Fostering ICT use by older workers

Lessons from perceptions of barriers to enterprise system adoption

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Abstract

Purpose – Adaptation to the requirements of digital economy is especially difficult for older workers, which is a challenge for today's organizations due to workforce shrinking and ageing. Therefore, the purpose of this paper is to investigate how it is possible to develop older employees' potential in technology use in the business environment.

Design/methodology/approach – The authors examined how employees at various age perceive barriers during enterprise system (ES) adoption and use. This exploratory study is based on grounded theory and draws from the opinions of 187 Polish ES practitioners.

Findings – With age, emphasis on employees' perception of mandatory ICT implementation projects is shifting from technology to people-related considerations. For older employees, job security and workload appear the most critical issues in such projects. Age-diverse collaboration appears necessary to address the problems posed by technology-related and demographic changes.

Research limitations/implications – The findings imply that incorporating multiple stakeholder perspectives and age-related considerations into research on ICT adoption appears essential.

Practical implications – ICT adoption in the business environment can be successfully supported by age-balanced team building, cooperation between younger and older employees, and age-adjusted change management initiatives.

Social implications – Supporting older employees during the implementation of mandatory business software should embrace reducing their negative attitudes to ICT-induced change by minimizing their perception of job insecurity.

Originality/value – Unlike many prior studies, the current research places age in the central role and discusses not only how it is possible to support older employees, but also how to leverage their potential in the process of ICT adoption and use in a mandatory setting.

Keywords Poland, Barriers, Older workers, Age diversity, Enterprise system, Mandatory information system implementation

Paper type Research paper

Introduction

Contemporary demographic processes in developed countries, particularly in Europe, characterized by falling mortality and low fertility, result in population ageing. The forecasted continuation of downward trends in fertility and mortality will deepen the process of population ageing (Basten *et al.*, 2013; Harper, 2014). This situation will have

important implications for societies and economies, affecting labor markets, patterns of saving and consumption, families and households, and health and welfare services (Boersch-Supan, 2003, 2008; Harper, 2014).

Labor markets are expected to face particular challenges as, due to population ageing, labor force will both shrink and get older (Boersch-Supan, 2003, 2008). In addition, continuous development of ICT alters the work environment and forces the adjustment of employee skills to the ongoing changes (e.g. Michaels *et al.*, 2014; OECD, 2016; Parry and Strohmeier, 2014). The required skills not only should allow the employees to use the technology effectively (ICT specific skills) but also to carry out the work within the new environment shaped by ICT, i.e. a "technology-rich environment" (ICT-complementary skills) (OECD, 2016). Adaptation to changed working conditions might be difficult for older employees due to technology anxiety growing with age and usually less confidence in their own computer knowledge compared to younger workmates (Hardy and Castonguay, 2018; Marquié *et al.*, 2002). The youngest generation as "digital natives," in turn, might experience difficulties in teamwork with older workmates (Parry and Strohmeier, 2014; Urick *et al.*, 2016).

Enterprise system (ES) adoption is an example of the undertaking where a broad range of ICT skills are needed and merging of various knowledge types from different sources is required (Lech, 2014). ES, having their roots in MRP, MRP II and ERP systems, are now very complex systems that support the management and integration of the whole company and offer inter-organizational integration with company's clients and suppliers (Volkoff *et al.*, 2005). Since the use of ES within an organization is usually mandatory (e.g. Keong *et al.*, 2012) and the involved stakeholders represent the adopting company and external organizations, in full-scope ES adoptions practically all company's employees are affected by the implementation project.

ES adoption, due to its ICT-related complexity, organizational considerations and multiple stakeholders involved, is a risky and challenging process during which implementers have to face numerous impediments (Saatcioglu, 2009; Themistocleous and Irani, 2001). In addition, during the post-implementation stage, continuous improvement efforts and on-going organizational support are necessary (Ha and Ahn, 2014). As explained earlier, demographic structure of workforce might be highly diversified, affecting employees' perception of ES and its adoption process. Examining the barrier perceptions by employees in the light of age-related characteristics of workforce should help us to understand how it is possible to better leverage older employees' potential. In particular, we might learn how to protect them from real impediments, but also how to use their abilities when a solution to the problem is feasible. We formulated the following research questions which guided our exploratory study:

RQ1. What is the role of employee age in perceiving barriers occurring during ES adoption and use?

RQ2. How to adapt ES/ICT adoption process to ageing and shrinking workforce in order to use older workers' potential?

The paper is organized as follows. In the next section, presenting research background, we focus on implications of ageing and barriers to ES adoption reported by prior research. Then we describe our research approach, which is followed by the presentation of results. We then discuss our findings and explain the implications for practice. Next, the study's limitations and directions for future research are outlined. Then, we summarize the multifaceted contribution made by the current paper, highlighting various aspects building the originality of our study. Finally, the paper ends with concluding remarks.

Research background

Impact of ageing on workforce and organizations

Population ageing is inevitable and will deepen in the future due to change in basic demographic phenomena in the past and the continuance of this trend in the future. Fertility values remaining below the replacement level and continuing decline in mortality fundamentally alter the age structure of a population and lead to increasing median ages and demographic ageing (Basten *et al.*, 2013; Harper, 2014). Such a situation has also an impact on the structure of potential labor force, which, according to the European Commission's report (European Commission, 2015), is forecasted to decline by 8.2 percentage points between 2023 and 2060, representing roughly minus 19m people. At the same time, it is also foreseen that the participation rate of older people (55–64) will increase by about 15 percentage points between 2013 and 2060. This means that in the future labor force will not only shrink but also gradually age.

The forecasted changes in labor resources will affect all European countries; however, the changes will be especially visible in countries from Southern and Eastern Europe. As can be seen in Table I, all European regions will experience a decrease in potential labor resources, which can reach the maximum value of 15 percentage points in Poland. Simultaneously, all regions will experience an increase in shares of people aged 50–69 years within the potential labor resources (i.e. people aged 20–69 years). These shares can reach the level of nearly 7 percentage points in Southern Europe, while in Eastern European countries, such as Slovakia and Poland, they can reach the level of 5.9 and 5.4 percentage points, respectively.

The labor force-related consequences of population ageing will be a particular challenge for companies in the light of requirements of digital economy (Parry and Strohmeier, 2014). The widespread use of ICT at work requires the development of new skills along three lines. First, workers need to acquire so-called "generic ICT skills" to be able to use such technologies in their daily work, e.g. access information online or use software. Second, the production of ICT products and services requires "ICT specialist skills" to develop applications and manage networks. Third, the use of ICT is changing the way work is carried out and raising the demand for "ICT-complementary skills," e.g. the capability to process complex information, communicate with co-workers and clients, solve problems, plan in advance and adjust quickly. Such skills are particularly important due to the significant increase in the demand for non-standard interpersonal and analytical skills in the digital economy (OECD, 2016).

ICT is becoming a more and more integral component of the contemporary world; however, the benefits offered by ICT are not enjoyed equally by all members of society. This phenomenon is known as digital divide (Hill *et al.*, 2008) and it especially refers to the older members of society. Older adults appear to perceive various risks associated with ICT use, such as unreliability of ICT-based solutions and worsening family relationships (Soja, 2017). Digital divide is observed at the level of the society as a whole; however, some diversity with respect to labor force is also noticeable depending on age. In particular, taking into consideration the group of top managers, Awa *et al.* (2015) interestingly illustrate that younger top executives are more likely to introduce new ICT-based solutions into their companies.

Prior research reports that several characteristics of employees typically may change with age. In particular, physical work capacity and cognitive abilities associated with basic information processing are decreasing with age. However, on the other hand, cognitive skills referring to knowledge and experience, resulting in an ability to understand and integrate culture- and context-dependent factors, are relatively higher in older age (Conen *et al.*, 2011; Philips and Siu, 2012). Naturally, we should bear in mind that characteristics of older workers can be different among individual people (Rizzuto *et al.*, 2012). Also, in the context

Year	2015	2060	2015–2060	2015	2060	2015–2060	2015	2060	2015–2060	2015	2060	2015–2060
Age	20–34[a]			35–49[a]			50–69[a]			Potential labor resources 20–69[b]		
Europe	29.9	27.5	−2.4	31.7	31.6	−0.1	38.4	40.9	2.5	66.7	56.8	−9.9
Eastern Europe	32.3	28.0	−4.3	30.4	33.5	3.1	37.3	38.5	1.2	69.2	57.3	−11.9
e.g.												
Poland	32.2	25.6	−6.6	29.9	31.1	1.2	37.9	43.3	5.4	69.6	54.6	−15.0[c]
Slovakia	31.8	26.6	−5.2	32.0	31.3	−0.7	36.2	42.1	5.9	70.2	56.2	−14.0
Czechia	28.3	27.8	−0.5	34.1	32.2	−1.9	37.6	40.0	2.4	69.0	56.0	−13.0
Northern Europe	31.0	28.6	−2.4	31.3	31.4	0.1	37.7	40.0	2.3	64.4	58.3	−6.1
Southern Europe	26.5	25.0	−1.5	34.9	29.5	−5.4	38.6	45.5	6.9	66.1	54.4	−11.7
Western Europe	28.3	27.9	−0.4	31.3	30.6	−0.7	40.4	41.5	1.1	64.6	56.8	−7.8

Notes: [a]Values denote percentages within the population aged 20–69 years, representing the structure of potential labor resources; [b]values represent percentages within the whole population; [c]maximum value for European countries
Source: Based on United Nations (2019)

Table I.
Projected changes
in the structure
of potential labor
resources in
European regions

of ICT, individual predispositions of users might contribute to their negative attitudes such as resistance to mandatory information systems within an organization (Laumer *et al.*, 2016a). In addition, some characteristics of older workers, such as their lower level of innovativeness, appear to be opinions not based on accumulated empirical evidence (Ng and Feldman, 2013).

Therefore, prior research findings should be treated with caution. Nevertheless, it appears that there are characteristics of older employees commonly perceived by several previous research works and describing older workers' strong and weak points, or, in other words, strengths and weaknesses (Reday-Mulvey, 2005). The strong points of the older workers include (Ilmarinen, 2001; Reday-Mulvey, 2005; Turek and Perek-Białas, 2013; van Dalen *et al.*, 2010):

- know-how and experience, ability to comprehend the whole;
- awareness of one's own limitations and strong points, self-confidence;
- greater "soft skills" (e.g. interpersonal skills);
- reason in solving problems;
- reason in dealing with co-workers and clients;
- reliability and stronger commitment to work;
- loyalty and faithfulness to employer; and
- lower absenteeism.

The weak points of the older workers, on the other hand, include (Ng and Feldman, 2012; Reday-Mulvey, 2005; Turek and Perek-Białas, 2013; van Dalen *et al.*, 2010):

- decline in physical abilities, decreased perception and work pace;
- limited resistance to physical and psychological burdens;
- relatively lower level of education as compared to younger colleagues;
- lower new technology skills; and
- lower flexibility as compared to younger workers (e.g. related to technological changes).

Recognizing the contributions that older people make to society in responses to demographic changes, researchers indicate the significance of a large reserve of human capital of older people, especially in education and life experience. Their recommendations for business refer to adjusting human resources practices and adopting technological innovations that meet the needs of older workers (Bloom *et al.*, 2015). Our investigation should contribute to this research stream by examining how older workers perceive barriers associated with the adoption and use of advanced ICT systems in organizations. The results of such an enquiry should also help narrowing the gap in the current research on age-related workplace practices, with a special emphasis placed on ICT use (Kulik *et al.*, 2014; Truxillo *et al.*, 2015).

Barriers in enterprise systems adoption and use in prior research
Overall, barriers experienced by an individual ES adoption might depend on the project and organization type. In particular, barriers might vary depending on organization size (Gupta *et al.*, 2017) and system solution being accepted (Gupta *et al.*, 2017; Tome *et al.*, 2014). Specifically, different barriers might be experienced by cloud-based and on-premise ES (Gupta *et al.*, 2017), and some differences might occur between barriers experienced by projects implementing commercial ES and those adopting Open Source ES (Tome *et al.*,

2014). In general, barriers to ES adoption and use encompass various elements related to the project stakeholders, system solution being implemented, adopting organization, financial considerations and implementation project (e.g. Gable *et al.*, 2002; Kamhawi, 2008; Kumar *et al.*, 2002; Saatcioglu, 2009; Soja, 2015; Themistocleous and Irani, 2001).

The stakeholders-related barriers include lack of adequate knowledge possessed by project participants and company employees needed for the new system adoption and use. Other barriers refer to negative attitudes revealed by the project stakeholders such as resistance to the implementation project and new system. Knowledge- and human resource-related barriers are also present in Open Source ES (Tome *et al.*, 2014) and are perceived as more important than system-related considerations (Babaei *et al.*, 2015). The implementation services provider is an important stakeholder group associated with some significant barriers, such as inability to provide appropriate support due to resource constrains and lack of experienced consultants.

The system-related barriers boil down to shortcomings that prevent its smooth operation by the users, including, on the one hand, unnecessary system complexity and, on the other hand, its poor performance and reliability. In the case of cloud-based ES, special emphasis on security-related barrier is placed (Gupta *et al.*, 2017). An important barrier might be also associated with lack of fit between the system functionality and end-user needs.

Barriers related to the adopting organization involve company's poor organization, which might be associated with its not integrated business processes and weak performance. As regards business complexity, the study by Gupta *et al.* (2017) interestingly suggests that this barrier is experienced by both large and small organizations. Important barriers can also be caused by company's resources, which might be restricted and difficult to acquire and thus impeding the implementation project progress.

The resource-related barriers are associated with financial considerations, which come to light due to the high cost of the implementation project. Important barriers here include lack of financial resources to cover implementation costs and additional expenses incurred during the business process reengineering (BPR). With respect to ES adoption costs, general high costs appear not to be a barrier in the case of Open Source ES, while sunk costs seem to be a barrier experienced by ES adoption regardless of the system type (Tome *et al.*, 2014).

There are also barriers associated with the implementation process definition and run, such as difficulties with establishing project requirements and goals, inadequate project schedule, insufficient training and change management program, and lack of visible benefits. Koh *et al.* (2011) highlight here the idea of organizational inertia, associated with difficulties in maintaining and improving business processes.

Overall, it should be emphasized that barriers might not occur in isolation and relationships among different barriers might occur. In particular, prior research suggests that organizational barriers might cause the occurrence of system-related barriers (Peng and Nunes, 2010), while communication barriers can influence knowledge-related barriers (Andersson, 2016). Communication, in turn, might be negatively influenced by unbalanced composition of the implementation team (Babaei *et al.*, 2015).

In prior research, barriers to ES adoption were investigated from the perspectives of various stakeholders, such as ICT experts and managers (Kamhawi, 2008), project management personnel (de Burca *et al.*, 2005) and participants playing different roles during the ES adoption project (Soja, 2015). Nevertheless, in ES research a gap still exists, associated with lack of an in-depth investigation of the role of employees' age and demographic background. Few studies in this field suggest that employee age may play a significant role in the perception of impediments (Soja and Soja, 2017a) and threats (Soja and Soja, 2017b) to ES adoption success. With respect to barriers, to the best of our knowledge, no prior study conducted an age-based investigation of this phenomenon. In particular, none

of the works reviewed by the current study performed an age-related data analysis and only Saatcioglu (2009) reported age structure of the employed research sample.

We believe that in the light of demographic changes an in-depth analysis of the role of employee age in the perception of barriers to successful adoption and use of mandatory business software is an interesting and worth investigating research topic. The results of such an investigation should be helpful in understanding some interdependencies between demographic trends and proliferation of increasingly modern ICTs, a field largely unexplored by prior research (Tams *et al.*, 2014).

Overall, the current research can be positioned at the intersection of two research streams: barriers to ES implementations and the role of ICT in the ageing workforce. The key concepts describing the first area are: "ERP," "ES," "implementation," "adoption" and "barriers." The ageing-related field, in turn, can be described by the following concepts: "ICT," "older employees," "older workers," "ageing workforce," "ageing" and "age."

Method

The current study seeks to investigate the perception of barriers to ES adoption and use from the viewpoint of employees' age. Barriers are defined as various considerations that may prevent the project progress or successfulness. The ES adoption success is understood as an implementation project success, i.e. an up-and-running system with agreed-upon requirements delivered within schedule and budget (Brown and Vessey, 2003; Markus *et al.*, 2000). In order to answer our research questions, we turned to practitioners to learn what are their views concerning barriers to successful ES implementation and use. The data gathering method can be perceived as semi-structured, as it employed an interview guide (semi-structured questionnaire) whose purpose was to facilitate respondent opinion gathering on considerations of ES implementation and use.

In order to gather data on barriers, the respondents were asked an open-ended question: "Based on your experience, what were the most important barriers to successful enterprise system adoption?". Such an approach, encouraging the respondents to express their opinions in an unconstrained way was based on grounded-theory (Glaser and Strauss, 1967; Urquhart *et al.*, 2010) and was believed to help in gathering a broad range of respondent opinions allowing us to perform an in-depth investigation and obtain a rich description of the phenomenon in question (Wiesche *et al.*, 2017). We employed this approach primarily to capture age differences in the perception of barriers, and not just to discover barriers themselves. The method enabled us to gain a deeper insight into the ways barriers are perceived by comparing the vocabulary and the range of arguments used to describe barriers.

During the interviews, respondent opinions on other issues were also researched, such as motivations for ES adoption, benefits from using ES, difficulties experienced during the ES implementation and their perceived causes, and success/failure factors. Overall, during the interviews, seven or eight open-ended questions have been formulated depending on the role played by the respondent in the implementation project (i.e. adopter or provider). Also, the data regarding implementation project metrics (i.e. participants, duration time, budget and scope) and performance (i.e. performed activities, success evaluation) have been gathered. As our goal was to collect respondent perceptions, we decided not to use special prompting techniques for encouraging subjects to answer blank questions.

As for the sampling technique, following the grounded theory-based qualitative approach, we adopted the idea of theoretical saturation (Saunders *et al.*, 2018). Saturation means that no additional data are being found whereby a researcher can develop properties of the category (Glaser and Strauss, 1967; Given, 2016). In our research approach, sampling, data collection and data analysis were combined, rather than treated as separate stages in a linear process (Saunders *et al.*, 2018). In order to obtain a representative research sample,

during the data gathering process, both ES adopters and providers have been contacted. The respondents were recruited based on professional and personal contacts of the authors and also snowball sampling was adopted, which was especially useful in the case of ES provider representatives. Overall, the data gathering phase lasted for an extended period of time: the first interviews were conducted in 2006 and the whole process has been concluded in December 2016.

Poland has been chosen for data gathering place due to mainly three reasons: first, according to demographic forecasts for Europe, as illustrated earlier in Table I, Poland will be most strongly affected by a decrease in labor supply and a relatively strong increase in the share of the oldest employees. Second, Poland represents transition economies from Central and Eastern Europe, i.e. economies being in transition from a centrally planned system to a free market system (Roztocki and Weistroffer, 2015). Those countries experience specific considerations associated with ageing society and ICT-related considerations (Soja, 2017; Soja and Cunha, 2015; Themistocleous *et al.*, 2011), including immature, fast growing and more and more open to global players ES market (Roztocki *et al.*, forthcoming). The resultant changing ES implementation considerations in Poland are believed to be captured during the long-lasting data gathering process. Third, theories and approaches worked out in highly developed countries, which is the case of prevalent IS mainstream research, might not be easily transferred to less-developed settings (Soja and Cunha, 2015). Thus, given the scarcity of research on ICT in transition economies, there is a great need for research on ICT implementation, use and management in such economic settings (Roztocki and Weistroffer, 2015). One of the particularly important areas for future research is the investigation into the role of age in ICT implementation and acceptance (Roztocki *et al.*, 2019).

During the data gathering process, respondent opinions expressed in natural language have been collected, transcribed and entered into the database. Following the grounded theory approach, we then performed the process of open and axial coding (Corbin and Strauss, 1990). In order to increase the robustness of data analysis, we adopted investigator triangulation (e.g. Denzin, 1978), where the initial categorizations of barriers were prepared by each of the authors separately and were next discussed and agreed upon by the authors. Overall, in our data analysis leading to the final categorization of barriers, we employed three procedures typical of grounded theory-based analyzes (i.e. open coding, axial coding and constant comparison), which exceeds a median number of procedures used in this kind of approach (Wiesche *et al.*, 2017).

The final step of the data analysis was the elaboration of the distribution of barriers and barrier categories across different respondent age ranges to investigate the role of employee age in perceiving barriers. The age-related comparison, together with theory-based explanations why certain age-related considerations exist should allow us to advance the empirical understanding of age-related impacts on ICT use (Tams *et al.*, 2014).

In total, 187 respondents expressed their opinions regarding barriers to successful ES adoption and use. The interviewees held diverse organizational positions such as operational employees, line managers, directors (i.e. middle-level managers) and top management representatives. They also played diverse roles in ES projects such as end user, member of the implementation team, project manager and project supervisor. The interviewees represented organizations of various sizes and operating in a range of industries, such as manufacturing, trade, ICT and finance.

In order to investigate the role of age in the perception of barriers, we divided respondents into groups on the basis of their chronological age. While no generally accepted cut-off exists, for practical purposes, most organizations define "older workers" as those individuals either 40, 45, or 50 years and older (Kooij *et al.*, 2008; Philips and Siu, 2012). We decided to choose the age cut-off of 50 years because most organizational

decision makers in Poland refer to older workers as 50 years and older (Soja and Stonawski, 2012; Stypińska, 2015). A similar definition of older employee was adopted by Conen *et al.* (2011) in their investigation into potential of ageing workers conducted in eight European countries. Conen *et al.* also defined younger workers as those not older than 35 years. Therefore, we finally divided our respondents into three age groups: younger (less than 35 years old), middle-aged (between 35 and 49) and older (50+). The numbers of respondents in each age group taking into consideration organizational position are presented in Table II.

Results
Barrier categories
On the basis of empirical data analysis, three main barrier categories were extracted. They include difficulties associated with people involved in (or affected by) the implementation project (category "People"), barriers related to implementation process run (category "Process"), and impediments associated with technology-related issues referring to the system and the adopting organization (category "Technology"). The barrier categories and individual barriers indicated by the respondents are presented in Table III together with their perceptions by respondent age groups. The following subsections include the general presentation of barriers and barrier categories without discussing the role of age, which is performed in the next section.

It should be highlighted that some considerations pointed out by the respondents have a multifaceted character and may span across several categories. For such potentially ambiguous issues, we distinguished the leading category capturing the predominant meaning of the respondent opinions. An example is a barrier "project team," which generally might be treated as an implementation process-related consideration, but has been assigned to the category "People" in our analysis. The reason behind such a decision was that the "project team" barrier captures the respondent opinions associated with the characteristics and attitudes of the project team members, such as organizational position, involvement and responsibility.

Category "People". The people-related category includes barriers associated with stakeholders holding various organizational positions and responsibilities within a company, such as employees, management personnel and members of the implementation team. The related barriers refer to employees' negative attitudes toward changes and the new ES, their inappropriate behavior and skills. The attitudes-related barriers are varied with respect to the level of negative stance and include such elements as resistance, reluctance, fear and lack of acceptance. The barriers related to behavior concern employees, managers and the project team members (habits, management personnel, project team). Inadequate behavior of managers and the project team members mainly refers to involvement and responsibility, while in the case of other employees, their inappropriate behavior refers to habits associated with the previous style of work and legacy systems operation.

Organizational position	Overall	Younger (less than 35)	Middle-aged (35–49)	Older (50+)
Operational employee	86	60	18	8
Line manager	68	34	27	7
Director (middle-level manager)	17	5	6	6
Top management	16	3	9	4
Overall	187	102	60	25

Table II.
Number of
respondents by
age group and
organizational position

Barrier\Age group	Younger	Middle-aged	Older
People			
Resistance	●	◑	
Reluctance	◑	◑	●
Fear	◔	◑	●
Habits	◑	◑	◑
IT knowledge	◑	◔	◕
Skills and experience	◑	◑	
Human factor	◑	◔	
Management personnel	◔	◑	◑
Acceptance	◔	◔	◑
Project team	◔	◔	◔
Age		◔	◔
Process			
Schedule	◕	◕	◕
Company finances	◑	◕	◑
Implementation cost	◑	◑	◕
Workload	◔	◑	●
Organizational changes	◔	◕	◑
Training	◑	◑	◑
Communication	◔	◔	◔
Goals and requirements	◔	◔	◔
Provider	◔	◔	
Technology			
Infrastructure	●	◕	◕
Fit	◕	◑	◑
System quality	◕	◑	◔
Data	◑	◔	◔

Notes: ● – very high, ◕ – high, ◑ – medium ◔ – low level of importance Younger: < 35, Middle-aged: < 35, 49 >, Older: 50+ years

Table III.
Barriers and barrier categories by respondent age group

The skills-related barriers comprise issues related to general ICT knowledge and skills (labeled "ICT knowledge") and a broad range of issues associated with employees' experience and competence in the context of ES adoption and use (labeled "skills and experience"). The particular ICT knowledge-related barriers include inadequate knowledge of new information technologies and lack of basic skills in computer operation. The skills- and experience-related barriers include lack of experience and competence associated with ES implementation project management, inadequate knowledge of how to operate the new ES and, expressed in the general way, lack of competence. Some respondents indicated

people as a barrier without providing any details and such declarations were categorized as human factor. A separate barrier, important from the perspective of the current study, refers to demographic characteristics of employees associated with their older age, indicated in the context of employees' learning process.

Category "Process". Within the "Process" category, the most frequently indicated barriers include impediments associated with the project schedule (such as restricted or too short time, inadequate time calculation), company finances, high implementation project cost and workload imposed by the implementation project (e.g. necessity to learn new system operation, preparation of documentation, simultaneous work in two systems).

Other barriers were associated with organizational changes (e.g. changes in work organization, introducing employee control, missing organizational procedures) and trainings (e.g. too few trainings and of poor quality). The communication-related barriers mainly include difficulties in communication with the project environment and lack of information flow. Barriers related to goals and requirements refer to missing or unclear project targets. Finally, the provider-related barriers involve problems with their limited resources and shortcomings in providing trainings and consulting services.

Category "Technology". Within the category "Technology," the first barrier emphasizes difficulties related to the ICT infrastructure such as inadequate hardware and network-related issues. The second barrier (fit) refers to the relationship between the characteristics of the new ES and company's expectations. Particular issues include the inaccuracy of the system choice, company processes not aligned with the ES or vice versa, lack of compliance with legal regulations and lack of integration with company's legacy systems.

The next barrier is associated with the system quality, mainly perceived as system inadequate functionality, its unnecessary complexity and erroneous operation. The last barrier is related to data, capturing difficulties with data transfer from legacy systems to the new ES, lack of data integrity in legacy systems, and workload associated with completing data in the new ES.

Barrier perceptions by age

The results of data analysis from the employee age perspective are illustrated by the distribution of reported barriers across the three age groups, displayed in Table III. Following the suggestions of Miles and Huberman (1994), presenting the data in the table we used the symbols ●, ◕, ◑, and ◔ for very high, high, medium and low importance of perceived barriers. The symbols were defined on the basis of the distribution of responses and "quality" of respondent statements across the age groups. In the first step, for each age group, we evaluated percentages of the respondents declaring individual barrier types. Next, to evaluate the "quality" of respondent statements, we examined if and to what extent the respondents provided arguments for their claims, how they described the barriers, and in what order they enumerated individual barriers. In order to illustrate the most significant differences, we provide sample quotes from respondent statements used while describing barriers.

The category "People" is perceived by the respondents from each age group at the similar level, with a slightly less emphasis put by the middle-aged respondents. Nonetheless, when we take into consideration individual barriers within the category, there are visible differences for all elements except for project team and habits. When we compare the youngest and oldest respondent groups, the perception of the following barriers seems to grow with respondent age: reluctance, fear, acceptance, management personnel, age and ICT knowledge. This is visible both in the form of respondent statements and in the frequency of reported barriers. The opinions of older employees, especially those related to negative attitudes, appear more elaborated than the declarations of younger respondents, who often only mentioned the problem without providing any explanation. This is illustrated by the following respondent statements.

Talking about barriers associated with reluctance and fear, two older respondents commented:

[…] Usually people are the greatest barrier, especially those from the lowest organizational level […] They are afraid of changes, they are concerned about their jobs, they are afraid of new duties […] New systems are associated with a possibility of making new mistakes, people are afraid of this and worried about resulting consequences, which are more serious in the case of new systems […].

[…] Barriers were dissatisfaction and reluctance of employees due to changes and accumulation of workload and new duties. Employees' reluctance was also caused by the threat of losing one's job or position due to company's reorganization. And additionally lack of information, which also caused employees' discontent and reluctance […].

One younger respondent briefly stated:

[…] Mental barrier, human factor, fear of unknown […].

Another younger respondent, describing barriers associated with technology, laconically added at the end of his opinion:

[…] Employees reluctance.

Talking about barriers associated with management personnel, one older respondent commented:

[…] There were several barriers in the project […] A manager who personally decides on everything within the company becomes a bottleneck for the company processes, including the implementation project […].

One younger respondent, in turn, briefly stated:

[…] Lack of management personnel's involvement in the project […].

Talking about barriers associated with ICT knowledge, both older and younger respondents rather briefly described the barriers. Two older respondents commented:

[…] Lack of employees' ICT education and lack of ICT skills, inadequate system knowledge […].

[…] Employees – poorly educated, not knowing how to operate a computer […].

Two younger respondents stated:

[…] Poor ICT knowledge of end users […].

[…] Apart from weak (or non-existing) ICT knowledge of employees from lower and middle organizational level there were no other barriers […].

Talking about age-related barrier, one older respondent and one middle-aged respondent commented:

[…] Employees' age is a barrier, older people learn slower […].

[…] Employees' age, especially noticeable during trainings […].

The perception of remaining barriers, i.e. resistance, skills and experience, and human factor, decreased with age. This is illustrated by the following respondent statements.

Talking about barriers associated with resistance, the youngest mentioned a greater range of reasons for resistance, while the middle-aged respondents in brief statements mainly emphasized mental aspects. The oldest respondents, in turn, did not use any of such statements in their descriptions of people's attitudes and behavior. Tree younger respondents commented:

[…] User attitudes, i.e. resistance to changes […].

[…] User resistance to the new system, considering the replacement of the properly operating legacy system with the new one unjustified […].

[…] Employees' resistance to the new system resulting from fear of the unknown and lack of appropriate skills […].

Two middle-aged respondents stated:

[…] Change in employees' mentality, i.e. resistance to change […].

[…] Psychological resistance of employees […].

Talking about barriers associated with skills and experience, two younger respondents commented:

[…] Lack of competent and knowledgeable people, who can be asked for help in case of a problem […].

[…] Lack of a person who would be well-versed in organizational considerations of both adopter and provider companies […] lack of patterns that could be used in the implementation project […].

One middle-aged respondent stated:

[…] Team members not prepared to work in the project-oriented environment, lacking experience, training etc. […].

In the case of the category "Process," the respondent perception of this barrier category gradually increases with age. This relationship for the whole category mainly results from a strong growth of the perception of workload and a slight growth of the perception of implementation cost. While describing the workload-related barriers, the oldest respondents reported the greatest number of factors causing workload, i.e. necessity to learn in different domains, excessive duties, necessity to prepare system and project documentation. The middle-aged respondents mainly emphasized workload related to system implementation and mentioned the problem of excessive duties, particularly simultaneous work in two systems. The youngest respondents to a limited extent emphasized the necessity to learn (only with respect to the new system operation) and the problem of simultaneous work in two systems. The following statements illustrate the opinions of respondents from different age groups.

Talking about workload-related barriers, three older respondents commented:

[…] Everybody who currently works with the system had to familiarize herself/himself with the new structure of book-keeping and cost accounts. Naturally, the employees also had to learn the new system operation […].

[…] Necessity to work out and implement the system documentation. Also, necessity to document tasks and verify the documents […].

[…] Barriers also resulted from imposing additional duties on employees during the implementation project run […].

Two middle-aged respondents stated:

[…] Performing tasks related to regular business duties and simultaneously preparing for the implementation project […].

[…] Enterprise system implementation was a relatively difficult and complex process. Implementation of the new system functionality, mainly new software […].

Two younger respondents stated:

[…] Simultaneous work in two systems, learning and data verification at every level […].

[…] Necessity to learn the complex operation of the new system from scratch […].

The perceptions of the majority of remaining process-related barriers do not differ depending on respondent age. Only in the case of the perception of finances and organizational changes the middle-aged respondents predominate a bit. The provider-related barrier, in turn, was to a limited extent declared by the respondents from two younger groups and was not perceived by the oldest respondents. Among the three abovementioned barriers, those related to organizational changes deserve our special attention as they were somewhat differently perceived by representatives from various age groups. In particular, the middle-aged respondents most often indicated impediments related to poor organization of the company, highlighting organization's immaturity and the lack of necessary business procedures. The older respondents, in turn, uniquely reported barriers related to the introduction of greater control and, similarly to the youngest, they pointed to barriers related to the diversity of departments or business units. However, only the youngest reported the problem of adapting the organization in the context of the new system implementation. The following statements illustrate the opinions of respondents from different age groups.

Two middle-aged respondents stated:

[…] Immature organization of both the adopter and the provider company […].

[…] Lack of procedures how to conduct business, lack of business process description […].

One older respondent commented:

[…] Imposing responsibility and evaluation of job positions with the help of standardized business indicators […].

Two younger respondents stated:

[…] Difficulties in introducing organizational changes required by the new system […].

[…] Integrating franchise stores into one network. Prior to implementation, each store operated on its own equipment without communication with the head office. Overall, 200 branches located throughout the country were integrated […].

In the last barrier category, associated with technology-related considerations, respondent perceptions clearly decrease with age. The opinions of the youngest respondents were the most detailed and covering the broad scope of barriers. The oldest interviewees, in turn, more often declared general barriers associated with infrastructure and uniquely pointed to problems with lack of fit perceived from the perspective of employees. The middle-aged respondents concentrated on single barriers and more often provided more elaborated descriptions. In general, taking into consideration individual barriers, barrier perceptions gradually decrease in subsequent age groups only in the case of system quality. Overall, for all technology-related barriers, there is a difference between the youngest group and the rest of respondents. The following statements illustrate the opinions of respondents from different age groups.

Talking about barriers associated with fit and infrastructure, one younger respondent commented:

[…] Lack of fit between company's processes and those embedded in ES […] shortcomings of ICT infrastructure and incompatibility of systems during data migration were the main barriers that occurred during the implementation project […].

Another younger respondent, talking about barriers associated with system quality and fit, stated:

[…] Adaptation of overlays, such as invoice, to the requirements of national tax law […] division of work during entering data about providers into the system database […] problem with LFS rules […] bar codes […].

One middle-aged respondent, talking about barriers associated with fit, commented:

> […] Customization of software in order to achieve integration with a legacy system for production management […].

Another middle-aged respondent, talking about barriers associated with system quality, stated:

> […] Ineffective system solution, long system reaction time to user activity […] too complicated interrelations between requirements for the implementation of service processes […].

Talking about barriers associated with system quality and fit, one older respondent commented:

> […] Lack of adjustment of the company (that is company employees) to the implementation process […] problems with system migration […].

Another older respondent stated:

> […] Lack of appropriate computer hardware […].

Discussion

Barrier comparison with prior research

Within the category "People," barriers describing people's negative attitudes, knowledge and skills were reported by the majority of the previously mentioned ES studies and were also popular in IS research. In particular, resistance was highlighted by Laumer *et al.* (2016a) and work routines causing resistance were emphasized by Laumer *et al.* (2016a, b). People's fear was discussed by Agogo and Hess (2018), Compeau *et al.* (1999) and Thatcher and Perrewe (2002), while IT knowledge, skills and experience were highlighted by Compeau and Higgins (1995). Barriers associated with management personnel and the project team, in turn, did not receive much attention from prior ES literature. In particular, management personnel-related barriers were reported by two papers (Kamhawi, 2008; Saatcioglu, 2009), while the project team-related issues were discussed by just one study (Saatcioglu, 2009). Finally, a barrier capturing characteristics of older employees appears to be uniquely reported by the current study.

Among the barriers belonging to the category "Process," those associated with company's resources, implementation cost and provider were the most popular among prior ES studies. Nevertheless, the provider-related impediment appears the least important process-related barrier in the current study. On the other hand, the project schedule-related impediments, appearing the most important issue for the current study's respondents, were less frequently reported by prior ES studies. Barriers associated with company reorganization, goals definition and training were reported by prior ES studies to a limited extent. Interestingly, workload, although present among prior IS studies (e.g. Moore, 2000), appears uniquely reported by the current study when compared with prior ES studies.

Within the category "Technology," barriers associated with system quality and fit appear popular among prior ES studies, they also represent well-known issues in IS research (e.g. DeLone and McLean, 1992, 2003; Petter *et al.*, 2013; Sun *et al.*, 2009). However, on the other hand, a barrier related to infrastructure, being the most important technology-related impediment in the current study, was reported by only one of the previously mentioned ES studies (Kamhawi, 2008). In a similar vein, a barrier capturing difficulties in completing data in the new ES was reported by only Gable *et al.* (2002).

To sum up the barrier comparison with prior research, it appears that a majority of barriers discovered in our study were reported by prior ES studies. Nevertheless, among

people-related considerations, our respondents uniquely report characteristics of older employees as a barrier and appear to perceive people's negative attitudes to a greater extent, not only talking about resistance, which is a common barrier in prior ES research, but also emphasizing reluctance and fear. As regards process-related impediments, our respondents appear to put a greater emphasis on project-schedule and uniquely report a workload-related barrier. Among technology-related issues, our respondents appear to uniquely perceive the role of inadequate infrastructure.

The role of age in barrier perception
Table IV shows individual barriers depending on the perceived importance, relationships with respondent age, and category membership (i.e. People, Process and Technology). The following relationships between the perceived importance of barriers and respondent age were defined: lack of dependence, decreasing importance with age and growing importance with age.

The most important barriers whose perceptions are decreasing with respondent age include first and foremost elements from the category "Technology." This can be explained by the fact that technology-related knowledge is attributed to younger people, who, as "digital natives," represent the first generations to grow up with this new technology (Parry and Strohmeier, 2014). Additionally, younger people possess better cognitive abilities grouped under the category of fluid intelligence (which reflects working memory capacity, processing speed and selective attention), considered to be somewhat independent from knowledge and education. As these cognitive processes decline with age, tasks that require e.g. higher levels of information-processing may be more difficult for older workers to perform compared with younger workers (Rizzuto *et al.*, 2012; Fisher *et al.*, 2017).

The next group of barriers whose perceptions decrease with respondent age is associated with the category "People" (i.e. resistance, skills and experience). The possible explanation of the first subcategory refers to younger employees' greater willingness to changes and greater ICT-related expertise, which, combined with their observations of their older co-workers, might motivate them to define attitude-related barriers in a more radical way as resistance. Older people, in turn, may define the same problems in a more moderate way because, on average when compared to younger adults, they are perceived as being more psychosocially mature and as having greater emotional control (Tams *et al.*, 2014; Truxillo *et al.*, 2015; Wille *et al.*, 2014).

Independent of age	Decreasing with age	Growing with age	Lack of occurrence in the oldest group	Lack of occurrence in the youngest group
1. *Schedule*	1. **Infrastructure**	1. Reluctance	1. Resistance	1. Age
2. *Company finances*[a]	2. **Fit**	2. *Workload, implementation cost,* fear	2. Skills and experience	
3. *Training,* habits	3. Resistance, **system quality**	3. IT knowledge[a], *organizational changes*[a]	3. Human factor	
4. *Communication, goals and requirements,* project team	4. **Data,** skills and experience	4. Management personnel	4. **Provider**	
	5. Human factor	5. Acceptance		
	6. *Provider*	6. Age		

Notes: Underlined – category People; Italic – Process; bold – Technology. [a]Refers to the relationship between the youngest and the oldest group only

A greater perception of barriers related to the second subcategory (skills and experience) by the youngest respondents can be explained by the socioemotional selectivity theory (Carstensen *et al.*, 1999), according to which younger people, seeing time as open-ended, will choose to focus on activities to gain needed skills and advance. The older people, on the other hand, see time as limited and concentrate on applying their accumulated skills and developing warm interpersonal relationships to obtain emotional satisfaction or solidify existing relationships. Younger employees, in turn, seek the opportunity to achieve knowledge-acquisition goals and to accumulate needed work-related experience to advance in their careers (e.g. Fraccaroli *et al.*, 2017). If an organization is lacking competent and knowledgeable people who can be asked for advice and could serve as mentors, such opportunities are restricted, which can be noticed in the youngest respondents' opinions related to barriers associated with skills and experience. Appreciation of competence by the youngest respondents was also visible in the subcategory management personnel, where the youngest was the only one age group who emphasized a barrier related to lack of managerial staff's competence, rather than their lack of involvement, which was a barrier noticed by other age groups.

Barriers whose perceptions are growing with age belong to the category "People" (reluctance, fear) and "Process" (workload, implementation cost, organizational changes). Older people, being aware of their insufficient abilities and practice in using ICT, might understand that changes require a greater effort from them and are concerned if they fulfill new duties. Therefore, perceiving the ageing workforce structure in the company, older workers might mention barriers associated with attitudes to new technologies and adjustment to organizational changes. Loyalty and conscientiousness of older employees might also motivate them to perceive the risk of overloading the organization with high costs of the implementation project. Such an explanation appears feasible in the context of reported age-related gains of cognitive ability associated with a so-called crystallized intelligence, which is the ability to use knowledge, skills, experience and wisdom that one has accumulated over one's life. It may peak at about age 60 and then only gradually declines in late life (Rizzuto *et al.*, 2012; Truxillo *et al.*, 2015). Additionally, personality researchers suggest that positive traits like dependability or conscientiousness increase over lifetime and have been empirically linked to good citizenship behaviors associated with job performance and organizational performance outcomes (Fraccaroli *et al.*, 2017; Wille *et al.*, 2014). In our study, the oldest respondents were the only ones raising issues related to introducing responsibility and evaluation of individual work positions during organizational change.

The majority of barriers revealing some importance regardless of respondent age belong to the category "Process." A possible explanation might refer to the fact that education can act as a potential buffer to cognitive ageing and that more-educated older persons reveal fewer declines in information speed and general cognitive functioning than less-educated older people, particularly when accounting for the complexity and challenge of their jobs (Bosma *et al.*, 2003; Rizzuto *et al.*, 2012). In our research, older respondents are well-educated individuals and involved in more complex and challenging jobs, therefore their perceptions of implementation process-related barriers do not have to differ significantly from those of younger respondents. As explained earlier, the most important differences are associated with technological issues (the younger have an advantage of greater fluid intelligence and experience as "digital natives") and people-related problems (the older have an advantage of crystallized intelligence and prosocial work behaviors associated with mature personality).

The role of strong and weak points of older workers
While explaining differences in the reported barriers with respect to respondent age, we might take into considerations strengths and weaknesses of older workers that might help

them to perceive specific barriers. In this respect, in the case of the category "People," it appears that perception of barriers associated with weaknesses is growing with age. This phenomenon is visible for several attitude-related barriers (reluctance, fear and acceptance) and ICT knowledge. These impediments are to a great extent associated with decreased perception and work pace, and limited tolerance to psychological burdens related to changes imposed by the new ES implementation. As mentioned earlier, these characteristics of older workers might be explained by fluid intelligence, which is decreasing with age and refers to individuals' abilities to learn and adapt to new situations (Rizzuto *et al.*, 2012; Tams *et al.*, 2014).

A workload-related barrier, belonging to the category "Process," might also be explained taking into consideration weaknesses of older people (e.g. decline in physical abilities, decreased perception and work pace, lower new technology skills). Typical activities during ES adoption, such as the necessity to learn new system operation, a simultaneous work in two system solutions and changes in work organization require a significant adaptation of the employees. In such an environment, apart from fluid intelligence, physical abilities appear to play an important role. In particular, an incorrectly planned implementation project, without taking into consideration the needs of older employees who require adequate amount of time needed to complete implementation tasks, generates an additional barrier associated with excessive workload. In this respect, prior research indicates that when the older employees perform activities which require knowledge-based judgments, they should not be under time pressure (Maertens *et al.*, 2012). The importance of employees' adaptation to the changes in work organization and used tools and methods is a typical situation when implementing new technologies. The responsibility for employees' adaptation to the new work demands should be carried by management personnel and employees should not be blamed for insufficient competency and experience (Ilmarinen, 2001).

The age-related limitations might help older respondents to perceive the trainings-related barrier, which is an impediment perceived by all respondent groups to a similar extent. However, this barrier mainly includes issues associated with training's amount and duration time, which are organizational matters. The problem related to the performance of older workers during trainings was reported only by older respondents and was categorized as a barrier "age" in the category "People."

The strengths of older workers which allow them to have a deeper insight into issues associated with people are so called "soft skills" (e.g. interpersonal skills), ability to comprehend the whole, and awareness of one's own limitations (especially those associated with age). These can be explained in the context of cognitive and personality changes. For example, in the case of interpersonal skills, the older people, in general, demonstrate greater verbal ability and they tend to be more familiar with the various nuances of word meaning than younger ones. They also have a greater ability to comprehend the whole, which is associated with crystallized intelligence. Because of more life experience and knowledge, the older people tend to be better able than younger ones to link related pieces of information, creating a specific knowledge structure that can be helpful in a specific context (Rizzuto *et al.*, 2012; Tams *et al.*, 2014). The older people are also less impulsive and more agreeable, compared to the younger, which is associated with age-related changes in personality (Fraccaroli *et al.*, 2017; Tams *et al.*, 2014).

The current study's results suggest that older workers were aware of their weaknesses associated with restricted ICT competency and decreased work pace (e.g. declaring barriers reluctance, fear, age and workload). Nevertheless, facing the necessity of ES implementation, older workers appear to seek solutions associated with workload, organizational changes and management personnel. Such an explanation is in line with selection, optimization and compensation theory (Baltes and Baltes, 1990), positing that as people age, they adapt to resource losses and gains by selecting particular skills or tasks

to optimize their success and compensate for resource losses. Selection occurs when people select and prioritize specific goals, optimization encompasses strategies focus on one's available means (e.g. allocation of time and attention), whereas compensation entails various actions that counteract the experience of losses in goal-relevant means (e.g. substituting unavailable for available resources, using external aids, seeking help from others) (Fraccaroli *et al.*, 2017; Truxillo *et al.*, 2015).

Another issue, where older respondents better evaluated the needs of older employees, is associated with the necessity of supplementing ICT knowledge as a prerequisite for a greater ES acceptance. The older understand that older people usually need to know how any device or application operates before they start using it (e.g. they read manuals). The younger, in turn, usually look for faster solutions and more often experience how a given solution is working by a process of trial and error and learning by doing (e.g. Chen *et al.*, 2017; Parry and Strohmeier, 2014). Hence, the younger place a great emphasis on practice, perceiving barriers associated with general experience and skills, while the older more often report the necessity to supplement ICT knowledge, acknowledging this as a precondition of employing technology-related solutions in practice.

Implications
The current study's results illustrate interesting implications associated with team-building strategy and a related well-known issue in ES research associated with balanced team composition (Rothenberger *et al.*, 2010). Our results suggest that the team balanced with respect to team members' age might be beneficial for the project successfulness. This should help to create hybrid team cultures that integrate a diversity of backgrounds, experiences, perspectives, cultures and goals, which is necessary in large scale systems implementations (Jones, 2008). In particular, ICT-related knowledge and skills of younger workers, together with their positive attitudes toward changes, combined with general knowledge, work experience and interpersonal skills of older workers, indicate some opportunities for cooperation between the youngest and oldest employees.

However, in this respect, Profili *et al.* (2017), evaluating an organizational perspective on ageing and age diversity at work, conclude that there is no clear consensus about whether age diversity has an overall positive or negative effect on issues in the workplace. They suggest that, on the one hand, positive effects should prevail because age-diverse teams benefit from a wider range of non-redundant knowledge, experiences, relationships and perspectives. Such cooperation creates the opportunity and encourages team members to transform various sources of task-relevant information, leading to more innovative solutions. On the other hand, age diversity could have both positive and negative effects depending on several moderating and mediating variables (e.g. task-specific knowledge or task motivation).

Age-diverse cooperation seems necessary due to the predicted changes in the labor force and companies' age structure becoming older and older. During such cooperation, the younger, being more and more frequently "digital natives" (Parry and Strohmeier, 2014), might learn from the older how to better understand and cooperate with other people, such as workmates and customers. These favorable interpersonal skills have been demonstrated in our study by an emphasis put on people-related issues within each barrier category and a richer and more accurate evaluation of people's attitudes performed by older respondents, compared to younger interviewees' assessment.

The current study's findings illustrate that older employees might require a special organization of trainings in order to efficiently acquire new ICT-related skills and knowledge. This conclusion is in line with prior research findings, emphasizing the role of facilitating conditions for learning by older adults how to use digital technologies (Barnard *et al.*, 2013). The current study's results also corroborate the findings of

Mantzana *et al.* (2010) who suggest that it is beneficial to organize trainings for older employees in such a manner that involved tutors at the same time play the roles of mentors. The current study sheds more light on this issue and illustrates that older employees, due to their work experience and interpersonal skills, might achieve a high level of competence as trainers or consultants and should be able to adjust the way of consulting or training to the needs and abilities of older people.

Our results imply that job security might be a central idea during the implementation of mandatory software in an organization. As pointed out by our older respondents while explaining a barrier associated with fear and reluctance, negative attitudes are caused by job insecurity, which, in turn, is caused by company's reorganization. These relationships are also suggested by prior research. In particular, Keim *et al.* (2014) claim that lower levels of job insecurity are associated, among other things, with less organizational change and younger employee age. Cheng and Chan (2008), in turn, posit that greater perceptions of security should be associated with more positive employee behavior and attitudes (e.g., job satisfaction, job involvement and job performance). Therefore, as ES implementation is associated with significant organizational changes, it appears that the resulting job insecurity should be mitigated by a change management program adjusted to employee age. In particular, the older workers require appropriate preparation so as not to be afraid of new duties, making mistakes or even losing their jobs. They expect trainings which are organized in advance and extended in time; they also need to be informed about new duties and related evaluation, and benefits from using the new ES. Overall, the above mentioned change management initiatives should have a positive impact on the older workers' perception of job insecurity, which appears to be an underlying cause of older employees' negative attitudes to ICT-induced change.

Limitations and future research

The main limitation of the current study is related to the scope of its findings, as the investigation was based on the data gathered in one country, i.e. Poland. However, since demographic forecasts suggest that similar changes in the workforce take place in other EU countries (United Nations, 2019), the current study's results and implications might also be applied, to a certain extent, to other countries within the EU. Nevertheless, the application of the current study's findings to more developed economic settings should be done with caution because Poland, as mentioned earlier, might be perceived as a transition economy (Roztocki and Weistroffer, 2015) and thus experiencing different ICT-related considerations than well-developed economies (Soja and Cunha, 2015). Therefore, it appears that a cross-country European investigation into ICT-related considerations for an ageing workforce is an important direction of future research.

Another limitation of the current study is associated with the composition of our sample, which is different in various age groups and the oldest group of respondents contains a greater number of individuals holding managerial positions. This might be partly explained by the fact that with age employees tend to hold higher organizational positions. Older employees' higher organizational positions might allow them to perceive a greater spectrum of people- or organization-related considerations. At the same time, an interesting issue for future research is associated with the hypothesis if their higher organizational position prevents them from perceiving technical barriers. With this respect, our preliminary analysis interestingly suggests that, within the group of respondents holding managerial positions, perception of people- and process-related barriers seems to grow with age, while it remains at the same level for technology-related barriers.

The current study's findings illustrate some important implications for researchers. In general, our results indicate that there is a need for incorporating the viewpoints of multiple age groups in order to gain a fuller insight into ICT adoption considerations in a

mandatory environment. This seems especially important in the light of an ageing society and workforce and should increase our understanding of interrelations between demographic trends and widespread use of modern ICT. Interesting research challenges are related to a greater understanding of the interplay between worker age, job characteristics (e.g. complexity, active use of cognitive abilities and the level of specialization required) and work outcomes (e.g. performance and work engagement).

Other promising research avenues stemming from the current study's results are associated with an investigation into the types of problems occurring during complex ICT adoption projects that might be better solved by the age-balanced teams. In the case of ES adoption and related barriers, it seems particularly interesting how to improve the planning process leveraging strengths of employees in different ages. The goal of such an improvement would be to elaborate the project plan which incorporates activities aligned with the age structure of the organization workforce.

The data analysis, further reflection on findings and comparison with prior research allowed us to formulate a range of ideas which, although associated with our results, might not come directly from our data and might not be in the stage of hypotheses ready to be tested. Nevertheless, we believe that they might help explain the findings and can be a good starting point for further investigations. Therefore, following the ideas of Akkermans and van Helden (2002), we call them research propositions and explain in the following.

The first research proposition concerns potential benefits from cooperation between older and younger employees. The related questions are what benefits can be expected from such cooperation and what might be the most promising areas for collaboration. In this respect, the findings of Wegge et al. (2008) interestingly suggest that age diversity is positively related to performance when groups are solving complex decision making tasks but negatively related to performance when they are solving routine decision-making tasks. Due to the complexity of ES implementation project, we might expect a valuable cooperation on working out solutions during organizational change and in securing organization-system fit.

Another promising area for age-diverse cooperation includes joint development of the project definition/business case in order to minimize implementation costs (here the perception of the oldest employees appears the strongest, as our findings suggest) by greater optimization of system quality and fit to company requirements (here the youngest employees predominate). Another example is related to the development of software tools aligned with the needs of various age groups. In this context, a shared testing of detailed solutions related to system interface, performed by both young and older employees, appears particularly promising. For instance, as suggested by Tams et al. (2014), personalization of the web browsing activities placing greater demands on crystallized intelligence than fluid intelligence could help older users navigate the websites more easily and effectively, while not imposing a disadvantage on younger users.

The second proposition concerns improving older employees' competence in consequence of inter-age collaboration. Older workers might learn from the younger their approach to work with respect to a growing competition, constant change and uncertainty. The older should also be aware that intuition in using ICT solutions is necessary and needs to be developed. Joint problem solving with younger workmates might broaden ICT knowledge of the older and should encourage them to acquire ICT skills on their own, as gaining experience increases people's willingness to further develop relevant skills (Hill et al., 2008). The indicated earlier propositions associated with inter-age collaboration can be useful for an organization how to help older workers adapt to technology and to better understand how to develop technology that is easily adopted by and actively addresses the needs of older workers (Truxillo et al., 2015).

The third research proposition refers to the idea that older workers' have potential to develop ICT-complementary skills needed in a technology-rich environment. Such skills, including communication with co-workers and clients, problem solving and advance

planning, might be developed thanks to older employees' strengths related to intrapersonal and interpersonal domains. ICT-complementary skills are especially important for today's and future organizations which are supported by ICT and relying on information diffusion (OECD, 2016). However, in order to leverage older workers' potential, organizations need to complement their ICT knowledge and skills at least at the basic level and facilitate their adaptation to new ICT solutions.

Summing up, we can conclude that the main limitations of the current study are associated with the research sample, which is restricted to one country and is not balanced with respect to organizational positions of respondents. There are two directions for future research resulting from these limitations: replication of this study in other European countries and sample extension with an emphasis placed on incorporating multiple stakeholder perspectives, taking into account respondent age. Other avenues for future research indicated by our study concern ideas on how organizations can benefit from age diversity and how it is possible to support older employees in ICT use.

Contribution
The aim of the current section is to provide the reader with a clear summary of our contribution, which refers to several aspects such as research approach, originality of results as compared to prior studies, implications and illustration of directions for future research. The ideas summarized in the current section are discussed in more detail earlier in the manuscript; nevertheless, this section can be treated as a summary of the main highlights offered by our study.

As pointed out by Tams *et al.* (2014), few IS studies have been conducted in which the concept of age played a central role. Prior studies tended to model age merely as a control variable, with limited understanding of its conceptual nature. Therefore, more studies focusing their attention on the role of age in IS phenomena are needed to extend our knowledge of age-related impacts (Tams *et al.*, 2014). Our study helps to narrow this research gap by placing the concept of age in the central role while researching barriers to mandatory software implementation and use. In particular, by employing an extensive empirical data set and performing a comparison between age groups, our study advanced the empirical understanding of age-related impacts on IS phenomena (Tams *et al.*, 2014).

As compared to prior studies, our research presents a holistic approach which provides a broad overview of considerations related to perceived barriers to ICT adoption and use, depending on employee age. In this approach, we indicate how barriers were perceived by employees at different age; we not only provide possible explanations of differences in the perceptions of individual barriers, but also attempt to explain the barriers' co-occurrence from the perspective of the chosen ageing theories which are most pertinent to the work context (i.e. socioemotional selectivity theory, theory of selection, optimization and compensation) (Baltes *et al.*, 2012).

Prior studies conducted in the context of older employees and ICT mainly emphasized the need to help older workers adapt to technology, mostly by developing appropriate training and friendly design (Foster Thompson and Mayhorn, 2012; Truxillo *et al.*, 2015), which is also indicated in our research. However, we put greater emphasis on people-related considerations, whose perception appears a strong point of older employees. In particular, our results imply that with age, employees' perception of ES adoption considerations is shifting from technical issues toward people-related considerations. In this respect, we posit that job insecurity might be a central idea during the implementation of mandatory software in an organization and can be mitigated by appropriate change management initiatives, resulting in minimizing employees' negative attitudes toward changes. Other implications discussed in our study are associated with age-balanced team building and cooperation between younger and older workers. We recommend that there are opportunities to use

older employees' potential during ICT implementation and use in a mandatory organizational setting and we believe that this topic has been rarely discussed by prior research and appears an important contribution of the current study.

Conclusion

The current study investigated the role of employee age in the practitioners' perceptions of barriers to ES implementation success. Using a data-driven approach, the discovered barriers were divided into three categories: People, Process and Technology. The age-based analysis yielded the greatest differences for categories "People" and "Technology." We might conclude that older employees' perception of barriers is more insightful and characterized by responsibility for people and an organization. On the other hand, perception of problems with broadly understood technology is the preserve of younger workers. The current study's findings imply that cooperation between various generations of employees is necessary due to ongoing work digitalization and an ageing workforce; and change management program adjusted to employee age is needed in order to decrease older employees' job insecurity. The results achieved should be valuable for practitioners and researchers. Practitioners may better compose work teams to benefit from all employees potential and, taking into consideration the needs of older employees in the process of company reorganization, they might positively influence older employees' perception of job security and consequently minimize their negative attitudes toward changes being incorporated. Researchers, in turn, are encouraged to incorporate multiple stakeholder perspectives and age diversity in their investigations. In general, unlike much of the existing literature, the current study not only points to the negative aspects of ageing, but also emphasizes the positive aspects or chances older employees provide for ICT implementation within an organization.

Glossary

BPR	Business process reengineering
ERP	Enterprise resource planning
ES	Enterprise system
ICT	Information and communication technology
IS	Information system
IT	Information technology
MRP	Materials requirements planning
MRP II	Manufacturing resource planning
OECD	Organization for economic co-operation and development

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