Shadow IT and ERP: Multiple Case Study in German and Serbian Companies*

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Abstract

More and more companies are trying to optimize their corporate goals through digitalization. These include large corporations, medium-sized companies, but also small businesses. Starting with a central information system, companies are networking to obtain as much information as possible and to keep processes lean in order to increase sales and profits. The complexity of an ERP system often prevents complete transparency in use due to gaps in knowledge. This makes faster, simpler solutions from the common software shelf appear more attractive and is preferred by the user.

The aim of this research is to determine the factors for the use of shadow IT. Thus, connections with general information systems such as an ERP system become recognizable. The research questions which are derived from this: What types of shadow IT exist in Germany and Serbia? What are the reasons for a use and do they entail risks?

In order to be able to answer these questions, a thorough analysis of the applied software is required. In this case, this also includes an analysis from the user's point of view. These considerations are also differentiated regionally as well as content-related in the following research. Here, experts from European companies were interviewed.

By means of a survey, participants were able to explain their use of additional software. This results in interpretations regarding the use of shadow IT. There is a clear trend towards the use of certain auxiliary software. In addition to the strengths and weaknesses of the shadow IT, this work also conveys the weak points of the standardized information system, such as the ERP system and its modules.

Keywords: Shadow IT, information systems, ERP, SAP, risk mitigation.
JEL Codes: M1, M15, M19

1. Introduction

"The Trend is your friend at the end when it bends."

This phrase is valid in society as well as in the economy and provides for a certain actionism in many areas of life. The digitization strategy in Europe makes the so-called trend towards "computationalisation" socially acceptable (Kagermann/Lukas/Wahlster 2011). We are experiencing keyword battles in the media,

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both in business and in educational institutions. And yet it is difficult to find uniform definitions and calculate the common denominator. Technologies develop rapidly with the increasing demands of civilization. As the product life cycle becomes shorter and shorter, the demands and the associated data increase more and more (Eigner/Stelzer 2009). On the one hand it is chance. The associated processes can be optimized on the basis of disproportionately increasing data (Mertens/Mertens 2019). On the other hand: This creates enormous pressure on the company. To cope with this pressure and the demand not only does the company develop new strategies, but also an information system has to be developed. According to the "Cisco Visual Networking Index™ (VNI)", global data traffic will triple by 2021 and then reach a volume of 3.3 Zettabyte per year. Since an information system as we know it is a powerful tool, there is no question. Does it also have the weaknesses of a Goliath – inflexible and hard to move? He is faced with small, agile systems – David, speedy and versatile.

Digitization, with its almost infinite potential, also contains enormous risks. The aim of this article is not to name and explain them all. Rather, it is about the paradox in the IT world. On the one hand, ERP pioneers such as Oracle, Microsoft and SAP try to keep the business world "lean" – this applies both to the application software and to the IT landscape presented. On the other hand, start-up companies are springing up like mushrooms with innovative, customizable products for small, medium-sized and large companies (Bosma/Kelley 2018). Thousands of applications for even the smallest use case. The crux of the matter is the compatibility with the information systems existing in companies. What was the goal of the pioneers at that time, a system for the entire company seemed in the beginning to be an all-round tool, the miracle cure? From time to time, this idea may be removed, especially when those who use ERP software are asked whether they use additional tools. The so-called shadow IT (Haag/Eckhardt 2015, 2017; Huber/Zimmermann, Rentrop/Felden 2017 a, 2017 b; Kopper/Westner 2016; Rentrop/Zimmermann 2012; Silic/Back 2014; Urbach/Ahlemann 2019; Zimmermann/Rentrop/Felden 2017). The unambiguous answer is: YES. Faster data analysis, user-friendly interfaces, location-independent, standardized elements are the key advantages over classic ERP software. What is much more serious is the fact that shadow IT does not require the bureaucratic, organisational approval of the company council. The user composes his individually made system from different puzzle parts. However, this also involves a major risk. The more application software you use, the more difficult it is to control (Silic/Back, 2014).

Now this is exactly where the question arises if the weaknesses of an ERP system can be covered up by shadow IT.

Numerous results of related research encouraged the authors of the article, who are also SAP ERP consultants, to conduct literature and empirical research in or-

der to reach the main goal of this study – identification of shadow IT risks and establishing recommendation for their mitigation. To create prerequisites for achieving the main goal of this, the following research questions were defined:

RQ1: Which are the most commonly occurring forms of shadow IT in Germany and Serbia?

RQ2: What are the reasons (motives) for appearance of shadow IT in Germany and Serbia?

RQ3: What are risks and the suggestions for risks mitigation of shadow IT in Germany and Serbia?

Answers to these research questions will be obtained by conducting a systematic literature review and empirical research in which users of ERP systems from business units and IT experts working in companies operating in countries at different development degrees, Germany and Serbia, were consulted.

2. Literature review

A systematic literature review was conducted in order to identify attitudes on the connection between shadow IT and ERP system and create preconditions for discussing results of empirical research. A methodology set by Barbara Kitchenham (Brereton/Kitchenham, Budgen/Turner/Khalil 2007; Kitchenham 2004; Kitchenham et al. 2010) was chosen for realisation of systematic literature review. It includes: defining research questions, search process, defining inclusion and exclusion criteria, evaluation of the quality of papers, and data gathering and analysis. In relation to the research questions, a research process was conducted and the following citation databases and research databases were searched: Web of Science, Scopus, SpringerLink, AIS digital library, IEEE Xplore, Google scholar, ACM Digital Library and DBLP.org according to descriptors shown in the second column of Table 1. The descriptors were defined so that the result of search would be papers and articles dealing with connection of shadow IT, feral systems and workarounds with ERP systems. Criteria for including published scientific papers into a more detailed analysis are:

- Time dimension: studies published in the period 2000 to 2019,
- Type of paper: study resources matching the defined descriptors in the title and/or the abstract. Study resources are peer-reviewed scientific and expert articles published in scientific journals and collections of papers from workshops and scientific conferences.
- Papers relating shadow IT and ERP

Criteria for excluding papers from the detailed analysis: papers dealing with shadow IT generally, papers not relating Shadow IT to ERP, and papers only defining future research into the area of Shadow IT.

Table 1. Desktriptors

Data source	Descriptors	Number of hits	Number of papers that meet research domain
Web of Science	"shadow IT" and ERP	3	3
	"feral system" and ERP	1	1
	workarounds and ERP	22	15
Scopus	"shadow IT" and ERP	1	1
	"feral system" and ERP	8	7
	workarounds and ERP	19	15
SpringerLink	"shadow IT" and ERP	777	3
	"feral system" and ERP	31	2
	workarounds and ERP	284	3
AIS digital library	"shadow IT" and ERP	177	9
	"feral system" and ERP	24	11
	workarounds and ERP	278	6
IEEE Xplore	"shadow IT" and ERP	0	0
	"feral system" and ERP	0	0
	workarounds and ERP	3	1
Google scholar	"shadow IT" and ERP	492	4
	"feral system" and ERP	49	6
	workarounds and ERP	2620	3
ACM Digital Library	"shadow IT" and ERP	3	0
	"feral system" and ERP	0	0
	workarounds and ERP	9	0

Titles and abstracts of papers were analysed in the first phase, and 90 papers matching the research subject were identified. After this, doubled (duplicated) papers were excluded resulting in 61 papers, whose quality was evaluated according to some of criteria set by Dybå and Dingsoyr (2008) shown in Table 2

Table 2. Criteria for evaluation of scientific material

1	Is there a clear research objective?	Yes/No
2	Is there an adequate description of the research context?	Yes/No
3	Is there an adequate description of contribution of method or approach?	Yes/No
4	Are there clear data on research results?	Yes/No
5	Is the study significant for practice or research?	Yes/No

31 papers passed this evaluation and underwent backward & forward reference searching, which did not produce any additional papers for analysis. These 31 papers were, therefore, subjected to a detailed analysis.

Different terms such as workarounds, feral IT, Feral system, shadow IT and shadow systems were used for auxiliary tools in the identified papers and literature. Shadow IT will be used to simplify the reading and comprehension of the article. The following section contains opinions from the identified papers which pointed why shadow IT is introduced in organisations, the impact on the overall quality of data shadow IT has, and the risks involved when relying on shadow IT.

The consequence of dynamic requirements for information has established the phenomenon of shadow IT. There are numerous reasons for which end users turn to using shadow IT to perform their tasks (Malaurent, 2011). Shadow IT often bypass ERP functionalities (Alter 2015; Davison/Wong/Alter/Ou, 2019; van de Weerd/Vollers/Beerepoot/Fantinato 2019), that is, serve for bridging the gaps in the functionalities of ERP systems (Alraddadi/Champion/Lagna, 2018; Seethamraju 2015; Tambo/Olsen/Bækgaard 2014; Tajul Urus/Molla 2016; van de Weerd et al. 2019) in situations when customization of functionalities is euither too costly or infeasible (van Beijsterveld/van Groenendaal 2016). Shadow IT also feature in situations of transfer from an old to a new information system (Davison et al. 2019). Also, they are used in situations when the users are unable to enter the desired data due to limitations set on entering data into ERP systems (Alraddadi et al. 2018; Malaurent 2011; Malaurent/Karanasios, 2019). Sometimes, although the required functionalities do exist implemented in the ERP system, users resort to shadow IT due to lack of certain skills, stemming mostly from insufficient or inadequate training (Hustad/Olsen 2011; Malaurent 2011), or, simply a wish to increase operative efficiency and efficacy (Behrens/Sedera 2004; Spierings/Kerr/Houghton 2017), appearing due to inflexibility of the existing ERP solution (Koch/Kerr 2014 a, 2014 b). The attribute of usability of ERP, reflected in low operability and learnability features as another reason for the emergence of Shadow IT (Tajul Urus/Molla/Teoh 2011; Tajul Urus/Molla 2016). In certain cases, shadow IT are created with the aim to support, or, in extreme cases, even replace the ERP system (Kerr 2008), or a backup solution due

to unavailability of ERP (Kerr/Houghton 2008, 2010; Alraddadi et al. 2018; Malaurent 2011; Malaurent/Karanasios 2019).Malaurent and Avison (2015) point out another dimension of emergence of shadow IT. Namely, implementation of ERP system in Chinese subsidiaries of a French multinational company was a failure because certain functionalities of ERP could not be applied in Chinese context, so that the users turned to shadow IT. Owing to this, shadow IT functioned in China as a whole.

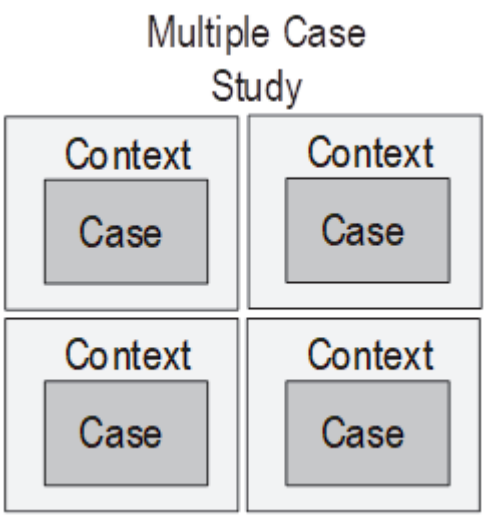
Despite the fact that shadow IT often bear the epithet of innovativeness and, in the opinion of their users, are used for better performance of tasks, they are often associated with numerous problems. One of the frequent problems is poor data quality. In the majority of cases, end users developing shadow IT come from business units, and, in most cases, lack adequate knowledge and skills required for developing software solutions (Jones/Behrens/Jamieson/Tansley, 2004, Petrov/Ćelić/Uzelac/Drašković, 2020, Raković/Sakal/Vuković 2019, Raković/Sakal/Matković/Vuković/Pavlićević 2019). Also, insufficient knowledge of all functionalities of the tools used for developing shadow IT solutions leads to numerous problems related to data quality with the attributes of untimeliness, data incorrectness and incompleteness. (Hustad/Olsen 2011; Tajul Urus et al. 2011) Poor data quality affects numerous business processes and functional areas in organisations (Ajer/Haustad 2015; Drum/Pernsteiner/Revak 2016, 2017).

Given that 64 % of shadow IT is related to ERP systems (sharing data and/or functionalities), shadow IT pose risks for organisations (Huber/Zimmermann/Rentrop/Felden 2016). On the one hand, they increase flexibility of business units, while, on the other, they take up organisations' resources and duplicate effort. (Behrens, Sedera, 2004). Shadow IT may make a powerful impact on internal controls in financial reporting, as they introduce their own controls, which are often manual, and therefore reduce effectiveness and efficiency (Pernsteiner/Drum/Revak 2018). Providers of ERP solutions should offer core functionalities required by most businesses, and, at the same time, offer the possibility of integrating shadow IT with ERP solutions (Behrens/Sedera 2004). Mitigation of these risks can be achieved in such a way that shadow IT, characterised by lack of integration and automation, must be borne in mind in the digitalization process (Huber et al. 2017 a, 2017 b), that is that shadow IT and risks should be considered together when modelling uncertainty in organisations, as well as the fact that informal shadow IT practices need to be incorporated into organisational models (Barata/da Cunha/Abrantes 2015), that is, redesigned business processes (van de Weerd et al. 2019). Also, bearing in mind that the process of shadow IT is dynamic, it must be managed in continuity (Alraddadi et al. 2018).

3. Research design

Empirical research in the form of qualitative research component was conducted through multiple case study (Runeson/Höst 2009; Yin 2009) on a purposive sample of organisations according to Creswell's recommendations (as cited in Onwuegbuzie/Collins 2007) in Germany and Serbia, estimated to have the richest information of high relevance for the basic research purpose and obtaining answers to research questions posed in research. According to Runeson and Höst (2009) research into more cases spontaneously results in more information on the researched phenomenon and this is not only because of the enlarged quantity of data gathered from the sources of information but also based on the features of the selected cases themselves (figure 1).

Figure 1. Multiple Case Study (Runeson/Höst 2009, Yin 2009)



According to Yin (2009), definition of the research problem is followed by selection of cases, then performance thereof, then writing individual case reports, and, finally, draw-case conclusions. Criteria for choice of companies where case study was conducted are: (1) use of one of the most dominant current ERP systems (SAP ERP or SAP S/4 HANA) and (2) location of the company in one of these countries, Germany or Serbia. SAP ERP was chosen because it represents the most used enterprise software (Panorama Consulting Group 2019), and to provide preconditions for the possibility of data comparison in different companies.

These countries were chosen because they differ in economic development and the fact that Germany is an EU member, and Serbia has been a membership candidate since 2012. According to the above defined criteria and recommenda-

tions, three companies from Germany and three companies from Serbia were selected, thereby creating preconditions for comparative analysis of research results through the prism of developed and less developed countries.

The research instrument is semi-structured interview in accordance with recommendations of Ristić (2016) and Runeson & Höst (2009). It was pre-tested in one organisation in Germany and Serbia each in order to remove dilemmas and ambiguous questions. The questions were modified based on received suggestions. The final interview version is given in Appendix A. The interviews were conducted in the period from January to May 2019. Tables 3 and 4 show relevant data of the organisations where the empiric research was conducted such as country, industry type, number of employees and number of respondents per department. A total of 28 respondents were interviewed, 18 from business units and 10 from IT departments. All six organisations belong to production industry type for the reason that only these companies have the potential to apply all SAP ERP modules, which was the case with the studied companies.

Table 3. Companies from Germany

Companies from Germany	Case A	Case B	Case C
Industry type	Production	Production	Production
No of Employees	12000	30000	2500
Respondents from:			
Business units	2	2	3
IT department	1	2	2

Table 4. Companies from Serbia

Companies from Serbia	Case D	Case E	Case F
Industry type	Production and sale	Production	Production
No of Employees	2000	1500	3300
Respondents from:			
Business units	5	4	2
IT department	1	1	3

4. Results

4.1. Results about respondents

Average work experience of German respondents is about 11 years, and about 10 years in Serbia (Table 5). End users coming from IT department belong among power users, whereas users coming from business departments belong among standard users.

Table 5. Work experience

	Work experience		
Country	Average	Minimum	Maximum
Germany	11.17	3	26
Serbia	9.94	1	21

Respondents have an enviable experience in the use of SAP ERP system, average of 9 years in Germany and about 7 years in Serbia, where SAP ERP system has been implemented long enough in all companies both in Germany and Serbia, 17.5 and 14.5 respectively (Table 6, Table 7).

Table 6. Work experience in SAP ERP

	How long have the respondents been using SAP ERP?		
Country	Average	Minimum	Maximum
Germany	9	3	20
Serbia	7.25	1	17

Table 7. Time period of production of SAP ERP

	How long has SAP ERP been implemented		
Country	Average	Minimum	Maximum
Germany	17.5	10	25
Serbia	14.5	12	17

The following three sections of the paper presents the results of empiric research grouped by defined research questions, countries and organisations.

4.2. Most commonly occurring forms of shadow IT

4.2.1. Case studies from Germany

Case A – Respondents from business units point out that they do not use shadow IT, whereas the respondent from the IT department mostly uses MS Excel and MS Access. MS Access was not approved and installed by IT department.

Case B – Respondents from both departments (business and IT) use MS Excel approved and installed by the IT department.

Case C – All respondents use MS Excel, and in addition to MS Excel, three out of five respondents also use MS Access (two respondents from business units and one from IT department) and one uses MS Visio. MS Excel and MS Visio were approved and installed by the IT department, while MS Access was installed by the users themselves.

4.2.2. Case studies from Serbia

Case D – All respondents use MS Excel, and one each from business and IT department also use MS Access. These auxiliary tools were approved and installed by the IT department.

Case E – All respondents use MS Excel and point out that they sometimes use spreadsheets parallel with SAP ERP and sometimes instead. MS Excel was approved and installed by the IT department.

Case F – All respondents use auxiliary tools in the form of shadow IT, and they all mention MS Excel (all respondents) and MS Access (two respondents from the IT department). In addition to these, some of the respondents mention the following auxiliary tools: Redmine, IT4U and OpenText.

4.3. Reasons (motives) for the appearance of shadow IT

4.3.1. Case studies from Germany

Case A – Respondents from business units opine that SAP ERP covers all their needs and they do not use auxiliary software. However, they emphasize that poor visualization, slow and difficult pace of finding real transactions are burdening problems and therefore they rated their satisfaction with SAP ERP with a very low average grade 2. A respondent from the IT department states that SAP ERP covers between 70 % and 80 % of his needs and because of this, he uses shadow IT. In addition to lower costs, he also states the fact that users are "more familiar with these tools" as one of the reasons. The majority of respondents claim that the greatest need for the use of shadow IT occurs in SAP ERP modules Production Planning (SAP PP) and Materials Management (SAP MM).

Case B – All respondents (business and IT) opine that SAP ERP does not fully cover their needs and point out that SAP ERP covers about 80 % of their needs. They state the need for adjusting reports and lack of certain functionalities as one of the reasons for turning to shadow IT. The majority of respondents claim that the greatest need for the use of shadow IT occurs in SAP ERP module Production Planning (SAP PP).

Case C – Only one of three business units respondents opine that SAP ERP mostly covers all needs, whereas the other (business and IT) respondents claim that SAP ERP does not cover all their needs (SAP ERP covers about 75 % of their needs). They state not user friendly user interface, lack of certain functionalities, slow system and poor user support as some of the reasons. The respondents point out that they have to perform some daily activities manually and that reports in ERP systems do not meet their daily needs. All respondents use shadow IT, and they list "better reports, flow of data, and extraction from SAP ERP", and ease of use of shadow IT tools as some of the reasons. The majority of re-

spondents stated that the greatest need to use shadow IT appears in SAP ERP modules Production Planning (SAP PP) and Materials Management (SAP MM).

4.3.2. Case studies from Serbia

Case D – The respondents rated their satisfaction with SAP ERP system with a moderate average grade of 3.2; only one of five respondents states that SAP ERP mostly meets their needs. The respondent from IT department believes that SAP ERP in such a large company covers only 50 % of needs, causing the use of additional software solutions of competing companies. The respondents mention inflexibility of ERP, incomplete data and poor responsiveness as reasons. An IT user states that SAP mostly requires the organisation to adjust their business processes to the software rather than vice versa, which may be useful bearing in mind the year-long experience of the company in SAP. He also mentions the cost of both acquisition and maintenance of SAP ERP, that an average user finds it difficult to understand, and often requires additional employees to secure its optimal functioning. Respondents from business units primarily mention ease of use and flexibility of MS Excel as reasons for using shadow IT. The majority of respondents stated that the highest need for use of shadow IT occurs in SAP ERP module Production Planning (SAP PP).

Case E – The respondents rated their satisfaction with SAP ERP system with a solid average grade of 4. All respondents (4 from business units and 1 from IT) believe that ERP does not cover all their needs. They mention rigidly defined processes, low flexibility, slow implementation of changes, lack of required reports, and that data often do not mirror the real state as the most common problems of SAP ERP systems. In this specific organisation, a subsidiary of a German company, the cost of making changes and implementing SAP ERP is higher, as these services are invoiced at current prices from Germany. In addition to these shortcomings, the respondents mention inability to follow suppliers' capacity and follow the production plan on a daily/weekly basis in SAP ERP due to specific nature of production, confirmed by the result that the majority of respondents have the greatest need to use shadow IT in SAP ERP modules Production Planning (SAP PP) and Materials Management (SAP MM) as reasons for using shadow IT.

Case F – The respondents rated their satisfaction with SAP ERP system with a high average grade of 4.6. Three out of five respondents believe that ERP covers all their needs. The respondents state that SAP ERP is not user friendly and that it does not offer possibilities for deeper analysis as the most common problems. One of the IT respondents states that “the most common problems related to SAP ERP are, in fact, slow responses of the company to legislative changes in Serbia”. They mention the need to export and import data in SAP ERP, lack of certain functionalities, creating reports, consolidating reports of different depart-

ments, data analysis, prognosticating, compiling and monitoring plans as reasons for using shadow IT. The majority of respondents stated that the highest need for use of shadow IT occurs in SAP ERP modules Production Planning (SAP PP) and Customer Services (SAP CS).

4.4. Risks and suggestions for risks mitigation of shadow IT

4.4.1. Case studies from Germany

Case A – Respondents from business units opine that shadow IT does not make a negative impact on data quality and integrity, security, availability and redundancy (DQISAR), whereas a respondent from IT department has a completely different standpoint. His opinion is that "There are many additional files with data redundancy, lack of data consistency and more frequent occurrence of human mistakes. Also, employees spend more time in performing their tasks, which reduces productivity." He claims that the main risk is the fact that "there are too many files in different locations that can create confusion and make it difficult to find the information you need. This can cause a loss of data about day-to-day business activities. Also, some tables are not transparent and some employees only have a basic knowledge of these tools". On the other hand, business users see no risks. The respondents make the following suggestions for risks mitigation of using shadow IT: carry out a quality on-boarding training for new employees; track employee skills (create and maintain skill matrix); improve business procedures and inform all employees.

Case B – Respondents from business units are unaware of the negative impact of shadow IT on DQISAR, unlike IT respondents, who claim that the negative impact of shadow IT on DQISAR stems from the fact that they are mostly maintained by line people without proper IT control, posing a security threat (outdated servers, software versions), isolating process knowhow, creating inefficiencies by not being integrated in change management projects. IT respondents state data non-transparency and occurrence of incorrect data as risks. The respondents state that shadow IT should be placed under control of the central IT department and integrated into change control processes.

Case C – Only one respondent (from business unit) believes that use of shadow IT does not make a negative impact on DQISAR, whereas the other respondents agree that shadow IT makes a negative impact on DQISAR. They claim that data redundancy is an actual problem, then that data in shadow IT can be out of sync a period of time, and add that activities in shadow IT are performed mainly manually, often resulting in errors. The respondents mention additional maintenance required, less protected data, double work, data accuracy and data loss as risks. The respondents suggest that shadow IT risk could be mitigated by removing weak spots of SAP ERP such as better reports, flow of data, and extraction from SAP ERP, as well as defining requirements at company level and imple-

menting them in SAP ERP, and, finally, training users in work with the SAP ERP system.

4.4.2. Case studies from Serbia

Case D – All business units respondents opine that use of shadow IT does not make a negative impact on DQISAR, and do not see the risks of using them. A respondent from IT department points out that shadow IT solutions are becoming increasingly complex, and require integration into ERP. Integration of these solutions into ERP produces numerous problems and is impossible in many situations, implicating development of a new functionality in the existing SAP ERP system. In the same respondent's opinion, in an ideal scenario, there should be a person dealing exclusively with considering information needs and defining the architecture of a possible solution, or integration of shadow IT into the existing software solutions. However, this task is also delegated to department heads, who cannot have the picture of the whole organisation, leading to numerous problems.

Case E – Two out of four respondents from business units believe that use of shadow IT does not make a negative impact on DQISAR. One of them highlights as follows: "Use of shadow IT does not make a negative impact on data as long as this use is limited at as long as the organisation is not based on them." The other two respondents from business units are of opposite opinion and points out that use shadow IT may make a negative impact on DQISAR. One of them states: "Any software lacking the possibility of following changes is not reliable enough", to which the IT expert replied the following: "The answer is not unambiguous – in some segments, confidentiality, integrity, and availability (CIA triad) are jeopardised, whereas in others, the only possible path, as the dynamics of changes of processes in ERP system is not flexible or cost effective". The respondents mention the following as the greatest risks of shadow IT: data redundancy, jeopardised CIA resulting in increase in errors leading further to incorrect data, inability to integrate processes fully, manual data updates, inability to follow changes. The respondents mention that it would be better to integrate SAP ERP with day-to-day operations and train the employees better. Improved communication between business units and the IT department is the most frequently mentioned way of risk mitigation. A respondent from IT department points out that it is necessary to follow continuously the existing auxiliary applications and understand why they were introduced. The same respondent claims that it is especially necessary to study the financial impact of ERP in large multinational organisations, where one-size-fit-all is not always optimal, as it jeopardizes the business logic of outsourcing, e.g., in this specific example, relocation of production increases profit margin (labour price is lower in Serbia), while using the same class of expensive ERP in Serbia lowers this margin.

Case F – All respondents believe that, to an extent, shadow IT may make a negative impact on DQISAR. One of the respondents states as follows: "Shadow IT do not make a negative impact provided that they are used carefully and in the right way; however, potential problems may occur when somebody does not have adequate knowledge and experience working with auxiliary software." Despite the awareness of the negative impact of shadow IT, the respondents point out that shadow IT are necessary in some areas, as SAP either does not cover them well enough or in terms of adherence to local legislation or some functionalities are too expensive for companies so that they turn to a cheaper solution. A respondent from IT department states: "shadow IT in our company result in the fact that we do not have complete information in ERP, because somebody processes them in an auxiliary tool, and then forgets to save them in ERP as well". The respondents mention most frequently inaccurate data, lack of important data in ERP, threat of leaking important information about the company if a free web tool is used, errors in analysis, data security, manual data updates as risks of shadow IT.

5. Discussion

In the following section of the paper, answers are given to the posed research questions through analysis of empiric research and related work.

5.1. Which are the most commonly occurring forms of shadow IT?

Like in the papers identified in the systematic literature review (Davison et al. 2019; Tajul Urus/Molla, 2016; Tajul Urus et al. 2011; Seethamraju, 2015), most commonly occurring forms of shadow IT, both in German and in Serbian companies, are spreadsheets created in MS Excel. Bearing in mind the fact that MS Excel is used by more than 750 million users worldwide (Excel with Business, n.d.), and that it offers a wide range of possibilities to users, such a result is not a surprise. Despite being approved and installed by the IT department in all companies where the research was conducted, users use it for creating shadow IT. In addition to spreadsheets, MS Access is also used, sporadically approved and installed by IT departments, for own databases. In view of the fact that MS Access is predominantly used by users in IT departments both in Serbia and Germany, it can be concluded that more knowledge generates more shadow IT from MS Access, because background from the ABCs of databases is required (or, at least, desirable). Therefore, the fact that it is also used by business users without adequate IT background can point to the risks of using shadow IT. In addition to MS Excel and MS Access, the following auxiliary tools were also identified in the research: Redmine, IT4U and OpenText. Like in the study conducted by Tajul Urus et al. (2016), it was noticed that shadow IT are used for project management, in the mentioned study they were solutions created in MS Project,

whereas in the conducted research it was Redmine. In view of the fact that SAP ERP has a module for product managements, this points to inadequate knowledge of users about this module, which was also confirmed in the study conducted by Hustad & Olsen (2011).

5.2. What are the reasons (motives) for appearance of shadow IT?

In German companies, in both units (business and IT) there is no unified position on the issue of coverage of their business needs by the SAP ERP system. A minor number of users believe that SAP ERP covers all their business needs, while most business users and all IT users, it is believed that SAP ERP covers between 70 and 80 % of their business needs. The following crystallized as the main motives for building and using shadow IT. Tajul Urus et al. (2011) identified the problem of usability manifested through operability and learnability of SAP ERP, which is also the case with Serbian and German companies included in the empirical research. In numerous studies (Alter 2015; Davison et al. 2019; van de Weerd et al. 2019), it was established that shadow IT often bypass IT implemented systems. Both in Serbian and German companies, lack of necessary reports in SAP ERP and lack of certain functionalities are the reasons for resorting to shadow IT, like in the identified studies (Alraddadi et al. 2018; Seethamraju 2015; van de Weerd et al. 2019; Tambo et al. 2014; Tajul Urus/Molla 2016). Hustad and Olsen (2013) and Malaurent (2011) reached the conclusion that inadequate training in ERP generates shadow IT, which may result in insufficient knowledge of SAP ERP functionalities, which, in turn, may lead to creating shadow IT functionality that already exists in SAP ERP, as confirmed in a study conducted by Kerr & Koch (2014) point out that users mostly create shadow IT to facilitate their own work, which may be induced by slowness of SAP ERP, representing the result of the conducted case study. The possible reasons for using shadow IT identified in Serbian and German companies also include higher familiarity of users with tools for creating shadow IT and inadequate user support. Reasons for turning to shadow IT not identified in the conducted empiric research, but resulting from studies included in the systematic literature review are situations of transition from old to new information system (Davison et al. 2019), overcoming limitations on data entry into the ERP system (Alraddadi et al. 2018; Malaurent 2011; Malaurent/Karanasios 2019), and use of shadow IT in cases when some IT functionalities cannot start operating in the context of some states (in the specific case, China – Malaurent/Avison, 2015).

As well as in German companies, Serbian companies do not have a unified position on coverage of their business needs with SAP ERP. In both countries, the PP module of SAP ERP stand out as the largest generator of use of shadow IT, followed by MM module, which is also the case with the results of studies Kerr & Houghton (2008, 2010). In addition to the above mentioned reasons for using

shadow IT, their generators also include inflexibility of SAP ERP (Koch/Kerr 2014 a, 2014 b), incomplete data, and the high cost of changes and implementation of changes in SAP ERP, which can be substituted by shadow IT, as also stated in the study conducted by Huber et al. (2017 b). The last one is specific of Serbia due to the fact that standards of living, as well as the majority of living costs and business costs are lower in Serbia compared to Germany. On the other hand, maintenance prices of SAP ERP are similar in both countries, which, in some cases, delays the necessary changes of SAP ERP that can be the consequence of either changes in legislative conditions or real business needs.

5.3. What are risks and the suggestions for risks mitigation of shadow IT?

Huber et al. (2017 b) reach the result that shadow IT pose a risk to organisations, which was also confirmed by conducted empirical research both German and Serbian companies. Kerr (2008) emphasises that shadow IT are highly problematic for the organisations because they do not see them as shadow IT. Perhaps this is the reason why it was identified in the conducted empirical research that the majority of business users in German companies do not see any negative impact of shadow IT on DQISAR, but, on the other hand, all IT users are aware of this negative impact. The reason for this attitude of business users can be connected to frequent overconfidence of users (Kerr/Houghton, 2008, 2010; Raković/Sakal/Vuković 2019). The users who are aware shadow IT risks most frequently mention redundancy, inconsistency, non-transparency, inaccuracy, data exposure and possible data loss, which is the result of some papers identified by literature review (Ajer/Hustad 2015; Drum et al. 2016, 2017; Malaurent/Avison, 2015; Tajul Urus et al. 2011). These risks mainly occur because shadow IT are created without appropriate IT control and their manual nature, which, according to Pernsteiner et al. (2018) influences reduction in efficiency and effectiveness. Unlike their German colleagues, business users from Serbian companies are somewhat more aware of the negative impact of shadow IT on DQISAR, whereas in case of IT users there is no difference on this issue in both countries. The above mentioned shadow IT risks also include the inability to integrate business processes, which corresponds to the result of a study conducted Huber et al. (2017 b). Behrens and Sedera (2004) add taking up resources and duplicating effort to the above mentioned risks related to shadow IT.

Hustad and Olsen (2011) established that ERP training of the users is not at an adequate level, that is, that companies have underestimated the process of providing high-quality training. In relation to this, empirical research results point to the fact that the common position within German companies is that mitigation of shadow IT risks can be achieved by adequate training of employees in SAP ERP, and adequate monitoring of their skills, as they often do not know the existing functionalities of SAP ERP so that they naturally migrate to shadow IT

solutions. Also, the employees have to be informed on time about any change in business processes implemented in SAP ERP. Defining new requirements at company level and their implementation in SAP ERP must be systematised, which is a shared attitude both in Germany and in Serbia. In the case of Serbian companies, the suggested direction for mitigation shadow risks is pointing to the potential threats of use of shadow IT, as employees are mostly unaware of shadow IT risks (Kerr/Houghton, 2008, 2010). Furthermore, better communication between IT and business units, as confirmed by the study conducted by Malaurent and Avison (2015), as well as following the auxiliary tools used for generating shadow IT can be activities useful for mitigation of shadow IT risks. As shadow IT is virtually impossible to eliminate from organisations, IT department needs to make a list of approved tools and provide appropriate and adequate training in work with them.

Taking into account all risks identified both in the systematic literature review and in the empirical research, Alraddadi et al. (2018) are definitely on trace of perhaps the best way of managing shadow IT risks, because, recognising that shadow IT is a dynamic process, they recommend that it must be managed continuously.

6. Conclusion

Shadow IT appears in most organisations to either make up for shortcomings of the existing ERP solution, or, simply, do the job faster. Shadow IT should not be viewed as deviant behaviour, as employees chiefly wish to improve their operative efficiency. In other words, shadow IT is not a rebellion, but a need of employees in organisations. However, there is an alarming fact that certain ERP functionalities are doubled in shadow IT solutions, which points to inadequate training of users by ERP. They mostly create shadow IT with MS excel and Access. In addition to lack of certain functionalities in SAP ERP, or simply due to ignorance of the existence and their usage, employees also turn to shadow IT due to insufficient flexibility, bad usability and slowness of SAP ERP, which is, insufficient or inadequate support. What is especially alarming is the fact that business users in a large number of cases are unaware of the risks implicated in shadow IT. They turn to developing shadow IT in tools they do not know sufficiently, but due to their overconfidence they are not even aware of this. The most frequent shadow IT risks actually refer to data, more precisely, to their redundancy, inconsistency, non-transparency, accuracy, exposure and possible loss of data. These risks also include inability to follow changes and interfering with integration of organisation, which represents one of main goals of implementation of ERP systems.

Omnipresence and existence of shadow IT are not questionable, so that it is up to organisations to reduce shadow IT as much as possible, and thereby also re-

duce the implied risk. First, communication between IT and business units must be better, so that gathering new information requests and their implementation must be much more efficient. Due to unawareness of the use of shadow IT, users need to be educated into this direction, as the very awareness of risks and errors can reduce overconfidence an affect their behaviour. It is necessary to identify the tools most commonly used for creation of shadow IT, and if they cannot be eliminated, it is necessary to at least carry out training for their use. What is also desirable is ongoing coordination between business and IT units.

Briefly, findings of unified literature and empirical research can contribute to organisations in terms of awareness of the existence of shadow IT, risks it carries with it, and, finally, possibilities and recommendations for their minimization.

Limitations of the conducted empirical research inherit the features of limitations referring to case study research strategy, such as inductive reasoning (specific-to-general), inability to draw conclusions on causality, and also potential atypicality of organisations and/or respondents in relation to population, which was in this study alleviated with multiple case study type and more respondents. Also, when selecting organisations for the sample in conducting case studies, the authors opted for organisations that agreed to participate in the research, which is why it is relatively small. As for data gathering techniques, interviews were used exclusively, whereas observation, documentation analysis were omitted, which represents a limitation in terms of the quality of the case study.

Future research within the framework of this research subject can be planned in a period of at least three years, when it can be expected that a higher number of organisations will implement and use for a certain time period the "new" SAP ERP from SAP S/4 HANA business suite, where comparative analysis of results of this study and future research could determine the differences in the occurrence of shadow IT and all of its risks.

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Appendix A – Interview scheme

The goal of the interview is to find out your opinion about the ERP system you are using, and whether you use certain auxiliary software tools (shadow IT) to solve everyday business activities (which are not under the direct competence of the IT department).

1. Company type (e.g. production, trade):
2. No of employees in the company:
3. Your workplace:
4. Years of work experience:
5. Which ERP system is used in your company?
6. How long does company use this ERP system?
7. How long do you use this ERP system?

8. Are you satisfied with ERP system that you're using? Additionally, rate the ERP system from 1 to 5.
9. Does the ERP system cover all your needs for daily work assignments? If the answer is negative, to what extent does it cover?
10. What are the most common problems with the ERP system?
11. Do you use some auxiliary software tools (shadow IT) beside ERP system (MS Excel, MS Access, some online tools)? If the answer is negative, go to question no 15.
12. If the previous answer is positive, list them and for each one provide the information is it installed/approved by yourself or IT department, and is it integrated to ERP?

Title of auxiliary software	Installed/approved by	Integration to ERP
MS Excel	IT department	Data integration
MS Access	myself	Function and data integration
...		

13. What are the reasons for use of auxiliary software tools?
14. In which ERP modules there is a largest need for the use of additional (auxiliary) software tools.
    - Materials Management (SAP MM)
    - Production Planning (SAP PP)
    - Logistics Execution (SAP LE)
    - Quality Management (SAP QM)
    - Sales and Distribution (SAP SD)
    - Plant Maintenance (SAP PM)
    - Customer Services (SAP CS)
    - Project System (SAP PS)
    - Financial Accounting (SAP FI)
    - Management Accounting (SAP CO)
    - Human Capital Management (SAP HCM)
15. Do you think that use of auxiliary software tools has negative influence on data quality and integrity, security, availability and redundancy? If the answer is positive, please explain how.
16. In your experience, what are the risks of auxiliary software tools usage in the company?
17. In your experience, what do you suggest for the risk mitigation of auxiliary software tools usage in the company? How the usage of auxiliary software tools usage in the company can be minimized?