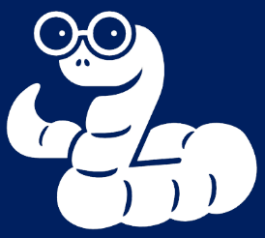

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Reliability of information systems in organization as a factor shaping organizational culture

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Reliability of information systems in organization as a factor shaping organizational culture[1]

Abstract: This paper is devoted to analyze the potential relation between IS reliability and organizational culture. Based on the literature review, the research gap is identified and hypotheses concerning potential role of IS in shaping organizational culture are proposed. The community-oriented culture is proposed as potential direction of culture reorganization. The hyphotesys are verified based on the empirical research performed in 2017 among 400 organizations in Poland. Research results indeed confirmed that IS can be considered as one of the factors shaping organizational culture. However, the direction of its change appeared to be different than the one presented in the current literature.

Key words: information systems, IS reliability, organizational culture
JEL: M14, M15

1. Introduction

Information systems (IS) reliability is a notion directly embedded in the user experience with the IS in organization and a new framework that allows for the more meaningful analysis of IS in organization, which elides the outdated question: "Is the organization using an IS" and assumes question, which is more meaningful for modern organizations "Is the IS used in our organization good enough?". On the one hand, with the increase of IS reliability, there is an increase in employees' conviction that it will be beneficial for the organization and employees themselves to use it. On the other hand, with the increase of IS reliability, its influence on the organization is more profound. Due to the fact that IS reliability is so closely connected to the employees and their role as an IS users, it seems to be important to determine what is the actual influence of IS and its reliability on those employees.

This paper is devoted to analyze the potential relation between IS reliability and organizational culture as one factor closely correlated with employees, their work environment and potential performance. It addresses a research gap in the literature, which widely characterize the ways in which organizational culture influences the IS in organization, but often disregards the fact that the opposite relation is also true and IS may be a factor influencing the culture in organization. It is crucial to determine whether the IS reliability influences the employees enough to shift the organizational culture due to caused reorganizations. Therefore, the main aim of this paper is to identify the relation between the type of organizational culture in the organization and the level of IS reliability and based on that conclude what may be the

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potential influence of IS reliability on organizational culture, and because of that – on the employees.

2. IS reliability in organization

Organizations are managing a diverse portfolio of information systems (IS) applications (Cummins, 2002) that are building the IT in organization. Therefore, the notion of IT reliability connects directly to the concept of IS reliability and IT in organization simply consists of all IS in this organization. That is why in many publications those two acronyms are used interchangeably. However, it is important to underline at the beginning that reliability of IT or all IS in organization is a different concept than reliability of software or hardware, which are notions well known and broadly discussed in literature (Banker et al., 2002). Hence, it is crucial to not confuse it with those embedded directly in computer sciences, which do not include the IT management standpoint. And this standpoint is a crucial part for obtaining and retaining a competitive advantage from IT use in organization.

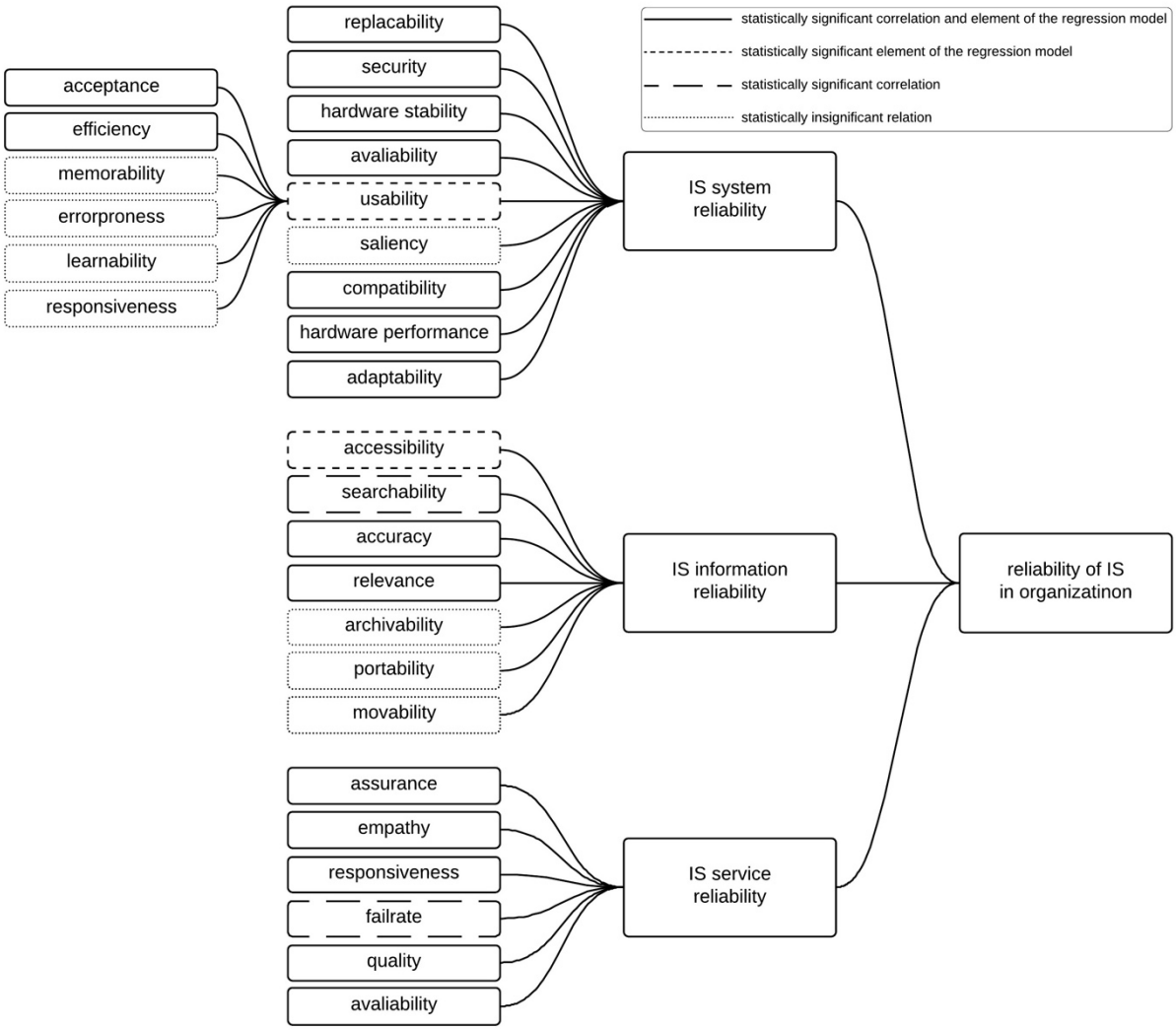

Figure 1. Model of reliability of IS in organization

Therefore, reliability of IS in organization is understood as measurable property of IS, useful for its control and management, identifying its quality level and pointing out potential problems (Zahedi, 1987) and it is directly linked to the efficiency of IS components, especially those critical to its proper operations. Therefore, it can be said that IS reliability in organization is a notion build by factors connected to 3 different IS theories. First one is DeLone and McLean success model DeLone & McLean, 2003), second one is Lyytinen (1987) 4 types of IS failure and third one is TAM model (Davis, 1985). Therefore, in order to fully develop the notion of IS reliability it is crucial to identify factors that are constructs for each of 4 identified variables proposed in the IS reliability model (see Fig 1). To identify all of them, the search of articles published from 2000 to 2018, with key words "IS in organization", "measurement" was conducted with EBSCO and ProQuest databases. From all available publications, those concerning lists of factors describing IS in organization were purposefully selected. Based on those research (Niu et al, 2013; Palmius, 2007; Finne, 2005; Irani, 2002), all factors potentially related to IS reliability in the cotext of above-mentioned 3 IS theories were identified and assigned to proposed 4 variables (Niu et al, 2013).

Model of IS reliability in organization has been developed, detailed description is published by Tworek (2016) and it is presented on Figure 1. The reliability of IS in organization consists of 4 factors: reliability of information included in IS in organization, reliability of support services offered for IS in the organization and reliability of system itself, which also includes the usability of this system. Each factor is built by series of items, listed on Figure 1.

Moreover, based on the results of model testing, it can be said that reliable IT in organization is characterized as (Tworek, 2019):

- IT, in which all ISs have a short response time, high availability connected with high security. However, the security should not be strained by the need for the availability.
- IT, in which information is easily accessible, and the accuracy of them is guaranteed.
- IT, is in which all ISs are accepted by its users and easy to use.
- IT, which has a responsive and available support services.

The model is the basis for measurement scales created for IT reliability analysed in this study. The corresponding items for measuring the IT reliability are presented in Appendix 1.

3. Organizational culture and IS reliability

There is a growing number of studies concerning cultural issues in the literature covering the field of information systems (IS) over the last several decades (Jackson, 2011; Leidner & Kayworth, 2006). Organizational culture is usually listed as an important factor in the success or failure of information systems (IS) in organizations (Jackson, 2011). However, it can be said that even though those studies concern several different aspects of IS in organization (development, adoption, use, management etc.), almost all of them concern in some way the notion of IS reliability stating that organizational culture somehow influences the user experience with the IS. The table 1 shows chosen research articles concerning 4 aspects of organizational culture relation with IS in organization. Authors name several main conclusions, all related to the fact that there is a need to find and "IS-culture" fit in every organization (Leidner & Kayworth, 2006).

First of all, it is not clear which type of culture will be the best choice for organizations trying to maximize their experience with IS use. Tomlin (1991) expressed his opinion about the concept of cultures oriented on information. Grover et al. (1998) concluded in previous century that cultures oriented on planning are better for organization using IS. Harper and Utley (2001) suggest that organizational cultures that are oriented on people are known to create better environment for IS adoption, use and management that those oriented on production. However, Kanungo et al. (2001) stated, that organizational cultures oriented on tasks are even better from the perspective of IS in organization, suggesting that besides from that, cultures oriented on innovation are the best choice for organizations, which underline the importance of IS.

Second of all, it is not clear which culture values should be present in the organization in order to maximize the experience with IS use.

Table 1. Literature review concerning relation between organizational culture and IS

Main topic	Source	Main conclusions
Organizational culture and IS development	Ngwenyama & Nielsen (2003)	The success of IS development is connected with the fact that cultural values build into the development methodologies should be shared by both development team and main client.
Organizational culture and IS adoption	Jackson, S. (2011) Huang et al. (2003)	Those employees, who are less comfortable with the uncertainty and have the tendency to avoid it will be less likely to adopt new IS in organization. The employees are more likely to adopt new IS in organization when their values are shared by the concept of this IS system and the system itself.
Organizational culture and IS use	Doherty & Doig (2001) Kanungo et al. (2001) Baitahazard & Cooke (2003)	There is a particular set of culture values, which is shown in organizations, which present higher user satisfaction and higher efficiency of IS use.
Organizational culture and IS management	Kaarst-Brown (1995)	There is not a lot of studies concerning this topic (Leidner and Kayworth, 2006) and usually they are focused on values and actual use.

However, those literature findings may be considered as a source of important question. Is it clear that the adopted organizational culture influences the IS in organization (and its success) or maybe this relation works both ways? There are some authors suggesting that IS in organizations changed the nature of task implementation in every company in such a profound way, that it should be consider as a main factor influencing the social changes in organization (Crowston, 2000; Cecez-Kecmanovic et al., 2014).

Considering the statement of Crowston (2000), that IS first and foremost impact on every organization is caused by the fact that it reorganizes the communication channels within the organization (making it easier for employers to communicate directly) it seems logical to assume that this impact causes the shift in organization culture. More confirmation can be found

while considering other aspects of IS influence on organization, such as (Crowston, 2000; Tworek, 2012):

- Reduction of the number of administrative employees and middle management employees mainly caused by a more efficient exchange of information.
- Increase of self-reliance due to better access to information among employees using IT, which contributes to the increase of the average span of management.
- Increase of information synergy on the lower levels of management, which leads to the situation, in which employees are better equipped to make the right decisions in place, in which the problem arises.
- Willingness among managers to delegate decisions to lower levels of the hierarchy due to the fact that employees acquire additional skills and knowledge while using IT.
- Emergence of intelligent formalization effect, which allows employers to communicate and exchange information in codified way, which at the end contributes to unification and organization of documents and procedures.
- Reduction of negative effects of specialization due to work enrichment and increased self-reliance of employees.

It is clear that with the increase of IS reliability, employees become more inclined to use the IS and the potential influence it has on organization is bigger (Tworek, 2019). Since the influence is directly linked to the employees' role and tasks performed in the organization, it may be assumed that IS reliability has the potential to impact factors related to the employees. One of those factors if organizational culture. Hence, it may be concluded that IS reliability may be somehow correlated with the type of organization culture or it may even influence the shift in organizational culture.

The direction of this shift is partially suggested by the researchers analyzing the relation between organizational culture and IS in organization, listed above (Kanungo et al., 2001; Leidner and Kayworth, 2006). As mentioned, the authors are suggesting that the best fit for organizations, which want to benefit from IS, are cultures, which enable employees to be innovative, cooperate and give them flexible work environment.

Hopej et al. (2017) are proposing the organizational structure continuum based on few typical culture dimensions. On the one end of this continuum there are top-down cultures, where power, decisions, knowledge and culture itself is disseminated from the top of the organizational hierarchy to the bottom of it and on the other end there are bottom-up cultures, disseminated from the bottom of the organizational hierarchy. The community-oriented culture, according to Hopej et al. (2017), is one of the extremes of proposed continuum. It is a type of culture which favors the development of cooperation between employees. It could be even characterized as "bottom-up cooperation" or "self-organization". This culture is based on the assumption that employees have a natural predisposition to cooperate. Banker (2011) is discussing the "gene of cooperation" together with the brief overview of the latest experiments. He suggests that people have a tendency for a "natural collaboration", which can be perceived as the third pillar of evolution, next to mutation and natural selection (Nowak, 2006). Hence, this kind of organizational culture seems to be a logical goal for organization, which wants to gain competitive advantage from using IS and gain advantage from positive influences the IS has organization. Not only because IS influence on organization concerns the reorganization of

communication channels in order to establish platforms for mutual cooperation of employees, but also because it gives employees the substantial validation of their role in the organization and empowers them to use the decision-making and knowledge sharing opportunities that reliable IS is giving them. Therefore, it may be concluded that reliable IS, which reorganizes the communication channels and workflows in organization may be also a factor enabling the organization to assume the community-oriented organizational culture.

Therefore, based on the literature review and own reasoning presented in this paragraph, two hypotheses arise:

Hypothesis A: The IS reliability is one of the factors influencing the organizational culture.

Hypothesis B: The more reliable the IS in organization, the more community-oriented culture.

Those hypotheses are the form of an answer to the previously formulated question: yes, the IS reliability may also influence the organizational culture, not just the other way around. Those hypotheses will be tested in order to verify the actual relation between the organizational culture and IS reliability in organization.

4. Research Methodology

The survey was conducted in order to identify the level of IS reliability in organization, organizational culture type (based on the community-oriented culture concept) and contextual variables (manufacturing technology, strategy, environment). The pilot survey was conducted in 2017 among the group of 100 organization, indicating the issues concerning ambiguity of several questions. It led to the collection of random answers given as a response for those questions. They were rewritten in order to obtain the more reliable results, ensuring the informed response from the respondent. The main survey was conducted later in 2017, among small and medium (SME) organizations located in Poland, using online survey service: SurveyMonkey. Only one survey was carried out in one organization. The research was anonymous. Efforts had been made to make sure that the questionnaire was filled in by employees who have a broad view of the entire organization. The statistical population (SME operating in Poland) is finite, but very large. 400 valid responses were collected. Since the responses were collected using properly prepared form, the online system counted only those fully and correctly filled in.

Respondents were asked to evaluate the IS in the organization based on the list of factors using the Likert scale (from very poor to very good with the middle point: fair). They were asked for the general opinion concerning reliability of system, usage, information and service, and then they were asked to evaluate each factor constructing those 4 variables. Using a Likert scale to measure IS reliability seems to be an appropriate choice. First of all, reliability of IS in organization is a subjective notion. Employees own perspective and opinion concerning aspects of IS reliability is the best source of knowledge, since their perception matters the most, that is because IS influences the organization mainly through its potential to influence every-day work of the employees. Quantitative methods are commonly used to assess the software and hardware features linked to the reliability. However, they do not give the information concerning the actual perception of this notion within the organization.

Respondents were also asked to evaluate the organizational culture type based on the list of factors describing the community-oriented culture. The question concerning the contextual variables were based on the standard questionnaires used for each of them. Appendix A presents all items relevant to the subject of this article analyzed during this research.

4.1. Research Results

The statistical analysis performed to verify presented hyphotesis was based on several variables. IS reliability was measured using items forming IS system reliability, IS information reliability and IS service reliability. Overall IS reliability measure was also used for some statistical tests. Items characterizing organizational culture, structure, manufacturing technology and environment were also formed. The aalfa-Cronbach nalysis of scales were perfomed, confirming that scales for each variable were chosen correctly (see Table 2).

Table 2. Alfa Cronbacha analysis of scales

Variable	Alfa-Cronbach
IS System reliability	0,967
IS Information reliability	0,931
IS Service reliability	0,941
IS Usage reliability	0,984
IS reliability	0,931
Organizational structure	0,824
Organizational culture	0,709
Environment	0,813
Manufacturing technology	0,762

As a first step, correlation analysis was performed and is presented in Table 3. The analysis shows that there is a statistically significant correlation between reliability of IS in organization and organizational culture. However, considering the formation of each scale, it should be underlined that the correlation is a negative one. It means that the increase of IS reliability in organization causes a decrease of the characteristics, which are building the culture variable.

Table 3. Spearman correlation between variables

		Structure	Culture	Environment	Manufacturing technology
IS reliability	r	-,334**	-,671**	-,303**	-,383**
	p	<0,01	<0,01	<0,01	<0,01

r- Spearman correlation; **p**- significance level **r**; ******- corelation significant on the level of p<0,01

Next, in course of regression analysis, 5 models were obtained (see Table 4). The models were obtained for organizational culture as a dependent variable and IS reliability and contextual variables as a independent ones. The best fitting model was obtained for IS system reliability, manufacturing technology and structure (corrected R2 = 0,552 which means that

those variables explain more than 50% of organizational culture variance) and is presented in table 5. It is worth noting that similarly fitting model was obtained using those variables together with IS information reliability, which means that this aspect of IS reliability does not have a meaningful role in explaining the organizational culture variance.

Table 4. Regression models for organizational culture

Model	Predictors	R	R^2	Corrected R^2	Standard error
1	information reliability	,543[a]	,295	,293	,53380
2	information reliability, structure	,719[b]	,517	,515	,44233
3	information reliability, structure, manufacturing technology	,737[c]	,543	,539	,43100
4	information reliability, structure, manufacturing technology, IS system reliability	,746[d]	,557	,552	,42485
5	structure, manufacturing technology, IS system reliability	,746[e]	,557	,553	,42432

Table 5. The most fitting regression model for organizational culture

	Coeff.	*Standard error*	*t Stat*	*P Value*
Constant	2,093	,111		18,790
Structure	,345	,042	,364	8,137
Manufacturing technology	,185	,040	,210	4,667
IS system reliability	-,313	,021	-,498	-14,830

Hence, the results of the regression analysis confirm that at least one aspect of IS reliability (IS system reliability together with usage reliability) has statistically significant influence on organizational culture. To further confirm this conclusion, the MCA analysis was performed (see Table 6). For each variable, results were categorized based on standardized distribution into the Lower and Higher category. The results shown in Table X confirm that lower levels of IS reliability has high discriminatory power over lower levels of organization culture, and the same can be seen for higher levels. Hence, it confirms that indeed, IS reliability influences the culture in organization.

Table 6. MCA analysis of relation between IS and organizational culture

		Coordinate 2	Coordinate. 2	Quality	**R:L** Discriminatory power	R:H
IS reliability	4.6:L	-1,23783	-0,407095	0,637454	**0,906**	0,097
	4.6:H	0,46471	0,152834	0,637454	0,081	0,894

4.2. Discussion

The obtained results are sufficient for the verification process of the proposed hypotheses. Hypothesis A, which stated that the IS reliability is one of the factors influencing the organizational culture was confirmed. There were three sources of this confirmation. First one was correlation analysis, which confirmed that there is a relation between those two notions, however cannot be used to confirm the cause-effect relation. Second one was regression analysis, which confirmed that part of items characterizing IS reliability in organization – IS system reliability together with IS usage reliability – is a statistically significant independent variable in the obtained, fitting model for organizational culture. Third one was an MCA analysis, which clearly confirmed that IS reliability as a whole concept influences the organizational culture. Based on all that, it can be assumed that IS reliability, especially the reliability of system itself and the employees' perception of its use, is an important factor, which together with organizational structure and manufacturing technology influences the culture in organization. Therefore, the obtained results remain in line with views presented in literature and mentioned earlier, that IS has the ability to influence and shape the organizational culture.

Moreover, the confirmation of the first hypothesis allows for the cognitive logic process to go further to the verification of the second hypothesis. Hypothesis B, which stated that the more reliable tis he IS in organization, the more community-oriented is the culture was disproved. It is mainly based on the correlation and regression analysis. The correlation analysis clearly showed that the statistically significant correlation between IS reliability and organizational culture is negative (and the same occurred for every element of IS reliability: IS system reliability, IS usage reliability, IS information reliability, IS service reliability). It shows that the increase of IS reliability in organization is correlated with the decrease of the organizational culture characteristics. Looking at the items building organization culture variable (Appendix A), it can be concluded that decrease of them is means that organizational culture is becoming less community-oriented. Therefore, it is a sufficient basis for disproving the proposed hypothesis and for concluding that the more reliable is the IS in organization, the less community-oriented culture is shaped in it. This conclusion is based also on the fact that Hyphotesis A was proven to be correct and it gives credence to the discussion concerning the nature of the confirmed relation between IS reliability and organizational culture.

5. Conclusions

The performed empirical research clearly shows that there is indeed relation between organizational culture and IS in organization. Moreover, it seems that the proposed research covers to some extent the identified theoretical gap. That is mainly because the research confirmed that IS reliability has the ability to influence culture in the organization. The role of IS system reliability, together with IS usage reliability was proved to be especially important in the context of organizational culture. Those two elements building the IS reliability are closely related to user experience with the IS. It confirms the initial thought that IS reliability influences employees in the organization based on the mechanisms identified in the second chapter of this paper, which may even cause the shift in organizational culture.

The most interesting part of the conclusions, that arose from the research is the direction, in which IS reliability shifts the organizational culture. Based on the analysis, it can be concluded that it shifts the culture to solutions associated with top-down cultures, where power, decisions, knowledge and culture itself is disseminated from the top of the organizational hierarchy to the bottom of it. This conclusion is in the opposition to views presented in most literature findings. However, it is not without merit and may be closely connected to the confirmed mechanism, which causes IS in organization to change the information and communication flows and causes them to be more efficient, has more bandwidth and be more reliable. All that suggests that it is easier and faster to disseminate power, knowledge and decisions throughout the entire organization when there is a reliable IS in it. It can be also seen as a proof that IS can influence an organization in many ways and many directions. The mentioned quicker propagation and deeper penetration of information throughout the organization may indeed influence the shift in organizational culture. However, it is important to underline that the shift is not necessarily directed at allowing the employees to use their natural predisposition to cooperate – proposed at most research findings. It but may be also directed to the more centralized organizational solution. This assumption can be further confirmed by the analysis of the role of structure – a contextual variable, which was also a statistically significant variable in the regression model. It is also negatively, statistically significantly correlated with IS reliability, which confirms that the increase of centralization is connected with the increase of IS reliability.

It is important to underline that presented research has limitations. They are based on the sample of 400 organizations operating in Poland and further verification in different business contexts is required. Moreover, only one aspect of organizational culture was tested. Although the research presented here is a solid first step in the process of verification of the relation between culture and IS reliability, different organizational culture types should be considered next. It should be done taking into account the obtained results and next research design should include not only bottom-up cultures, preferred in modern literatures, but also their opposites. However, it can be concluded that obtained results are a solid addition to the field of study concerning relation between IS in organization and organizational culture and are presenting point of view not yet present in current literature.

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