 1 = "<5 hours per week" to 3 = "16+ hours per week"), which has been shown to be a strong predictor of online buying (Goldsmith, 2002). Finally, when evaluating the use of supporting e-commerce features, we account for an individual's familiarity with e-coupon and price comparison sites by controlling for prior visits to such sites outside of the 3 days period prior to a transaction.

Selection of Statistical Methods

In order to account for differences in the composition of our six dependent variables, we use ordinary least squares (OLS), ordered logit and zero-inflated regression models to test our hypotheses. The two DVs related to the entropy measure of diversification (*DV1a-b*) exhibit properties of a continuous variable as well as linearity in parameters and are therefore treated with linear multiple regression. For *DV1c*, which is operationalized as a categorical variable, we use an ordered logit model to account for the discreteness of the DV. The model predicates that a series of breakpoints exist between the DV categories (McKelvey and Zavoina 1975), as is the case for *DV1c*.

DV2a-c are operationalized as count variables and require special consideration. The discrete, nonlinear and nonnegative integer properties of count data imply that the parametric assumptions of OLS regression would result in biased results. A Poisson distribution is much better suited to model count data, since it is also a discrete distribution and takes on a probability value only for integer values of 0 or greater (Coxe et al., 2009). In Poisson regression models, it is important to account for variable lengths in observation periods. Unless otherwise specified, Poisson models assume equal observation periods. This is not the case in our data, where the number of times that a user accessed a price comparison and/or e-coupon website in connection with a transaction is highly dependent on the user's total number of transactions. We account for this aspect in the regression models for *DV2a-c* by applying an expansion of the Poisson model that includes an offset to control for exposure (Coxe et al., 2009). This ensures that the correct probability distribution is maintained and error structure assumptions are fulfilled.

Another common problem with count data is overdispersion, the situation in which the variance exceeds the mean (Cameron & Trivedi, 2009). In this case, it is still possible to obtain consistent

coefficient estimates using a Poisson regression, but the standard errors will be deflated and the t-statistics inflated (Cox, 1983). In our dataset on the use of price comparison and e-coupon sites, we observe that the data is strongly skewed to the right with a large number of excess zeroes. Furthermore, comparably large differences between variances and means for DV2a-c (see Table 2) strengthen the impression of overdispersion. A likelihood ratio test using a negative binomial regression confirmed the suspicion. For all three DV2a-c, the overdispersion parameter alpha is different from zero and significant at $p < 0.001$.

Given the presence of overdispersion and excess zeroes in the sample, the most appropriate model to use is the zero-inflated Poisson (ZIP) model. The ZIP model is able to handle data with excess zeroes relative to the Poisson model by supplementing a count density with a binary process (Cameron & Trivedi, 2009). Vuong's likelihood ratio test (1989) for model selection confirmed the use of a zero-inflated model over a Poisson model in all instances.

Results

Table 3 displays summary statistics and pair-wise correlations for the variables in our study. No indications of multicollinearity could be found, which means that the independent variables are sufficiently unrelated and the standard errors not biased as a result.

Variables	Mean	S.D.	1	2	3	4	5	6
1 Age	3.69	1.51	1					
2 Gender	0.50	0.50	.08 *	1				
3 Household size	3.23	1.46	-.15 *	.06 *	1			
4 Internet use intensity	2.21	0.73	-.07 *	-.05 *	.10 *	1		
5 Urban/rural	0.72	0.45	-.09 *	-.04 *	.01	.08 *	1	
6 Household income	2.65	1.37	.11 *	-.02	.02	-.05 *	.09 *	1
7 DV1a. Across-website div.	0.09	0.22	.07 *	.08 *	-.02	.06 *	-.00	.06 *
8 DV1b. Across-platform div.	0.14	0.28	.07 *	.09 *	-.03	.03	-.02	.04 *
9 DV1c. Share alternative platforms	0.25	0.98	.01	.03	-.02	-.02	.01	.04
10 DV2a. Use of price comp.	0.32	0.88	.09 *	.03	.03	.09 *	.00	.06 *
11 DV2b. Use of e-coupons	0.23	0.86	.00	.08 *	.03	.11 *	.03	.06 *
12 DV2c. Use of both p.c. and e-c.	0.07	0.45	.01	.06 *	.05	.10 *	.01	.06
Variables			7	8	9	10	11	12
7 DV1a. Across-website div.			1					
8 DV1b. Across-platform div.			.20 *	1				
9 DV1c. Share alternative platforms			-.03	.10 *	1			
10 DV2a. Use of price comp.†			n/a	n/a	n/a	1		
11 DV2b. Use of e-coupons†			n/a	n/a	n/a	.35 *	1	
12 DV2c. Use of both p.c. and e-c.†			n/a	n/a	n/a	.54 *	.65 *	1

† Pair-wise correlations for DVa-c are based on the sub-sample $n=1195$; * $p < 0.05$

Note: Pair-wise correlations between DV1a-c. & DV2a-c. not comparable due to different sample configurations

Table 3. Descriptive Statistics and Pairwise Correlations

Tables 4 and 5 present the analysis results. Models 1, 3, 5, 7, 9 and 11 are the control models. Model 2 shows that income has a positive and strongly significant ($p < 0.001$) effect on across-website diversity. This finding supports H1a, in which we posit that users with higher income shop on a larger variety of websites within a given platform category. Model 4 indicates moderate support for H1b, in which we predict that higher income users are also more likely to shop on a larger variety of platforms. This finding is corroborated by Model 6, which shows a positive and significant ($p < 0.01$) effect of income on use of alternative e-commerce platforms, supporting H1c.

Furthermore, our findings validate hypotheses H2a-c: Model 8 indicates some support for a positive relationship between income and use of price comparison sites (H2a). Models 10 and 12 corroborate the hypotheses that users with higher income will be more likely to use e-coupons (H2b) and simultaneously use both price comparison and e-coupon sites prior to a purchase (H2c).

Variables	H1a. Across-website diversification		H1b. Across-platform diversification		H1c. Alternative platform use	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Age	.009 ***	.008 **	.012 **	.010 **	.020	.007
Gender	.037 ***	.039 ***	.052 ***	.053 ***	.459 **	.473 ***
Household size	-.004	-.004	-.007	-.007	-.076	-.082
Internet use intensity	.023 ***	.024 ***	.018 *	.019 **	.036	.049
Urban/rural ¹	-.000	-.004	-.012	-.014	.028	-.014
Household income		.011 ***		.008 *		.133 **
F	9.40 ***	9.86 ***	9.23 ***	8.41 ***		
Adj. R ²	.015	.019	.014	.016		
LR chi ²					12.57 *	19.16 *

Models 1-4 are calculated using linear regressions; models 5 & 6 are calculated using ordered logit regressions; N observations = 2819; p* < .05, **p < 0.01, p*** < 0.001; 1) Urban = 1, rural = 0

Table 4. Effects of Household Income on E-Commerce Platform Use Diversity

Variables	H2a. Price comparison		H2b. E-coupons		H2c. Combined usage	
	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
Age	-.022	-.036	-.100	-.119	-.005	-.463 *
Gender	.013	-.008	.070	.010	-.210	-.753 *
Household size	.091	.080	.011	.017	.154	.206
Internet use intensity	-.036	-.033	.268	.246	-.131	-.192
Urban/rural ¹	.054	.063	-.197	-.286	.656	-.268
Prior site visits	18.0	17.9	17.2	17.4	18.2	17.5
Household income		.084 *		.130 **		.271 **
Total transactions	-----exposure term-----					
LR chi ²	207.4 ***	211.8 ***	219.4 ***	226.7 ***	82.83 ***	88.96 ***
AIC	1304.1	1301.7	911.7	906.4	362.2	358.1
BIC	1370.2	1372.9	977.8	977.6	428.4	429.3

All models are calculated using zero-inflated poisson regressions ; N observations = 1195; p* < .05, **p < 0.01, p*** < 0.001; 1) Urban = 1, rural = 0

Table 5. Effects of Household Income on Use of Supporting E-Commerce Features

Discussion

This study set out to explore how individuals differ in their use of e-commerce as a function of their socio-economic status and, in turn, whether e-commerce amplifies or attenuates digital inequality. Our findings particularly contribute to research on digital inequality and the societal impact of ICT. First and foremost, the results underscore that digital inequality is a prevalent societal issue, which not only has a first-order effect related to unequal ICT access but also a second-order effect resulting from inequality related to differential ICT use. Despite undisputed advances in providing ICT access (OECD, 2013), ICT in general, and the Internet in particular, have so far failed to deliver on the promise of serving as equal opportunities platforms (Hargittai, 2010). In fact, as an unintended social consequence, the Internet might even perpetuate socio-economic stratification. Some scholars maintained that this divide will disappear with increasing Internet access over time (Compaine, 2001). Our results, however, tell a different story: even at levels of comparable Internet access, individuals who are already socio-economically advantaged are able to draw greater benefits from e-commerce use than do their disadvantaged peers. With the increasing pervasiveness of e-commerce applications in our everyday lives and a growing relevance of Internet based self-service solutions, these differences in e-commerce use could further widen the economic welfare gap between the rich and the poor. In addition, the societal impacts of differential e-commerce use patterns might be indicative for a variety of Internet use types such as e-learning or online job search where differential use among socio-economic classes might translate into unequal education and job opportunities.

Moreover, this study is, to the best of our knowledge, the first to empirically test and validate the long hypothesized relationship of an e-commerce divide. Digital inequality specifically in the context of e-commerce has so far garnered limited attention, but is of key importance given its immediate

economic implications. Prior research (Riggins & Dewan, 2005) has only theorized how socio-economic status negatively impacts the use of sophisticated e-commerce functionalities. Therefore, our findings represent an important step towards a more comprehensive understanding of digital inequality in the context of e-commerce.

In addition, our novel concept of use diversity could be particularly relevant to digital inequality research across different ICTs because it captures individual use patterns in multi-channel, multi-application environments. The less diverse use patterns of socio-economically disadvantaged users found in the context of e-commerce may be indicative for a variety of technological contexts, in particular those that offer a large range of use possibilities. Smartphone applications, for instance, are a case of a highly fragmented marketplace in which diverse use is likely to result in a higher payoff. Each application in itself generally only offers a limited set of functionalities; hence the ability to navigate across the marketplace and to identify, evaluate, and use a range of applications is critical to drawing a benefit.

This study also has several important theoretical implications for information systems research at large. Most importantly, we develop a more holistic conceptualization of e-commerce system use for the study of technology acceptance. Drawing on Benbasat and Barki (2007), we propose that the operationalization of e-commerce use needs to go beyond the traditional notion of a single purchase and has to account for the multi-dimensional context in which transactions take place. The advantages of such an extended behavioral operationalization of use lies in a “more faithful representation of usage activities that users engage in, [and] stronger links with salient outcome variables” (Benbasat and Barki 2007: p.215). Our conceptualization of e-commerce use contributes to the understanding of online shopping in a more holistic and nuanced manner, in particular with regard to economic utility-enhancing activities.

Finally, a major methodological contribution of our study is the introduction of clickstream data as an empirical basis for technology adoption research. As Straub and Burton-Jones (2007) have noted, one of the most critical methodological issues underlying TAM is the high risk of common method variance as a result of common-rater effects and self-report bias. Typically, respondents have to indicate both their attitude towards a particular ICT, e.g. how useful they find it, and whether they use or intend to use it. Consequently, the bivariate correlations between DV and IVs risk being severely skewed. The use of clickstream data allows overcoming these methodological limitations. In addition, clickstream data tracks actual rather than intended behavior over a sustained period of time avoiding problems with time-variant intentions and potential unreliability of self-reported behavioral attitudes (Podsakoff et al., 2003). While clickstream data is not without its limitations either (Bucklin & Sismeiro, 2009), technology acceptance researchers stand to benefit from integrating clickstream data tracking actual use with self-report surveys measuring behavioral antecedents.

Above and beyond contributions to theory, our study has implications for policy makers and for business practitioners alike. Understanding how socioeconomically advantaged and disadvantaged users differ in their use of e-commerce enables policy makers to potentially devise countermeasures and businesses to develop strategies to adequately cater to different societal groups.

On a public policy level, our study highlights that digital inequality is a substantial societal issue, even in developed countries such as the US. Despite a fast increase of Internet access, Internet use behavior still differs between socio-economic groups and reinforces societal stratification. Given that the Internet can be a catalyst for economic development and – when used effectively – possesses the potential to equalize social disparities (Anderson et al., 1995), unleashing this potential should be a priority for public policy. More specifically, our findings underline the importance of developing not only access-based initiatives but also use-oriented measures. Existing governmental initiatives targeting Internet use, such as the US National Broadband Plan, have largely focused on providing access. However, our study suggests that this is not sufficient to ensure the same online opportunities to all groups in society. The traditional assumption of homogeneous ability to use ICT needs to be replaced by a more nuanced understanding, leading to more tailored policies which take socio-economic status into account. Policy interventions focusing on Internet education and digital skills could help bridge the current gap and could be added to the educational agenda in the context of broader ICT education at secondary schools, in particular in underprivileged districts. Furthermore, consumer protection agencies could be empowered to raise awareness and promote knowledge dissemination about Internet use in general and e-commerce in particular.

Online businesses and providers of e-coupon and price comparison sites could use the insights on differential e-commerce use between socio-economic groups in order to make their services more

attractive to the socio-economically disadvantaged which currently might not be key customers. By effectively targeting currently alienated socio-economic groups, businesses have the potential to expand their customer base and generate additional revenue. For instance, our theorizing highlights that key hurdles – particularly for the socio-economically disadvantaged – associated with shopping on a large range of platforms are the complexity and the perceived risk of creating a unique personal account for each website. In some cases, particularly flash sale sites, users are required to sign-up before even being able to view the products on offer. An increased adoption of integrated single sign-on systems such as “Login with Amazon”, “Login with Facebook” or Google+ by online retailers could remove such frictions.

Limitations and Further Research

We acknowledge some theoretical and empirical limitations to our study, which call for further research. Further, we highlight additional promising avenues for research originating from our findings.

A common critique in technology acceptance research has been the focus on explaining a single behavior conceptualized in a narrow manner (Benbasat & Barki, 2007) at one point in time. Such a one-dimensional view is not reflective of the multifaceted uses of technology and the dynamism inherent in technological change. In today’s fast-paced digitalized world, the realm of online functionalities is constantly evolving. While our proposed conceptualization of e-commerce use aims to capture online shopping more fully in its complexity and variety than current constructs, it makes no claim to being exhaustive. Thus, we urge subsequent research to refine and extend our concept of e-commerce use. In particular, e-commerce applications relating to services such as e-banking, insurance and peer-to-peer marketplaces (e.g. for accommodation/travel) are gaining increasing importance and offer an interesting avenue for further research. In addition, applying a more in depth conceptualization of system use to other information systems can provide a particular rich basis for understanding individual use patterns and their implications.

Further, the notion of use diversity developed in this study can provide an insightful lens for information systems scholars seeking to capture ICT use in multi-technology, multi-application environments such as information search and browsing patterns, areas in which complexity of online behavior is the relevant research variable. To this end, the entropy measure of diversification proposed in this study may serve future researchers as a useful measure of use diversity. The concept of use diversity may also be of interest to digital inequality researchers, especially with regard to the broader issue of complexity management. Recent digital inequality research has sought to explain differential ability of socio-economic groups to use the Internet by studying skill-related aspects such as online navigation skills (van Deursen & van Dijk, 2010). However, more fundamental, cognitive-psychological drivers such as the ability to multitask or handle information overload may in fact lie at heart of why the socio-economically disadvantaged less often fully leverage the breadth of Internet opportunities. Future research may benefit from exploring the connection between diversity in use patterns and digital inequality in more detail, from both psychological and skills perspectives.

The clickstream data used in our study has advantages in avoiding typical weaknesses of cross-sectional data such as self-report bias and common rater effects (Podsakoff et al., 2003), yet has limitations with regard to uncovering the motivations behind observed behavior. Existing research on the impact of socio-economic status on the behavioral TAM dimensions allows us to theorize why the socio-economically disadvantaged are less likely to use certain functionalities. Empirical investigations into the behavioral antecedents of digital inequality within the specific context of e-commerce would contribute to further substantiating this theoretical basis. We therefore encourage the replication of our findings using clickstream data in conjunction with surveys or structured interviews in order to enrich the understanding of the factors driving differential behavior between advantaged and disadvantaged groups.

Finally, this research only captures online shopping behavior on home PCs and in a voluntary setting. As online shopping increasingly migrates from the traditional PC to mobile devices such as tablets and smartphones, future research should investigate the generalizability of our findings across channels. Furthermore, given that the observed use patterns occurred in a voluntary setting, scholars should investigate whether differential use persists if online use is mandatory as it might be the case for some e-government dealings. Moreover, technology acceptance patterns have been found to be influenced, for example by culture (Im et al., 2011). It would be prudent to examine if our findings from the US can be replicated in other countries.

Conclusion

This study presents a new perspective on how ICT in general and e-commerce in particular relate to the societal phenomenon of digital inequality. Following researchers' call to better understand digital inequality in the context of e-commerce, we introduce a nuanced conceptualization of e-commerce use and investigate how individuals from different socio-economic backgrounds differ in their online shopping behavior. We empirically examine this behavior using clickstream data. Our findings reveal that despite equal access, significant differences in e-commerce use behavior between the socio-economically advantaged and disadvantaged exist. Even though Internet applications such as e-commerce could serve as a catalyst to reduce existing socio-economic disparities, this potential is so far not being realized. In this respect, our research constitutes an important step towards a better understanding of how ICT can impact our society for better or worse and which measures could be devised to influence this impact.

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**Supplement B: Second-order digital inequality:
The case of e-commerce (presentation held at
ICIS 2014)**

Second-Order Digital Inequality: The Case of E-Commerce

International Conference on Information Systems

Auckland, December 17th 2014

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Agenda

- 1. Research Motivation and Hypotheses**
2. Methodology
3. Results
4. Discussion and Further Research


1. RESEARCH MOTIVATION AND HYPOTHESES

Ever since its inception, scholars have discussed the impact of the Internet on society

Hopes and apprehensions at the Internet's inception



- Internet might provide people with **access to creating value and thus fosters societal wealth and well-being** (Hargittai 1999, Madden 2000)
- Internet-based technologies could level playing field between societal strata and **reduce social inequality** (Anderson 1995)



- Internet could lead to „**increasing inequalities**, improving the prospects of those [...] in privileged positions while denying opportunities for advancement for the underprivileged“ (Hargittai 2003)
- Phenomenon described by term „**digital inequality**“ referring to differences between individuals regarding their access and ability to use Internet-based ICT (Di Maggio et al. 2001)

1. RESEARCH MOTIVATION AND HYPOTHESES

Current research aims to focus on „second order effects" of digital inequality: users' ability to use the Internet

First-order digital inequality¹

- **Focus on ICT access** as fundamental inequality driver (e.g. DiMaggio et al. 2001; Katz and Rice 2002)
- Focus of scholarly debate since early 90s and **mainly explored in descriptive manner**
- Of continued importance with regard to **base-of-the-pyramid ICT users**, mainly in developing markets

Second-order digital inequality

- Given widespread Internet availability & access, research focus has shifted to the **ability to use the Internet (2nd order effect)** (DiMaggio and Hargittai 2001)
- The key hypothesis is that the **manner of ICT use further perpetuates existing inequalities**
- Focus on **exploring existence/ implications of digital inequality in central and potentially beneficial Internet applications** such as info search (van Deurtsen 2012) e-government participation (Belanger and Carter 2009) and capital-enhancing website use (Zillien and Hargittai 2009)
- The aim is to explore how people use the Internet for **opportunity creation** in order to **bridge growing divides** (e.g. information, skill, economic opportunity divide)

¹ The terms "first-order digital inequality" and "digital divide" are used interchangeably

1. RESEARCH MOTIVATION AND HYPOTHESES

Recently, e-commerce has emerged as an additional area of opportunity creation within the digital inequality discussion

Growing significance of e-commerce

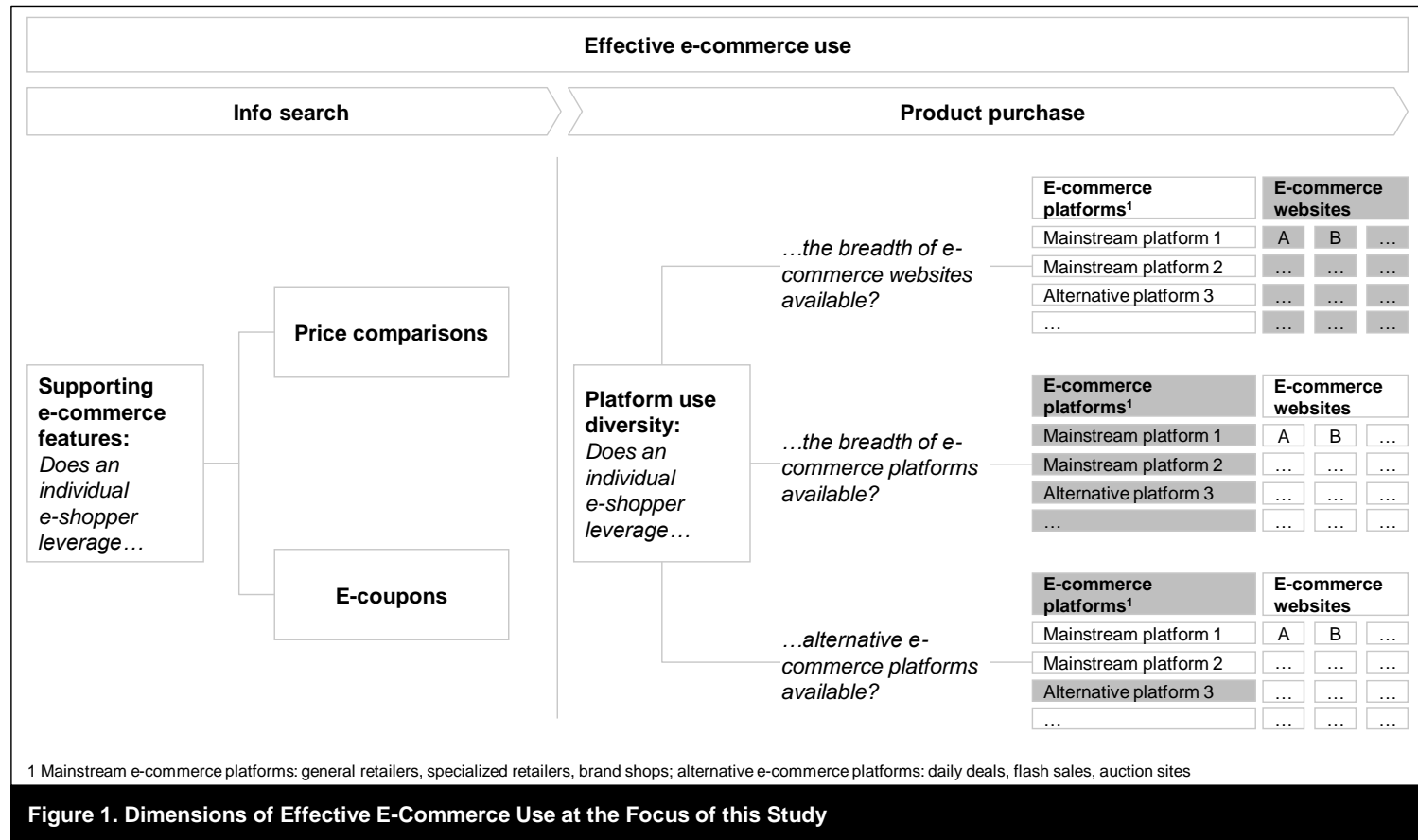
- E-commerce captures **substantial share of global business** exceeding US\$1 trillion (eMarketer 2013)
 - U.S. citizens alone spent US\$263 billion online (U.S. Department of Commerce 2014) and are expected to spend **US\$370 billion** by 2017 (Forrester Research 2013)
 - Wide range of e-commerce platforms and formats have evolved that help individuals to **optimize the economic outcome of purchases**, e.g. price comparisons, auctions, e-coupons
- ➔ Users who are able to **shop more effectively** by leveraging e-commerce functionalities can potentially generate as substantial **economic surplus**

Digital inequality in the context of e-commerce

- Little scholarly attention has so far been devoted to **digital inequality in the context of e-commerce**
 - Limited **empirical evidence** available suggests an **e-commerce divide** exists (Riggins and Dewan 2005)
 - Prior research (Akther 2003; Howard et al. 2001; Zillien and Hargittai 2009) suggests that contrary to homo-economicus expectations, those with the **least resources** might be **less likely to fully leverage e-commerce functionalities**
- ➔ Call from scholars for research that **better conceptualizes** and studies digital inequality **in the context of e-commerce** (Riggins and Dewan 2005)

1. RESEARCH MOTIVATION AND HYPOTHESES

To study e-commerce use a concept of effective use is required that takes into account multiple steps of the purchasing process



1. RESEARCH MOTIVATION AND HYPOTHESES

We aim to investigate if e-commerce amplifies or attenuates digital inequality by measuring the impact of SE-status on e-commerce use

RQ: How do individuals vary in their e-commerce use as a function of their socio-economic status and, as a result, does e-commerce amplify or attenuate digital inequality?

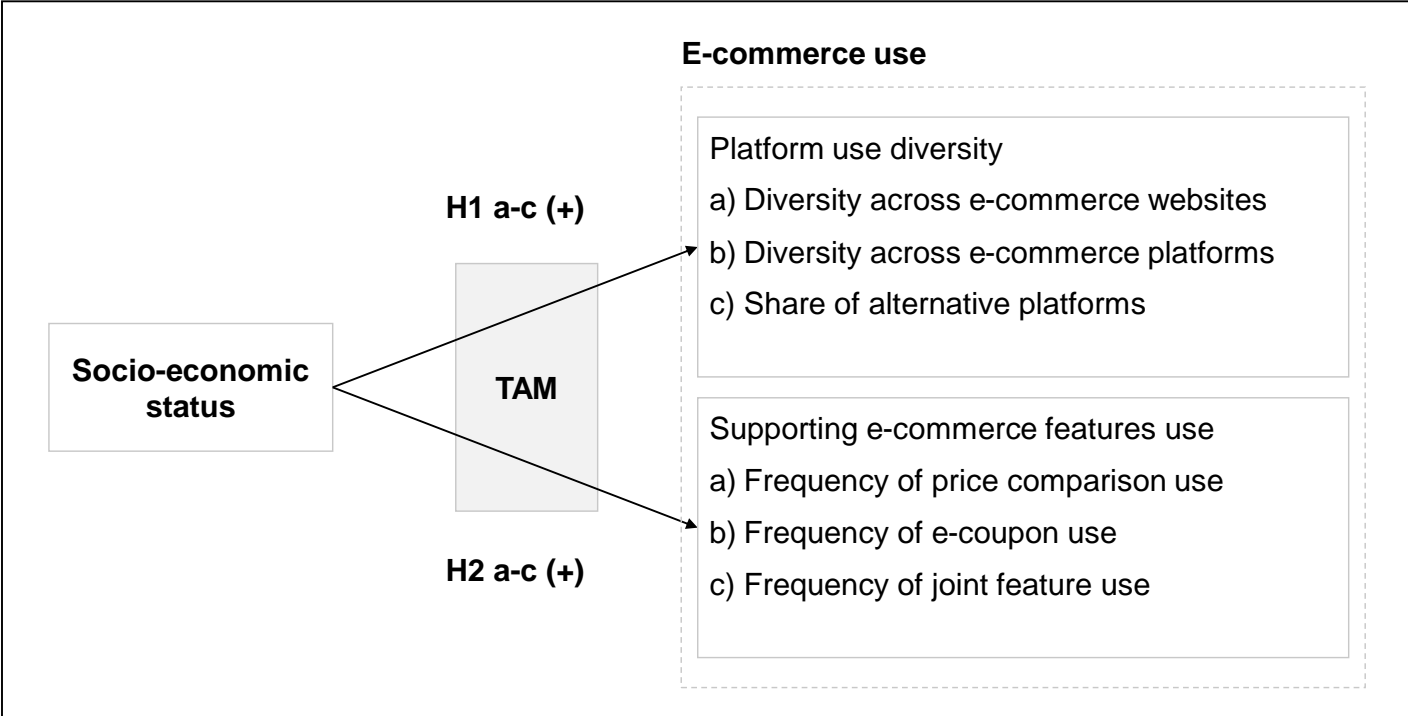


Figure 2. Research Model – Digital inequality in E-Commerce Use

1. RESEARCH MOTIVATION AND HYPOTHESES

We draw on TAM (Davis 1989) to build hypotheses on the relation between an individual's socio-economic status and e-commerce use

Table 1. Using TAM constructs to link socio-economic status and e-commerce use					
TAM construct	Definition	Relative importance of construct depending on socio-economic status	Support for identified relative importance from existing literature	Illustration of specific TAM construct influence on e-commerce use (examples)	
				Platform use diversity	Supporting e-commerce features
Perceived ease of use (PEOU)	Subjective degree of effort required to shop online (Davis 1989)	Relatively higher for the socio-economic advantaged	Van Deursen (2012), Fan and Eaton (2001), Hoffman (2003), Rice and Katz (2003)	(+) Requires PEOU to manage e.g. multiple interface complexity	(+) Requires PEOU, e.g. evaluate price comparison search results
Utilitarian motivation	Individual perception of gains that can be derived from shopping online (Davis 1989)	Relatively higher for the socio-economic advantaged	Bonfadelli (2002), van Deursen and van Dijk (2010), Hargittai and Hinnant (2008), Nomis (2001)	(+) Provides utilitarian benefit of cost savings, e.g. through using auctions or daily deals	(+) Provides utilitarian benefit of cost savings, e.g. thorough price transparency
Hedonic motivation	Degree to which an individual can derive enjoyment from online shopping (Childers et al. 2001)	Relatively higher for the socio-economic disadvantaged	Aneshensel (1992), Hsieh et al. (2008), Mathwick et al. (2001), Parker and Endler (1996)	(+) Provides hedonic benefits like e.g. novelty, thrill and feeling of escaping reality	(+) Hedonic benefits limited, e.g. to the joy of searching
Perceived Risk	Individual assessment of the risks associated with online shopping related to information misuse, product benefits and functionality inefficiency (Glover and Benbasat 2010)	Relatively higher for socio-economic disadvantaged	Schechter (2007), McLeod and Kessler (1990), Bhatnagar and Ghose (2004), Shaw (1996)	(-) Increases risk, e.g. through multiple disclosure of personal and financial data	Not applicable

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1. Research Motivation and Hypotheses
- 2. Methodology**
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2. METHODOLOGY

We tested our hypotheses on a unique set of clickstream data, which represents a record of an individual's actual online activities

Clickstream database

Click-stream database (ComScore)

- Total panel: ~20,000 users in the US
- Tracking period: May – October 2012
- Data captured:
 - Full site URL, site name, time stamp
 - Precursor / successor website
 - Full purchase and basket details (\$ spent, item-level description)
 - Search strings (user input)
 - Demographics (e.g. age, gender, income range, zip, ...)

Configuration of sub-sample

- Limitation to 4 product categories: apparel & accessories, consumer electronics, home supplies & living, and health & beauty
- Categorization of top 200 e-commerce websites in US in 6 disjoint categories
- Min. requirements: 18+ years, min. 1 transaction, complete demographics

Sub-sample

- 2,819 users
- 14,260 e-commerce transactions

Sample characteristics

Table 2. Demographic Characteristics of Sample (n = 2,819)

	Household income (US\$)				
	<25000	25000 - 49999	50000 - 74999	75000 - 99999	>=100000
Age					
18 - 24	32.1%	29.7%	26.1%	24.7%	25.4%
25 - 34	28.3%	23.7%	23.5%	21.4%	19.6%
35 - 44	16.3%	19.0%	18.8%	23.6%	18.2%
45 - 54	12.9%	14.3%	12.0%	14.0%	19.9%
55 - 64	7.3%	9.1%	11.0%	8.7%	10.7%
65+	3.1%	4.2%	8.6%	7.6%	6.3%
Gender					
Female	50.1%	50.7%	50.9%	51.1%	44.8%
Male	49.9%	49.3%	49.1%	48.9%	55.2%
Household size					
1 person	14.4%	11.9%	9.3%	11.5%	10.1%
2 people	23.2%	28.5%	28.5%	25.8%	22.8%
3 people	22.8%	17.6%	17.3%	21.4%	23.7%
4 people	15.1%	17.5%	20.9%	21.9%	19.4%
5 people	17.2%	17.8%	16.7%	12.9%	20.1%
6+ people	7.3%	6.7%	7.3%	6.5%	3.9%
Internet use					
<5 hours / week	15.1%	18.4%	19.5%	20.5%	20.8%
5-16 hours / week	44.9%	40.1%	43.1%	40.5%	44.3%
>16 hours / week	40.0%	41.5%	37.4%	39.0%	34.9%
Transactional data					
Ø number of transactions	4.6	4.8	5.4	5.1	5.7
Ø overall spend (US\$)	163.4	167.4	201.3	202.6	230.7

2. METHODOLOGY

A range of measures were developed to capture the model variables and statistical methods selected accordingly for the analysis

	Variables	Measure	Statistical method
DVs	Platform use diversity <ul style="list-style-type: none"> ▪ Diversity across e-commerce websites ▪ Diversity across e-commerce platforms ▪ Share of alternative platforms 	Entropy measure of diversification (Jacquemin and Berry 1979) $DT = DR + DU = \sum_{j=1}^M P^j \left(\sum_{i \in j} P_i^j \ln \frac{1}{P_i^j} \right) + \left(\sum_{j=1}^M P^j \ln \frac{1}{P^j} \right)$ Share of total transactions, clustered into ordinal scale (1-6)	OLS Ordered logit
	Supporting e-commerce features use <ul style="list-style-type: none"> ▪ Frequency of price comparison use ▪ Frequency of e-coupon use ▪ Frequency of joint feature use 	Count variable <ul style="list-style-type: none"> ▪ # transactions in which feature was used ▪ # transactions in which feature was used ▪ # transactions in which feature was used 	Zero-inflated Poisson with offset for exposure (Coxe et al. 2009)
IV	Household income as proxy for socio-economic status (Jung et al. 2001; Chiou-Wei and Inman 2008)	Ordinal scale (1-5) in US\$25,000 increments	
CVs	<ul style="list-style-type: none"> ▪ Age ▪ Gender ▪ Household size ▪ Rural/urban ▪ Internet use intensity ▪ Prior visits to price comparison / e-coupon sites 	<ul style="list-style-type: none"> ▪ Continuous variable ▪ Binary variable ▪ Continuous variable ▪ Binary variable ▪ Ordinal scale (1-3) ▪ Binary variable 	

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3. RESULTS (I/II)

We find positive and significant support for our hypotheses on the effect of household income on e-commerce platform use diversity

Hypotheses:	Supporting evidence:
<ul style="list-style-type: none"> ✓ H1a: higher income users more likely to shop on a larger variety of websites within a platform category ✓ H1b: higher income users more likely to shop on a larger variety of platforms ✓ H1c: higher income users more likely to use alternative platforms 	<ul style="list-style-type: none"> ▪ Income has a positive and strongly significant (p<0.001) effect on across-website diversity ▪ Moderate support that income has a positive effect on across-platform diversity ▪ Positive and significant indication of income effect on share of alternative platform use

Table 3. Effects of Household Income on E-commerce Platform Use Diversity

Variables	H1a. Across-website diversification		H1b. Across-platform diversification		H1c. Alternative platform use	
	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Age	.009 ***	.008 **	.012 **	.010 **	.020	.007
Gender	.037 ***	.039 ***	.052 ***	.053 ***	.459 **	.473 ***
Household size	-.004	-.004	-.007	-.007	-.076	-.082
Internet use intensity	.023 ***	.024 ***	.018 *	.019 **	.036	.049
Urban/rural ¹	-.000	-.004	-.012	-.014	.028	-.014
Household income		.011 ***		.008 *		.133 **
F	9.40 ***	9.86 ***	9.23 ***	8.41 ***		
Adj. R ²	.015	.019	.014	.016		
LR chi ²					12.57 *	19.16 *

Models 1-4 are calculated using linear regressions; models 5 & 6 are calculated using ordered logit regressions; N observations = 2819; p* < .05, **p < 0.01, p*** < 0.001; 1) Urban = 1, rural = 0

3. RESULTS (II/II)

Similarly, we find positive and significant support for the effect of household income on the use of supporting e-commerce features

Hypotheses:	Supporting evidence:
<ul style="list-style-type: none"> ✓ H2a: higher income users likely to use price comparisons more frequently when shopping online ✓ H2b: higher income users likely to use e-coupons more frequently when shopping online ✓ H2c: higher income users likely to use both features jointly more frequently when shopping online 	<ul style="list-style-type: none"> ▪ Moderate support for positive relationship between income and use of price comparison sites ▪ Income has a positive and significant effect on e-coupon use ▪ Positive, significant indication of income effect on combined use of price comparisons & e-coupons

Table 4. Effects of Household Income on Use of Supporting E-commerce Features

Variables	H2a. Price comparison		H2b. E-coupons		H2c. Combined usage	
	Model 7	Model 8	Model 9	Model 10	Model 11	Model 12
Age	-.022	-.036	-.100	-.119	-.005	-.463 *
Gender	.013	-.008	.070	.010	-.210	-.753 *
Household size	.091	.080	.011	.017	.154	.206
Internet use intensity	-.036	-.033	.268	.246	-.131	-.192
Urban/rural ¹	.054	.063	-.197	-.286	.656	-.268
Prior site visits	18.0	17.9	17.2	17.4	18.2	17.5
Household income		.084 *		.130 **		.271 **
Total transactions	-----exposure term-----					
LR chi ²	207.4 ***	211.8 ***	219.4 ***	226.7 ***	82.83 ***	88.96 ***
AIC	1304.1	1301.7	911.7	906.4	362.2	358.1
BIC	1370.2	1372.9	977.8	977.6	428.4	429.3

All models are calculated using zero-inflated poisson regressions ; N observations = 1195; p* < .05, **p < 0.01, p*** < 0.001; 1) Urban = 1, rural = 0

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1. Research Motivation and Hypotheses
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4. DISCUSSION AND FURTHER RESEARCH

Our findings have implications both for theory and managerial practice

Contributions to theory

- Digital inequality is a **substantial societal issue**, even in developed countries such as the US
- **First study to empirically test and validate** the existence of a second-order divide **within e-commerce** in this scale
- Introduction of ICT **use diversity** concept to digital inequality research
- Introduction of **clickstream data** as an empirical basis for technology adoption research
- **Conceptualization of e-commerce use** beyond the traditional notion of a single purchase accounting for a multi-dimensional context

Implications for practice

- Findings underline the importance of developing **not only access-based initiatives** but also **use-oriented policy interventions**
 - Traditional assumption of homogeneous abilities to use ICT need to be replaced by a more **nuanced understanding of target group differences**
 - Policy interventions could, e.g., take the form of **educational modules** in schools on effective Internet use, e.g., teaching “smart” ways to shop online
- Online businesses should use insights on differential e-commerce use between socio-economic groups to **make services more attractive to the disadvantaged** which currently might not be customers

4. DISCUSSION AND FURTHER RESEARCH

Potential avenues for future research

- **Refinement and extension of conceptualization of general system use** (as proposed by Barki and Benbasat 2007) and in particular **e-commerce use**, e.g. extension to e-services such as e-banking, peer-to-peer market places for accommodation and travel
- **Application of notion of diversity in broader IS field** to capture ICT use patterns in a multi-technology and multi-application environment
- Exploration of the **connection between diversity in use patterns and digital inequality** from both a **psychological and skill perspective**
- Further investigation into **behavioral antecedents of digital inequality** within specific context of e-commerce, e.g. replication of our findings using clickstream data in conjunction with surveys or structured interviews
- **Testing of further moderators** that influence effect of socio-economic status should be explored, e.g. impact of children on parents' behavior (Correa et al. 2013) or effect of personal network exposure (Hsieh et al. 2008)
- Accounting for omni-channel nature of e-commerce by including further devices in research setup
- Verifying generalizability of findings, e.g. testing influence of cultural idiosyncrasies (e.g. German thriftiness)