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User, Use & Utility Research

The Digital User as New Design Perspective in Business and Information Systems Engineering

Business and Information Systems Engineering (BISE) is at a turning point: The ubiquity of information technology (IT) that we experience today in all areas of life leads to a fundamental shift in the BISE landscape and demands the individual user and his or her needs to be put at the center of all investigations. The increasing linkage of human and machine makes it necessary to adjust the perspective on value-chains, processes, methods and structures in BISE. Building on three core themes, the paper at hand discusses this complex socio-technological phenomenon and introduces the new field of ‘user, use & utility research’.

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1 Introduction

Business and Information Systems Engineering (BISE) is at a turning point: The ubiquity of information technology (IT) that we experience today in all areas of life puts the individual at the center of future investigations (Benioff 2012, pp. 185–202). This individual, also described as the ‘digital user,’ is everybody who performs actions in the digital world and who therefore generates new data or puts existing data to use. Typically, the user does not consciously perceive any difference between the digital and the physical realm anymore, since the boundaries between the two have become increasingly blurred (Kagermann et al. 2012). The term ‘digital user’ encompasses everyone from the less tech savvy person

occasionally looking for help online, the many users of social networks, those who do business online, to those who manage almost every aspect of their life digitally. It is becoming evident, that the digital world is playing an ever increasing role in the lives of the digital users (Meeker and Wu 2013), who, in turn, are the driving force behind this change.

For BISE, this change demands a radical repositioning with regard to how information systems are to be planned, designed, and operated, both in business-to-customer (B2C) and business-to-business (B2B) environments (Iivari and Iivari 2011, p. 139). As a complex socio-technological phenomenon, this development has far reaching implications for business models, services, products, and processes. Novel user-centered approaches for analysis, design, construction, and management create new opportunities for the design and usage of information systems (Liang and Tinniru 2006). Examples for the use of this principle can be found in the digital support of service technicians during machine servicing, in driver-assistance systems in vehicles, and in business models for the intelligent management of mobility (e.g., Car2Go¹). Harnessing knowledge from other disciplines such as Design, Engineering, Computer Science, Psychology and Business Studies will unlock further potential. One outcome might be aligning IT even more closely with human needs and including the digital user into the development of information systems.

The next section will introduce ‘user, use & utility research,’ that is the study of the digital user, as a new field of BISE and situates it in the larger research landscape. Following this, Sect. 3 derives and describes the subsequent key subjects based on concrete research questions and examples. Section 4 will then discuss the methodological implications while Sect. 5 summarizes the key statements.

2 User, use & utility research as a new field in BISE

The paradigm of customer-centricity seems to be a familiar theme in the history of Computer Science and Management Studies. The keyword ‘human-centered design’ subsumes numerous publications that analyze the user from the perspective of Computer Science and deduce concepts from this perspective (e.g., Gasson 2003; Iivari et al. 2010, pp. 109–117; Lamb and Kling 2003; Venkatesh et al. 2012, p. 159). Also ‘customer orientation’ has been a field of research in Management Studies and especially in Marketing for decades, represented by researchers such as Meffert et al. (2011), Backhaus and Voeth (2011) and Homburg and Krohmer (2003). Understanding customer loyalty and interaction with the client have been some of the core interests in this area. Furthermore, in BISE, there are some studies that deal primarily with the user and organizations, for example by Brenner and Kolbe (1994), Mayer et al. (2012) and Nussbaumer et al. (2012).

The new field of user, use & utility research requires a re-thinking and further development of this line of inquiry by putting the digital user and his or her data, usage behavior, and perceived utility, at the center of study. The consequences for IT strategies, processes, systems, and management are that they must be derived by starting with the study of the user. Established companies such as Apple² and Amazon,³ but also startups such as ParkatmyHouse,⁴ zopa,⁵ MyTaxi⁶ or gumroad⁷ show how markets and business models are being transformed by information technologies that are consistently geared to the digital user. At the core of this is a shift from a standardized range of services towards a more dynamic, situation-dependent set of services for the digital user (Berkovich et al. 2012, pp. 261–271; Leimeister 2012). Crucial is not only the integration of information technology into almost all objects of daily life and their comprehensive networking capability (Fleisch 2010), but also the intelligent

personalization of products, services, and processes (Gummesson 2008, pp. 15–17). This enables an unprecedented variety of solutions customized to very specific usage scenarios. As a result, the interaction between digital users and companies changes fundamentally (Sheth et al. 2000, pp. 55–66).

The value chain itself is being reconfigured. Until recently, the user stood at the very end of the process, but this order is now being reversed. The users and the data trail that they leave behind intentionally or unintentionally in the digital world – for example through social networking or other behavior online – become the starting point for innovative products and services (Foss et al. 2011, pp. 980–999). The ‘vector of communication’ is being reversed – it does not lead from the business over its distribution channels to the market and finally to the customer anymore, but from the digital user to the business. This makes the digital user the driving force of the development. It requires a fundamental rethinking, now that the user is no longer merely a passive consumer of final products anymore, but the point of origin and an active participant throughout the process of innovation, development, management, and to some extent even production (Kagermann and Österle 2006). The strategy paper Industry 4.0, published just recently by the German government points out this development very clearly (Kagermann et al. 2012).

In order to understand the influence of digital users on information technology and its management, it is necessary to analyze their behavior and needs as well as the mechanisms through which the influence takes place. This leads to the establishment of user, use & utility as a new field of research which aims at developing novel concepts, methods, and theories based on the user’s perspective and his or her influence on the design and operation of information systems. **Figure 1** shows the integration the field as

¹<http://www.Car2go.de>.

²<http://www.apple.com>.

³<http://www.amazon.com>.

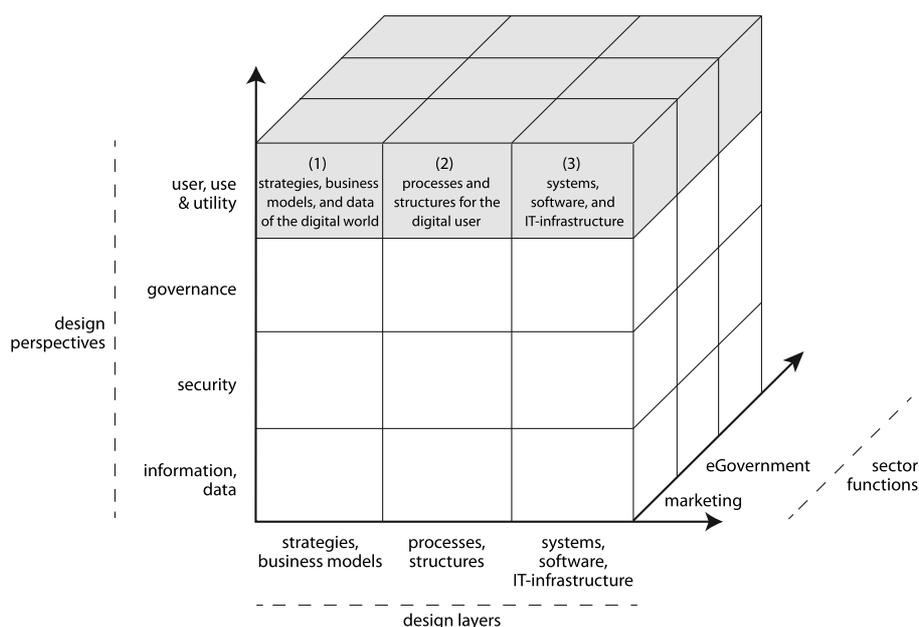
⁴<http://www.parkatmyhouse.com>.

⁵<http://uk.zopa.com>.

⁶<http://www.mytaxi.de>.

⁷<http://www.gumroad.com>.

Fig. 1 User, use & utility research in the context of BISE



a design perspective in the larger field of BISE⁸ that becomes visible in the design layers strategies, processes, and systems (Österle 1995), and is connected with all sectors and functions (e.g., marketing and production). The study of the digital user has to take all these fields of research into consideration in order to produce fundamental and useful insights.

The following question is formative key for the establishment of the field:

Who is the digital user and what impact does his or her 'new power' have on the levels of strategy, processes, systems, and management of information systems in organizations and private households?

3 Key subjects in user, use & utility research

In order to derive the key subjects in user, use & utility research, a pluralistic study design has been applied (Wilde and Hess 2007). Interviews with 50 IT executives (mainly CIOs of DAX-100 companies, between August and November 2012) and academics and practitioners in Silicon Valley (between October 2012 and February 2013) provided the foundation. These interviews were accompanied by a number of renowned experts from the fields of BISE, Computer Science, Engineering and Neuroscience.

Based on the formative question in Sect. 2, three key subjects were derived in accordance with the design layers 'strategies', 'processes', and 'systems' represented in Fig. 1. The key subjects are:

- Strategies, business models, and data in the digital world
- Processes and structures for the digital user
- Systems, software, and IT infrastructure

Each of these research foci addresses fundamental challenges for BISE – theoretically, as well as methodically and in regard to the design of information systems.

3.1 Strategies, business models and data in the digital world

Whole industries are being digitized. Business models that until recently were based on physical products have transformed into digital businesses, the media industry being the most prominent example. Newspapers such as the Frankfurter Allgemeine Zeitung are challenged to now reach their audience through digital channels. This development also affects trade, financial services, and even the manufacturing sector. The various 'smart-x'-initiatives such as 'smart globalized world', 'smart grids' or 'smart factory' represent a massive digitization

of entire sectors and a shift towards a product-service-economy. This transition calls for a redesign of business models with the help of predominantly digital services (Vargo and Lusch 2008; Chesbrough 2006; Bharadwaj et al. 2013).

This leads to the following research questions: Which business models support the digital user at home? Which design principles apply? Which benefits of digital business models can the user identify for him or herself? How do digital users perceive the availability of digital services? How do digital technologies influence the business models of the future? El Sawy and Pereira (2013) show that with the help of taxonomies, reference models and dynamic models, these questions can be tackled. Among many others, two particular business models promise to have exceptionally high potential for scientific analysis: data-oriented business models and micro businesses.

Data-oriented business models: The goal of these business models is to gather and analyze data generated by the digital user and then offer matching services (Mayer and Schaper 2010). With the use of increasingly sophisticated algorithms, companies hope to be able to predict the likelihood of purchase and positively influence it through targeted recommendations (Meckel 2011). Young businesses, 'born' into this digital economy, will generate novel and innovative

⁸The positioning of the field 'user, use & utility' as a design perspective is analogue design perspectives such as 'governance', 'security' (see Op 'Land et al. 2009) or 'information and data' in BISE.

business models based on this principle (McAfee and Brynjolfsson 2012). Due to the rapid spread of sensor technology in mobile devices and other machines, and through their networking capabilities, the pool of available data continues to grow quickly. In the future, ever more data from all areas of life of the digital users will be collected and their behavior will be analyzed in real time (Bharadwaj et al. 2013).

It is necessary for the scientific analysis, however, to recognize the digital user as an actor and not reduce him or her merely to a passive object of analysis. Our understanding is that only Business & Information Systems Engineering, as the science that is situated between Computer Science and Business Studies, can fulfill this pivotal role. The examination of the digital user and his or her data leads to the following questions: Why and when do users share their data with companies, households, and other users? Which economically exploitable effects emerge from the interaction with services? How can the digital user's data-ecosystem be effectively utilized to develop new business models, products, and services? How do users evaluate issues of privacy and security in the context of data-orientated business models? What is the impact of social media on the growth of data-orientated business models? Especially with regards to the first question, BISE can draw from the methods of ethnography, which observe and analyze the digital user as an individual in his or her 'natural' environment in order to develop new theories based on this data (compare with Grounded Theory) or in order to develop hypotheses to be tested.

Emergence of micro-businesses: In addition to the changes in established industries, also so called 'micro-businesses' emerge: companies, which offer products and services online and therefore only require a minimum amount of staff and financial resources. Building efficient provider networks is an obvious development. These structures make it possible to offer complex service packages which can be combined autonomously by the digital user with the help of integrators such as Zapier.⁹ Two relevant research questions in this context are: How do digital users create and customize their individual networks of services? Which tools could be helpful for the digital users to

design their individual service networks? Furthermore, at this point, we are not aware of any research tackling business models of customization and specialization enabled by digitalization. However, BISE is in the position to contribute significantly to these questions – for example by transferring insights from research on digital marketplaces. Research questions in this area are: What degree of individualization and context-sensitivity do future business models have to offer in order to meet customer expectations? How do networks of services configure themselves on the market in order to support the processes of digital users?

3.2 Processes and structures for the digital user

The design of processes and structures in companies is traditionally one of the strengths of BISE (Hammer and Champy 1994; Becker and Schütte 2004; Scheer 1998). Questions concerning the influence of user-orientated approaches on the design of processes and structures have been tackled by researchers such as Ives and Learmonth (1984) and the user has been integrated as an element in modeling languages. However, further research in this direction is necessary. The inclusion of the digital user opens up new potential in regard to a company's production and service provisioning, innovation, and development. Furthermore, digital users increasingly develop their own processes and process configurations.

Service provisioning processes in companies: BISE can not be limited to the study of the user but instead has to also investigate the user's impact on processes inside of businesses (Palfrey and Gasser 2008). Suggestions for research projects can already be found under the key word 'co-modeling': the bidirectional modeling of the physical and the virtual world in which the human is the starting point for the formulation of requirements (Kagermann et al. 2012). This area of inquiry offers great opportunities for BISE research as an integrative discipline. Research questions are for example: How are service provisioning processes designed under the increasing integration of the digital user? What do digital users require from a company's service provisioning processes? How should the service provisioning capabilities of

these processes be measured and evaluated? The change of perspective means that the users and their context have to be an active part of the development and design of service provisioning processes. Thus we have to ask: How can users be integrated into the design of service provisioning processes? Service provisioning processes in companies are also influenced by the digital user as a co-worker. For the first time in history, enabled by the combination of cloud computing and mobile devices, knowledge workers are now able to conduct their work almost independently from their geographic position (Petrie 2010). The necessary data and tools are accessible from virtually everywhere. The boundary between work life and private life has been increasingly blurred and some companies have already made the physical presence of their employees the exception and instead favor a mobile workforce ('telecommuting'). One driving force behind this development is information technology that is used privately as well as for business purposes – this is also called 'consumerization' (Harris et al. 2012). This in turn affects the work performance but also the distribution of the work load over time and the resulting stress (Niehaves et al. 2013). Due to its strong foundation in the modeling of processes, BISE is able to expand the portfolio of methods at hand – for example through 'need finding' (Patnaik and Becker 2010) – to generate new user insights, for example on how to better create working environments and structures that are beneficial for learning (Kagermann et al. 2012). The following questions are promising starting points for future studies: What are the demands digital users have as co-workers in regard to service provisioning processes in companies? Which factors play a role in the design of operational processes that consider the digital user as a co-worker in a company? How can insights from organizational theory be applied to flexible work structures?

Due to the transformation of service provisioning processes, the structure of organizations has to be reconsidered. Rigid company hierarchies are increasingly replaced by more flexible structures organizing work. Companies such as Google show how self-organized teams can be configured and how the design of the workplace affects the performance of teams (Allen and Henn 2006). BISE, with its competencies in Business Studies and

⁹<http://www.zapier.com>.

Technology and with the help of psychologists, sociologists, and architects, can support the design of working environments by formulating concrete demands of the users and by implementing them with the help of digital tools. This leads to some of the following questions: How do organizations and work environments have to be adapted to fit the needs of the digital user? How do users experience new work environments based on a high degree of digitization of everyday life? What forms of usage do particular groups of users prefer, and what can be inferred from the user behavior? Studies on telecommuting could be enhanced, for example, by direct observations of the digital user.

Innovation and development processes: The innovation and development processes of software systems play a crucial role and are equally important as the service provisioning processes. Established development methods are the ‘V-model’, the ‘rational unified process’, and the agile development method, ‘SCRUM’ (Boehm and Turner 2004). Existing studies, for example in the field of ‘agile information systems’ focus mainly on the development team within projects (Weiyin et al. 2011, p. 246). However, since information technology has moved closer to the user and is now being integrated in classic hardware driven products like washing machines, electricity meters, and power tools (‘embedded systems’), there is a demand in theory and in practice for changing the way innovation and development processes are to be performed.

In the areas of computer science and design, first experiences have already been made on how to integrate the digital user into the development process by applying user-centered design; BISE can build on these lessons learned. It is especially the early anticipation of customer needs and their transformation into new software-based solutions that is crucial for the future commercial success of many companies (Von Hippel 2009). Studies by Meinel and Leifer (2010) show that methods such as ‘design thinking’ can also be helpful in software development processes in order to identify customer needs early on, and in order to support processes such as ‘rapid prototyping’ and ‘divergent thinking’. The following questions result from this: What are the driving forces and motivations for

integrating user groups into the innovation process? How can the digital user be integrated more efficiently and effectively into innovation and development processes? How do users deal with their intellectual property rights? How can the effects of user orientation in processes be quantified?

Processes of the user: Under the keyword ‘user task automation’ we observe the emergence of a new field of processes and structures in households that makes the observation of the digital user mandatory. Services such as IFTTT.com already enable the user to design and automate processes related to the household. Users can, for example, have the lighting of their houses automatically switched on as soon as they enter a predefined perimeter of the building and, similarly, the heating can start to operate as soon as the inhabitant of a house arrives at the airport on returning from a business trip. These scenarios that are already available are just some of the visions for a user-centered process landscape. User, use & utility research is predestined to answer the following questions at the intersection of processes and various sectors and functions (Fig. 1): Why will digital users design the processes and networks related to their households themselves, and how can we support them in doing so? What are the consequences of these user-designed processes for businesses and market networks? What opportunities will emerge for the digital user to create new services and products for the household through the flexible connection of individual services?

3.3 Systems, software and IT-infrastructure

The success of Apple’s iPhone showed the importance of user-friendliness and technology that considers the needs of the digital user, for acceptance and differentiation on the market. At the time it was introduced to the market in 2007, the minimalistic design of the iPhone was in sharp contrast with the appearance of technologically comparable products. Another example are head-up-displays that will probably change the way we access and use information in our daily life (Google 2013). What both examples have in common is a consequent synthesis of functionality and design that defines their acceptance for private as well as for business

use. This is also one of the drivers for consumerization in IT, which becomes evident in the integration of privately used IT infrastructure in companies (‘bring-your-own-device’) (Weiß and Leimeister 2012; IBM Corporation 2011, p. 2; D’Arcy 2011).

The substantial progress in data processing technology is another crucial development. It offers new possibilities for the use of (mobile) applications, in businesses as well as in non-commercial contexts. By starting with the digital user, BISE should continue to investigate the impact of technological trends on the design and management of information systems. Some of the relevant questions are: What are the benefits of combining digital products for the customer? What is the economic value added that new technologies offer the digital user and the company? What is the usage behavior of different user groups in regard to different technologies? Concerning this very last question, market-basket analysis – as it was already conducted in computer science by Mennicken and Huang (2012, p. 4) – could prove insightful for understanding differences and similarities between user groups and therefore contribute to the formulation of theories.

Simplicity of design: The guiding principle for the design of new applications is simplicity in structure and surface. While conventional information systems offer a complex variety of functions, mobile apps and new web-based applications offer only a few very specialized functions (‘disintegration’). These new information systems are designed in a way that the user is able to understand the logic of the application very quickly and can therefore use it right away. This holds true for the group of ‘digital natives’¹⁰ (Prensky 2001) as well as for ‘digital immigrants’. From the widespread adoption of these technological developments in daily life and in the business context we can derive a number of questions from the perspective of Behavioral Science and from a design point of view, which BISE should address. The key research question here is: How are technologies and applications used and accepted, and where are they applied privately as well as in the business context? Reducing the field merely to technological questions unduly narrows the observation; the same is true for the reduction of the field to Computer Science. In that sense, BISE could further investigate the following questions: What

¹⁰The term ‘digital natives’ is used to describe people that were born after the year 1980 and who therefore grew up with digital technology.

Abstract

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User, Use & Utility Research

The Digital User as New Design Perspective in Business and Information Systems Engineering

Business and Information Systems Engineering (BISE) is at a turning point. Planning, designing, developing and operating IT used to be a management task of a few elites in public administrations and corporations. But the continuous digitization of nearly all areas of life changes the IT landscape fundamentally. Success in this new era requires putting the human perspective – the digital user – at the very heart of the new digitized service-led economy.

BISE faces not just a temporary trend but a complex socio-technical phenomenon with far-reaching implications. The challenges are manifold and have major consequences for all stakeholders, both in information systems and management research as well as in practice. Corporate processes have to be re-designed from the ground up, starting with the user's perspective, thus putting usage experience and utility of the individual center stage.

The digital service economy leads to highly personalized application systems while organizational functions are being fragmented. Entirely new ways of interacting with information systems, in particular beyond desktop IT, are being invented and established. These fundamental challenges require novel approaches with regards to innovation and development methods as well as adequate concepts for enterprise or service system architectures. Gigantic amounts of data are being generated at an accelerating rate by an increasing number of devices – data that need to be managed.

In order to tackle these extraordinary challenges we introduce 'user, use & utility' as a new field of BISE that focuses primarily on the digital user, his or her usage behavior and the utility associated with system usage in the digitized service-led economy.

The research objectives encompass the development of theories, methods and tools for systematic requirement elicitation, systems design, and business development for successful Business and Information Systems Engineering in a digitized economy – information systems that digital users enjoy using. This challenge calls for leveraging insights from various scientific disciplines such as Design, Engineering, Computer Science, Psychology and Sociology. BISE can provide an integrated perspective, thereby assuming a pivotal role within the digitized service led economy.

Keywords: Digital user, Use, Utility, User-centric IT design, User-centric IT management

is the impact of the digital user's interaction with new technologies on the design of business-orientated information systems and processes? What new services and products can be established in the business context through the convergence of hardware and software? Theoretical links can be found for example in the 'unified theory of acceptance and use of technology' (Venkatesh et al. 2012).

4 Methodological implications

Methodologically, BISE is well-positioned to deal with this complex field of socio-technological research questions (see Wilde and Hess 2007). Design-oriented approaches (Hevner et al. 2004; Österle et al. 2010), as well as sociological and explanatory approaches can be applied in order to understand the digital users, their usage behavior, and the resulting utility, and in order to develop new solutions for future usage.

Building on the research essay by Gregor (2006), we can ask an array of questions along the lines of the first four steps of theory construction – description and analysis, explanation, prediction or prediction and explanation respectively – for example: 'why do users share their data with businesses, households, and other users?' Suitable research methods can be found in areas such as (experimental) Psychology and Marketing. Deep insights not only into the humans psyche but also into the usage of information systems can be gained from focus groups, experiments with user groups, laboratory observations, association analyzes, ethnographic methods (e.g., 'living labs' and video ethnography), as well as from neuroimaging techniques (Loos et al. 2010). These methods can be complemented with new approaches such as the analysis of large sets of personal data (in the area of marketing see Hildebrand et al. 2012).

These four steps of theory construction described above lay the necessary foundation for conducting a fifth step, design and action – also known as the design of information systems – guided by theory. For this, BISE offers a mature portfolio of methods, starting with case studies and reaching to the prototypical design of solutions, but also A/B-testing and path analysis. Considering the strong involvement of the digital user in the development of products and services, a greater emphasis on methods that create concrete artifacts is preferable.

The findings from user, use & utility research will be of high value for many other fields of research, from intelligent monitoring and autonomous decision making systems, over the opening up of new business models – for example in the areas health, mobility, and energy – to the development of new methods of production (see 'smart production') and the integration of eGovernment services in private households. In all of these and in additional areas, the digital users and their expectations concerning information systems are as of yet not very well understood.

5 Conclusion

The changing role of the user in the increasingly digitized world shows that the entire value chain, from personal data management to business within the service and manufacturing industry, has to be reconsidered. The digital users and their use of information technology – privately and for business – is going to be the central focus of many decision making processes in companies. This leads to two key implications for BISE and its field user, use & utility research: first, the inquiries should be structured around the user (see Sect. 3). Second, the set of tools to address these questions is to be supplemented by methods from other academic disciplines; if necessary, new tools have to be developed.

To meet the requirements of this far reaching subject, it will be necessary to include all stakeholders: businesses, politicians, the scientific community, and society at large. Especially the first two groups have the potential to make a large contribution to the reorientation of Business & Information Systems Engineering by actively supporting specific studies and innovative teaching concepts.

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