Degree of Digitalization and Citizen Satisfaction: A Study of the Role of Local e-Government in Sweden

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Abstract: The aim was to investigate whether there is a relationship between degree of e-government in Swedish municipalities and perceived satisfaction among citizens generally. This is a large-scale quantitative study based on valid and reliable Swedish national surveys. Based on these surveys, a new comprehensive index for measuring "degree of digitalization" was constructed. Citizen satisfaction was measured using established indices covering three dimensions: satisfaction with living in the municipality, satisfaction with performance of government activities (delivered services), and satisfaction with transparency and influence. The results show that there is a relationship between the degree of digitalization in a municipality and the perceived satisfaction among its citizens. The degree of digitalization is related to all three dimensions of citizen satisfaction. Additionally, this study indicates that the strength of this relationship is in parity with or even stronger than the relationship between citizen satisfaction and other crucial factors such as educational level and median income.

Keywords: degree of digitalization, satisfied citizens, local e-government, municipality, Sweden

1. Introduction

E-government is supposed to increase administrative effectiveness as well as bring benefits such as promotion of democratic values and inclusion of citizens (e.g. Bannister and Connolly, 2014; Cordella and Bonina, 2012). In the digital era the use of information technology (IT) has the potential to improve the quality of public service, and successful implementation of IT in local government (e-government) has been reported in a number of studies (e.g. Gil-Garcia and Pardo, 2005; Yun and Opheim, 2010; Bernhard, 2015). IT can be used by municipalities to more efficiently provide up-to-date information to residents, potential residents and visitors. E-government also involves offering many municipal services online, with easy access outside regular office hours. According to the Swedish Association of Local Authorities and Regions (SALAR, 2014), efforts to support, encourage and inspire the mutual relationship between the municipality and its citizens include implementing a variety of technology-enabled services, such as apps, websites and various tools for citizen dialogue. In general such tools are meant to improve transparency and accountability, and to increase citizen participation in administrative and political processes (Pratchett, 1999; Dimitriu, 2008). According to Demchak et al. (2000) and Kim et al. (2005) this might consequently increase trust and citizen satisfaction with local governance.

Use of IT to deliver e-government services does not specifically address citizens' quality of life (Fischer, 2015). Instead the focus is still on "pushing" these e-government services to citizens, thus failing to accommodate current and future societal challenges in an innovative way (Susskind and Susskind, 2015; Fischer, 2015). Local government must strive to be administratively efficient, while continuing to provide essential public services to all (Bertot et al., 2016).

Arguably, the quality of e-government implementation needs to be better understood in relation to what value citizens perceive in the overall transformation of local e-government efforts (Bannister and Connolly, 2014; Axelsson, et al., 2013), i.e., in terms of quality of life. Quality of life covers a broad range of issues such as economic welfare situation, job quality, health status, civic engagement, governance, public safety and leisure (OECD, 2013). Many of these important factors are local, that is, they are related to the citizen's particular municipality and its governance. Our society is being "digitalized" and sectors crucial to our quality of life are taking advantage of its opportunities, e.g. education (e-learning) and health (e-health). In the same manner, governance is turning into e-government. Naturally, an important research question is to study the benefits from this digitalization, i.e., whether e-government is a change for the better. Many stakeholders could benefit from digitalization, and such gains could be assessed in terms of productivity and efficiency. We

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argue, however, that the most important stakeholders in local governance are citizens, and benefit should be measured in their perceived quality of life. Consequently, it is of great value to find the answer to the question: Is there an association between the degree of e-government and citizen satisfaction?

Thus, in this article we focus on the relationship between government and citizens. E-government has the potential to improve three dimensions of importance for citizens. Firstly, e-government has the possibility to improve information, awareness and guidelines regarding "general living conditions," e.g. schools, infrastructure and leisure activities. Secondly, many of the *services* that citizens expect could be digitalized and offered "24/7" (e.g. Nam, 2014; Mergel, 2013). Thirdly, *transparency and influence* could be increased by using digital technology and social media. Transparency and influence refer to the process of opening up government activities and decision-making processes to public scrutiny and creating spaces for citizen deliberation and discussion (Bertot, Jaeger and Hansen, 2012; Charalabidis and Loukis, 2012; Ellison and Hardey, 2013).

The relationship between e-government and citizens' perceived satisfaction is particularly interesting to study at the local level. In Sweden the municipality is the level of government with the closest, most immediate relationship to citizens, in the geographical location in which citizens live and spend most of their time (Bernhard, 2015; 2014a; 2014b; Briggs, 2008). Changes in local governmental activities or services might directly affect citizens' everyday quality of life in a number of important aspects.

Given these potentials with local e-government, an important overall concern is to what extent these efforts pay off in terms of greater citizen satisfaction. Is it worth the effort to develop and adopt e-government services? To our knowledge, there is no previous research that actually demonstrates that municipalities' efforts with digitalization are related to citizen satisfaction at large. Our point is that e-government should strive for higher, more innovative and important aims such as providing products and services that are developed based on the needs and requests of citizens, local democracy and increased civic engagement. Certainly a great challenge of the digital age is to find out how people-centered IT can be used to improve quality of life ((Fischer, 2015).

In this paper the aim is to study if there is a relationship between degree of digitalization in municipalities and perceived satisfaction among citizens at large. The degree of digitalization will include the following four aspects: Does the municipality work strategically with e-government?; Does the municipality provide information and enable transparency? Does the municipality provide e-services? Does the municipality provide possibilities for interaction, i.e., digital forms of participation? These aspects are also highlighted in the United Nations E-Government Survey (United Nations, 2016). The variables included in our operationalization of the degree of digitalization are however more explicit measures of the current state in the municipalities.

As pointed out above, local governance affects our everyday lives and a broad range of issues important for our quality of life. Citizen satisfaction can be categorized into three different dimensions according to a well-established national model. With the arguments given above regarding promising potentials with digitalization, we hypothesize that the degree of digitalization is related to all three dimensions (shown in italic below):

Firstly, e-government enables the possibility to inform citizens about what it is like to live in the municipality. This may include leisure activities, schools, housing, public safety, commerce and transportation, i.e., living conditions important for citizens' everyday quality of life. If digitalization could enhance information and market the merits of a municipality, we theorize that citizen satisfaction should potentially increase. Thus our first hypothesis is:

H_1: The degree of digitalization is positively related to how satisfied citizens are with *living* in the municipality.

Secondly, we are accustomed to online services such as shopping, filing taxes, buying tickets, and finding information, and now more or less expect services with 24-hour online access. Citizens expect municipal information and services to be available when needed, which makes continuously updated information and online services essential. Furthermore, digitalization enhances the possibility of keeping citizens updated regarding services provided and public safety efforts. The municipality can also respond to complaints and show graphically how they have solved problems and made improvements. The municipality could also use

social media as an accessible forum to promote and explain specific services, e.g. how to recycle, which may lead to improved functionality and usage. In sum, digitalization makes it easier for the municipality to describe and visualize its provided services and efforts, i.e., its *performance*. Therefore, our second hypothesis is:

H_2: The degree of digitalization is positively related to how satisfied citizens are with the *performance* of government activities – delivered services.

Thirdly, e-government enables a higher degree of transparency and openness, which are important factors for trust and democratic values, and therefore the third hypothesis is:

H_3: The degree of digitalization is positively related to how satisfied citizens are with the *transparency* of and the *influence* they have on their local government.

To study these hypotheses we use a large-scale quantitative study based on valid and reliable national surveys, including the vast majority of Swedish municipalities. We will develop an index for measuring the degree of digitalization (DoD) and analyze potential correlation to the indices measuring citizens' perceived satisfaction following the dimensions given above. Ultimately this study may offer evidence-based relationship between municipalities' efforts with digitalization and citizen satisfaction at large.

2. Related Research

There is currently a perceived need to rethink the relationship between government and citizens (Mossberger et al., 2013; Bonsón et al., 2012; Bernhard, 2014b). In recent years municipalities have succeeded in making administration more efficient in their efforts towards 24-hour services. These developments have led to more interactive services with online access, connecting citizens with the municipality in a more mutual relationship (Yun and Opheim, 2010; Meijer and Bekkers, 2015; Reddick and Anthopoulos, 2014; Bélanger and Carter, 2012) However, research indicates that it is important to know what citizens perceive as important or valuable in the overall transformation of local e-government (Bannister and Connolly 2014). Helbig et al. (2009) stress that current e-government research needs to discuss "effects related to the recursive relationship between social, organizational, political and technical factors with respect to the success and failure of projects" (p. 5). The authors, referring to Orlikowski and Iacono (2001), suggest that "e-government is thought of as enacted by complex relationships between social actors and the context in which they are embedded" (Helbig et al., 2009:92). Bernhard (2014b) has developed an actor-oriented triangle of e-government in general based on Grönlund (2005) and Giritli Nygren and Wiklund (2010). It illustrates three key actors and their relationships and activities that are to be performed. The relationships are e-democracy (relationship between the electorate and the elected, i.e., the political interplay and communication of citizens and elected officials), e-services (in the relationship between public administration and citizens, firms and other organizations), and e-administration (for the internal usage of information technology tools within governmental organizations to provide reports and support for decision-making).

Previous research indicates potential for digitalization of local governance (e.g. Bernhard 2014b; 2015; Bonsón et al., 2012; Bonsón, Royo and Ratkai, 2015). In recent years digitalization initiatives that focus on citizen participation and e-democracy are emerging both in practice and in the scholarly literature. The use of digitalization for citizen participation – or e-participation – is believed to motivate and lower the barriers for citizens to access and engage in government policy decision-making (Mossberger, Wu and Jimenez, 2017). E-participation is important in order for the government to be relevant to citizens and to build trust. To be relevant government has to be responsive to citizens' needs and wishes, for example by opening up spaces such as social media channels to gauge opinion and promote discussion (Ellison and Hardey, 2013; Bonsón, Royo and Ratkai, 2015). Monitoring online platforms beyond governments' own platforms, becomes an important task for the municipalities since it is on those platforms much civic discussion and collaboration takes place (Medaglia and Zhu, 2017).

Linders (2012) talks about a trend that goes from e-government (citizens as customers) to we-government (citizens as partners). That means transformation of the role of government as a provider of services, to a partner that enables citizens and organizations to create services, applications and content by themselves, independent of direct contact with local e-service providers. This can be done by opening up networking opportunities for different users and user groups where they can meet and collaborate. The concept of we-

government also implies a shift in responsibility. In we-government citizens are equally responsible for the development of government and they are equally responsible to engage in the relationship with the government in order to be informed and take advantage of possibilities related to their own and others' quality of life (Linders, 2012).

A major problem faced by government leaders globally is lack of citizens' offline as well as online participation (Mossberger, Wu and Jimenez, 2017) which may be a democracy problem. Hence, there are many expectations and promising formulations about how to achieve democratic values but there is no evidence-based research that fills the gap of such research and developments (Giritli-Nygren and Wiklund, 2010). Nor is there any substantial research on the effect of e-democracy for citizen satisfaction (Khan et al., 2012; Dixon, 2010). Furthermore, we can identify a gap of connecting e-government with real facilities and structures in order to improve actual quality of life. Matters and possibilities relevant to everyday quality of life raise the potential motivation to participate in a discussion with local government (Simmons, 2014; Wang and Wan Wart, 2007; Taylor-Smith and Lindner, 2010), and this feedback is crucial for government agencies to fulfill their ambitions (Bertot and Jeager, 2008; Ellison and Hardey, 2013). Hence, more research is needed that brings together the perspectives of government and citizens respectively, in order to understand how e-participation can be conceptualized and adopted.

3. Research Setting and Design

The study is conducted in Sweden. The Swedish multi-level government system is based on national, regional and local/municipal levels. Local government is the level closest to citizens in terms of public services, and together with regions and counties accounts for about 70% of all citizen contacts (SALAR, 2011). This implies a challenging position between the regulations of the central government and demands of citizens. There are 290 municipalities in Sweden, each with strong constitutional autonomy (Montin, 2007). This aims to relate democracy and public administration to local distinctiveness and the interests and ideas of citizens. Trust in local government is promoted by being inclusive, open, accessible and anchored in the local culture (Erlingsson and Ödalen, 2013; Montin, 2007).

In recent years, access to the Internet among Swedish inhabitants has been stable (and high), with just over 90% use in 2015 and 2016. However, even if the digital divide has been reduced, about 7% (630,000 people in 2016) of the Swedish population does not use the Internet (Davidsson and Findahl, 2016). Most of these are elderly, although other reasons not to use the Internet are lack of interest and complicated technology. The use of social media has increased over the past six years and was 77% in 2016 (Davidsson and Findahl, 2016). According to the United Nations survey Sweden ranks number six regarding the E-government Development Index and number 27 regarding the E-Participation index, out of 193 countries (United Nations, 2016).

3.1 Study Design: Using Secondary Data

This is an observational study, conducted in 2017, based on the following three Swedish different secondary data sources:

- Citizen Satisfaction Survey (SCB, Statistics Sweden), data from 2011-2015.
- Survey: "E-services and apps" (The Swedish Association of Local Authorities and Regions, SALAR, 2014)
- National Survey on Democracy (SCB, Statistics Sweden) (2012)

3.1.1 Measuring Citizen Satisfaction

Satisfaction among citizens is studied in a national survey which is performed twice annually by Statistics Sweden. The number of randomly selected individuals per municipality is usually 600 in smaller municipalities and 1200 in larger municipalities. The survey normally includes roughly 130 municipalities out of the 290 municipalities in Sweden. Some municipalities participate nearly every year, while other municipalities never participate. We gathered data from the surveys conducted from 2011-2015 and included the latest completed survey for each municipality during this time period. Altogether we have included 239 municipalities from this survey. The survey is comprehensive and includes a large number of questions. The complete survey and the underlying model is based on research developed by the marketing authority Claes Fornell, who developed the Swedish Customer Satisfaction Index (Fornell, 1992) and the widely used American Customer Satisfaction Index (Fornell et al., 1996). These indices are developed using multiple-item scales and partial least square

analysis. The indices are mainly composed of three items (questions) each. In this study, we include the three main indices included in the national survey. The first index measures "satisfaction with living in the municipality," the second "satisfaction with performance of delivered government services" and the third "satisfaction with influence on and confidence in governance." All indices are based on three items as described below. The calculations of indices and transformations of scores as described below were already done by Statistics Sweden.

Satisfaction with living in the municipality
This index is based on the following three question:

1. Overall how satisfied are you with living in this municipality? (Score from 1-10).
2. How well have your expectations about living in this municipality been fulfilled? (Score from 1-10).
3. Imagine the ideal municipality. How close to such an ideal do you think your municipality is? (Score from 1-10).

The index is constructed using the average score of the three questions above, and this average is then transformed to a scale from 0-100, according to the following:

Score	1	2	3	4	5	6	7	8	9	10
Index	0	11.1	22.2	33.3	44.4	55.6	66.7	77.8	88.9	100

For instance the scores 4, 5 and 6 would give an average of 5 and thus an index equal to 55.6. This index will henceforth be referred to as the Satisfaction with Living Index (SLI).

Satisfaction with performance of government activities
This index is based on the following three questions:

1. Overall how satisfied are you with the performance of government activities (delivered services)? (Score from 1-10).
2. How well have your expectations about performance been fulfilled? (Score from 1-10).
3. Imagine the ideal municipality. How close to such an ideal do you think your municipality performs? (Score from 1-10).

This index will hereafter be referred to as: Satisfaction with Performance Index (SPI) and it is calculated in exactly the same manner as SLI.

Satisfaction with transparency and influence
This index is based on the following three questions:

1. Overall how satisfied are you with the transparency and influence you have as a citizen in this municipality? (Score from 1-10).
2. How well are your expectations about transparency and influence fulfilled? (Score from 1-10).
3. Imagine the ideal municipality. How close to such an ideal do you think your municipality is regarding these attributes? (Score from 1-10).

This index will be referred to below as: Satisfaction with Transparency and Influence Index (STII) and it is calculated in exactly the same manner as SLI.

3.1.2 Measuring the Degree of Digitalization

To our knowledge there is no existing established instrument for measuring to what extent a municipality is digitalized. In this study we put a lot of effort into developing a comprehensive degree-of-digitalization index. Internal digitalization within the organization, i.e., e-administration was excluded, and instead e-service and e-democracy were in focus. By scrutinizing official databases and through discussions with responsible researchers at Statistics Sweden and the Swedish Association of Local Authorities and Regions (SALAR), two existing surveys that matched our objective were identified. One of the studies was done by SALAR aiming to

describe the current situation and level of digitalization in Swedish municipalities. This study mainly focuses on two dimensions: strategies and management of the digitalization, and the current number of e-services and smart-phone apps offered by the municipality. The study, conducted in 2014, included 129 of the 290 municipalities in Sweden. The study encompassed indices for ‘‘e-strategy’’ and ‘‘e-services and apps,” calculated by weighting a number of items (sub-questions) together. A more detailed description is given in Table 1.

The second study identified was a national survey on democracy made by Statistics Sweden in 2012. The purpose of this survey was to produce statistics on the development and functioning of local democracy in municipalities and regions. The survey was responded to by 254 of the 290 municipalities in Sweden. It was a comprehensive study including many dimensions, and all questions were scrutinized by independent researchers. Each researcher marked questions that were judged relevant to this study, i.e., questions concerning digital information or interaction. Thereafter, the researchers analyzed the combination of all questions. They found that the questions either considered one-sided information/concerns about transparency or two-sided interaction. It was decided to use this categorization and to develop the indices: ‘‘e-information/transparency’’ and ‘‘e-interaction,” see details in Table 1.

In sum, by using the existing national surveys, we were able to identify and construct four different indices: e-strategy, e-services, e-information/transparency and e-interaction. The research group evaluated the questions used by Statistics Sweden and SALAR and judged the face validity to be high. Furthermore, the dimensions covered by the four indices give a good content validity, even though the use of social media could have been highlighted more. A description of the items included in each of the four different e-indices is described in Table 1.

Table 1: The four e-indices and items included.

E-strategy A score (0-8 points) is given based on the following questions (yes=1 point, no=0 points): • Does the municipality have a strategy for the development of e-government (Yes/No)? • Has the municipality appointed a manager for the development of e-government (Yes/No)? • What priority does the work to develop e-government in your municipality have (“very low” to “very high”)? (Points from 1 to 5 for this item) • Does the municipality participate in cooperation on a regional digital agenda (Yes/No)?	**E-information/transparency** A score (0-12 points) is given based on the following questions (yes=1 point, no=0 points): • Are these things available on the municipal website (Yes/No)? o city council calendar, minutes and meeting documents o municipal regulations and digital/open register o information about citizen proposals • Are there any TV, radio or webcasts (live or recorded) from council meetings (Yes/No)? • Does the municipality use social media or Internet to inform citizens (Yes/No)? • Is there opportunity to take note of public documents and service declarations (Yes/no)?
E-services (tools) A score (0-14 points) is given based on the following questions (yes=1 point, no=0 point): • Does the municipality provide e-services (Yes/No)? • Does the municipality provide any mobile applications (Yes/No)? • Does the municipality provide e-services with the following features (Yes/No)? o that require two-factor authentication (e.g. eID/BankID) o that have a function for digital signatures o with the possibility to track the status of the matter and get feedback o that is integrated with a business system that is connected to a payment • How many e-services does the municipality offer? (For this item: 0=0 points, 1 to 5=1 point, 6-10=2 points, 11-15=3 points, 16-20=4 points, 21-30=5 points, 31-50=6 points, >50=7 points)	**E-interaction** A score (0-12 points) is given based on the following questions (yes=1 point, no=0 points): • Are these things available on the municipal website (Yes/No)? o discussion forum with the ability to read and write posts o opportunity to make comments/complaints about municipal services o ability to send messages to elected representatives on the council • Does the municipality use social media or Internet to (Yes/No)?: o make contact with citizens o give citizens the opportunity to influence political decisions • Is there any web portal or call center/customer service (Yes/No)? • Is there an established procedure for collecting and managing complaints about municipal services (Yes/No)? • Is it possible to attend a citizen dialogue via the municipal web portal (Yes/No)?

Since the four indices described above were in different metrics, e.g. e-services range from 0-14 while e-interaction ranges from 0-12, we had to standardize the scales. This was done by calculating standard scores (Z-scores). For each index the mean and standard deviation were calculated. Thereafter, from each value the mean was subtracted and the obtained difference was divided by the standard deviation. This transformation was done for all four indices, resulting in Z-scores, i.e., all indices have the average 0 and standard deviation 1, and thus are on the same metric. Thereafter, we constructed the overall degree-of-digitalization index (DoD index) simply by calculating the mean of the standardized e-indices. This was done for all municipalities with values on at least two of the four sub-indices.

In this way the DoD index constitutes a compound score covering strategy/management perspective, number of e-services offered, information and transparency issues, and the possibility to interact online.

3.2 Statistical Methods – Analytical Considerations

The primary variables (satisfaction indices and DoD index) are summarized with descriptive statistics, as are the sub e-indices. We found that the distribution shape for these variables was symmetric, hence the mean and standard deviation was used as measures of location and spread.

We transformed the e-indices into standard scores (Z-scores). This was done in order to achieve the same metric for all e-indices. The Cronbach's alpha for these four sub-indices was 0.74, which is an acceptable internal consistency legitimizing the calculation of the mean as an overall measure of DoD index.

As an exploration of whether the sample of municipalities could be considered representative or not, we analyzed response rate in municipalities with different regional characteristics. To do this we used a classification of municipalities suggested by the Swedish Agency for Economic and Regional Growth Analysis (2014). The classification into different groups of municipalities is based on a typology used by Eurostat and the OECD and can therefore enable international comparisons. The basic classification contains three types of municipalities: rural, intermediate and urban. This division into three municipal categories correlates to a large extent with regional characteristics such as income, unemployment and education level, income distribution and gross pay per capita.

For analyzing potential relationships between the primary variables the classic Pearson correlation coefficient was used.

Naturally, citizen satisfaction with a municipality is potentially affected by a number of other variables, such as population density, proportion of immigrants, proportion in employment, educational level, median income, Gini coefficient (distribution of income, values between 0 and 100, where 0 = totally equal distribution and 100 = totally unequal distribution), and sickness rate (the total amount of days with sick pay divided by the population aged 16-64). As a measure of education level we use the proportion of people with at least post-secondary education (three years or more). All these variables were found in national data repositories and were included in our database for 2014. As pointed out above, these variables are also closely related to the three categories of municipalities. Several of these variables may also be related to the e-indices. For instance, a wealthy municipality may have more money for investments in IT while wealthy municipalities are also more likely to have satisfied citizens than less wealthy municipalities. Consequently, due to the confounding factor situation described above, multiple regression analyses where relationships between e-indices and satisfaction are studied, but with adjustment for the covariates mentioned above.

Furthermore, we added zero-order correlation (equal to the Pearson correlation coefficient) and the partial correlation coefficient (correlation adjusted for the confounding with other explanatory variables). These results are presented in adjacent columns, allowing a comparison of correlation both with and without adjustment. The partial correlations are considered to be the main results in this study. Generally, 5% was used as significance level.

4. Results

4.1 Primary Variables – Descriptive Statistics

Descriptive statistics indicate that citizens, on average, are more satisfied with ‘‘living’’ than ‘‘performance’’ and ‘‘transparency/influence,” as seen in Table 2. It may also be noted that the score for e-interaction is rather

low compared to the other sub-indices. During the time of the study, the flourishing era of social media and interaction was still in its early stages.

Table 2: Basic descriptive statistics for the primary variables and sub-indices.

	N	Mean	Sd	Min	Max
SLI	239	59.7	6.7	41	78
SPI	239	53.8	6.0	37	69
STII	239	40.0	5.7	25	58
DoD index	271	0	0.8	-2.0	2.1
E-strategy	228	5.7	1.5	1	8
E-services	186	6.0	4.4	0	14
E-information/transparency	254	7.1	1.9	0	12
E-interaction	254	4.4	2.6	0	12

In Table 3, the response rates for the three types of municipalities are presented divided by the municipalities who responded to the satisfaction questionnaire and the municipalities with enough data to calculate the DoD index. The distribution of responders in different categories of municipalities resembles the overall distribution in Sweden. Thus, the samples are representative from this point of view (p-values: 0.464 and 0.869 respectively, chi-square test).

Table 3: Distribution of responding municipalities by categories of municipalities (Eurostat and OECD categorization)

	Rural (n=130)	Intermediate (n=131)	Urban (n=29)
Responders satisfaction (n=239)	41.0%	49.0%	10.0%
Responders DoD (n=271)	43.2%	46.5%	10.3%
Total (n=290)	44.8%	45.2%	10.0%

4.2 Main Analysis: Correlations between Degree of Digitalization (DoD) and Satisfaction

In Table 4-6 we present regression results and correlations, with and without adjustment for covariates, for the three satisfaction indices.

Table 4: A regression model for SLI with DoD as explaining factor, adjusted for covariates (R-square = 0.51).

	B	Std Err	t	p-value	zero-order correlation	Partial correlation
Constant	68.4	16.1	4.23	0.000		
Inhabitants/km^2	0.0010	0.0010	0.59	0.555	0.27	0.04
Proportion immigrants	-0.324	0.0753	-4.30	0.000	-0.20	-0.28***
Education level	0.666	0.157	4.23	0.000	0.61	0.28***
Proportion employed	-0.279	0.204	-1.37	0.173	0.36	-0.09
Median income	0.066	0.024	2.76	0.006	0.56	0.19**
Gini coefficient	-0..365	0.244	-1.49	0.137	0.34	-0.10
Sickness rate	-0.12	0.10	-1.15	0.253	-0.53	-0.08
DoD	1.75	0.482	3.64	0.000	0.33	0.24***

*** Significant at the 0.001 level, ** Significant at the 0.01 level, * Significant at the 0.05 level

Table 5: A regression model for SPI with DoD as explanatory factor, adjusted for covariates (R-square = 0.31).

	B	Std Err	t	p-value	zero-order correlation	Partial correlation
Constant	77.9	17.4	4.49	0.000		
Inhabitants/km^2	-0.001	0.001	-0.38	0.705	0.23	-0.03
Proportion immigrants	-0.157	0.0810	-0.02	0.985	0.07	0.00
Education level	0.512	0.169	3.03	0.003	0.46	0.20**
Proportion employed	-0.562	0.219	-2.57	0.011	0.13	-0.17*
Median income	0.071	0.026	2.75	0.007	0.42	0.18**
Gini coefficient	-0.547	0.263	-2.08	0.039	0.33	-0.14*
Sickness rate	-0.108	0.111	-0.97	0.335	-0.40	-0.07
DoD	1.85	0.518	3.56	0.000	0.36	0.24***

*** Significant at the 0.001 level, ** Significant at the 0.01 level, * Significant at the 0.05 level

Table 6. A regression model for STII with DoD index as explaining factor, adjusted for covariates. (R-square = 0.21).

	B	Std Err	t	p-value	zero-order correlation	Partial correlation
Constant	58.2	17.7	3.29	0.001		
Inhabitants/km^2	0.002	0.001	1.23	0.219	0.23	0.08
Proportion immigrants	-0.145	0.0825	-1.76	0.081	-0.02	-0.12
Education level	0.159	0.172	0.92	0.358	0.36	0.06
Proportion employed	-0.502	0.223	-2.25	0.025	0.15	-0.15*
Median income	0.073	0.026	2.77	0.006	0.38	0.19**
Gini coefficient	-0.284	0.268	-1.06	0.290	0.24	-0.07
Sickness rate	-0.12	0.114	-1.06	0.290	-0.35	-0.07
DoD	1.29	0.528	2.44	0.016	0.25	0.16**

*** Significant at the 0.001 level, ** Significant at the 0.01 level, * Significant at the 0.05 level

As can be seen in Tables 4-6, there was a statistically significant positive relation between DoD and the three satisfaction indices. When adjusting for different covariates, the partial correlation between DoD and SLI (Satisfaction with living in the municipality) was 0.24. The same value can be found between DoD and SPI (Satisfaction with performance of government activities). A slightly weaker partial correlation (0.16) was identified between DoD and STII (Satisfaction with transparency and influence). So, our results showed that DoD and satisfied citizens are correlated. This was the case even if we control for other factors that can influence citizen satisfaction. There was no problem with multicollinearity among the explanatory variables. The highest variance inflating factor (VIF) was 4.95 (educational level), while the smallest VIF was seen for DoD at 1.28. This means that DoD independently relates to satisfaction and that variation in DoD cannot be explained by variation in the other explanatory factors.

The model fit (R-square) was 0.51, 0.31 for SLI and SPI, respectively. The satisfaction with transparency and influence had the lowest R-square, i.e., the including factors explain only a small part (roughly one-fifth) of the total variation in satisfaction. The residuals were shaped as expected from a Gaussian distribution and there were no indications of heteroscedasticity, which confirms basic assumptions for our analyses.

In sum, the results showed that our three research hypotheses are all confirmed. Thus we have confirmed that the degree of digitalization is related to citizen satisfaction. Furthermore, the results showed that DoD, in

comparison to other important factors, had a comparatively strong relationship to satisfaction. It is worth noting that the partial correlations for DoD were in parity to factors like educational level and income, even though the correlations were of moderate size from a statistical point of view. As a matter of fact, for satisfaction with living, DoD turned out to be the third strongest partial correlation. Regarding satisfaction with performance of government activities DoD was the strongest partial correlation, and finally for transparency/influence DoD was the second strongest.

5. Discussion and Suggestions for Further Research

This study relies on well-established indices for measuring citizen satisfaction, which have been conducted in Sweden, twice a year, for more than a decade. Regarding the degree of digitalization we constructed a new index called DoD index based on a mean of four sub-indices measuring e-strategy, e-services, e-transparency/information and e-interaction. The fact that the sub-indices showed internal consistency implies that municipalities with high/low degree in one dimension also have high/low degree in other dimensions. For instance, if a municipality has a high degree of digitalized services, it is also likely to have a high degree of e-strategy, e-information/transparency and e-interaction. In other words, the different dimensions go hand in hand.

We are confident that our compound index is a valid operationalization of the degree of digitalization of a municipality fulfilling the aim with this study. We were fortunate in this study to be able to use existing surveys for constructing this purposeful index. However, the index includes information that may not be routinely available. It is therefore vital for both research and practice to develop more generic standardized instruments. Such an instrument should preferably be based on information that is relatively easy to collect. This would make it possible to investigate the development of digitalization over time. In Sweden, SALAR (2016) has already suggested such an approach called "eFlowerbin" as an online tool offering municipalities self-evaluation of their digital service and organization related to digitalization. It is meant to identify areas of improvement and serve as a ground for prioritization. It is important to develop practically applicable, reliable and valid instruments, i.e., instruments that measure citizen satisfaction and engagement. It may be tempting to use automatically generated measures found by using Google analytics or standard algorithms for measuring Facebook success (e.g. number of thumbs up), but such measures are not valid measures for values such as local democracy, engagement and satisfaction.

However, we believe that existing instruments focus too much on delivery of e-services, with a perspective of citizens as customers (e.g. "How well do e-services support citizens to: submit error reports; find public documents and protocols; hand in and follow up proposals?"). To develop a more generic index for DoD, we suggest that a more partner-like perspective on citizens (Linders, 2012) is required. Aspects such as participation, engagement and responsibility would need to be included in relation to new digital infrastructures such as e.g. social media. Hence there is a need to consider social media to a greater extent. Using data available from Facebook, Twitter, and big data analyses could give valuable information about the number of unique users being active, degree of activity, spread of discussions, likes, etc. This may be one way of receiving information about citizen engagement (Bonsón et al, 2015; Mergel, 2013) which may be one important aspect of a "we-government" approach.We believe that tensions like this between independent service providers' business logic and e-government logic will be an important issue to discuss within the e-participation research community as well as in practice in the future in order to reconsider existing instruments and frameworks for local e-government. We also think there is a need to identify more qualitative metrics to define the mission (e.g. transparency, participation and collaboration) and evaluate the outcome (e.g. accountability, trust, consultation, deliberation, satisfaction, community building, creation of issue networks) of we-government (Mergel, 2013). In doing so, the approach to citizens may have to be changed towards a less formal and bureaucratic treatment, which further challenges the role of the public servant (Norström and Hattinger, 2016). Studies of such role change may also be of interest for the e-participation research community.

Notably, the correlation between DoD and satisfaction may change when e-services are further developed and possibilities for interacting with citizens become more advanced and refined. Influence like this is an important aspect of QoL and will most probably increase satisfaction. However, it is important to keep in mind that even if we-government is a likely outcome of increased interaction (Linders, 2012), it does not necessarily generate more satisfaction. Transparency and engagement can also reveal inaccuracies, mistakes or unpleasant

information. Handled carelessly, this can generate negative perceptions of a municipality, which might have a negative effect on citizens' satisfaction and their willingness to participate (see e.g. Bannister and Connolly, 2014; Bertot, Jaeger and Grimes, 2012).

All our hypotheses were confirmed and the degree of digitalization was related to citizen satisfaction for all the studied perspectives. We believe that the relationship to a large extent is causal, i.e., that digitalization increases awareness about good things about living in the municipality and the municipalities' efforts and intention to improve service and therefore has a positive effect on satisfaction. However, this must be confirmed in future studies, preferably interventional or at least longitudinal studies.

Furthermore, somewhat unexpectedly, DoD was the third, first and second strongest factor for satisfaction with living, performance of government activities and transparency/influence respectively. We believe that this indicates that municipalities have reached a certain standard regarding e-services and that citizens increasingly expect services to be digitalized, but that interaction and the possibility to take part in and influence local government to a higher extent is in a relatively immature phase. It is also worth pointing out that this study uses data on an aggregated level, i.e., with municipalities as objects. Naturally, there could be variations within a municipality due to demographic variables. An important aspect is how digitalization could be used in order to increase equality and also reach its full potential in vulnerable demographic areas.

Our results relate to digitalization as something beyond public system performance and administrative operations which might be considered a significant contribution at the age of public digital transformation. Public authorities have to go beyond digitalization as means for enhanced services and improved performance; they need to think globally about the impact of digitalization on citizens' well-being. To have satisfied citizens must be a main concern for all municipalities. Satisfied citizens are of course related to the desire to continue living in the municipality and a municipality with high citizen satisfaction may also attract new citizens and thereby grow. As showed in this study, DoD has a correlation in parity with other crucial factors such as education and income. Naturally, a municipality must judge how to use its financial resources as efficiently as possible. We did not include any economic aspects in this study, but the technical investments needed for digitalization may not be of the same magnitude as resources needed for improving other factors, e.g. educational level and some of the other factors more or less beyond government control. However, technical investments must go hand in hand with strategy, management and new competence as pointed out above. Thus, a challenge for municipalities and SALAR is, together with researchers in joint projects, to increase the understanding for successful digitalization, develop policies and identify the need for new competencies.

6. Conclusion

In conclusion, there is a relationship between the degree of digitalization in municipalities and the perceived satisfaction among their citizens. The degree of digitalization is related to all three studied dimensions of citizen satisfaction: satisfaction with living in the municipality, performance of government activities (delivered services) and transparency and influence. Additionally, this study indicates that the strength of this relationship is in parity or even stronger than the relationship between citizen satisfaction and other crucial factors such as educational level and median income.

Based on our conclusions, it would be interesting to study more in depth how different digital strategies, e.g. digital services or communication via social media, relate to citizen satisfaction and to what extent. With such knowledge it would be possible to further refine the digitalization and increase satisfaction. This is especially crucial for the transparency/influence dimension which had the weakest relationship in this study. How could we enable and increase engagement and influence further? To enable continuous improvement in the digitalization process, standardized instruments for measuring DoD in a practically applicable way and with variables relating to important dimensions like satisfaction, engagement and local democracy would certainly be helpful.

References

Axelsson, K., Melin, U. and Lindgren, I., 2013. Public e-services for agency efficiency and citizen benefit – findings from a stakeholder centered analysis. *Government Information Quarterly*, 30(1), pp.10-22.

Bannister, F. and Connolly, R., 2014. ICT, Public values and transformative government: A framework and programme for research. *Government Information Quarterly*, 31, pp.119-128.

Bélanger, F. and Carter, L., 2012. Digitizing Government Interactions with Constituent: An Historical Review of E-Government Research in Information Systems. *Journal of the Association for Information Systems*, 13, pp.363-394.

Bernhard, I., 2015. Incentives for Inclusive e-government: The Implementation of Contact Centers in Swedish Municipalities. In: K. J. Bwalya and S. Mutula, eds. 2015. *Digital Solutions for Contemporary Democracy and Government, Series: Advances in Electronic Government, Digital Divide, and Regional Development.* Hershey, USA: IGI Global. Ch.16, pp.303-326.

Bernhard, I., 2014a. Local e-Government in Sweden - Municipality Contact Center implementation with focus on Public Administrators and Citizens. *The Journal of Community Informatics,* 10 (1), pp.1-15.

Bernhard, I., 2014b. *E-government and e-governance: Local implementation of e-government policies in Sweden.* PhD. The Royal Institute of Technology, Stockholm, Sweden. Available at:, http://www.diva-portal.org/smash/get/diva2:750658/FULLTEXT02.pdf [Accessed 1 October 2017].

Bertot, C. J., Estevez E. and Janowski, T., 2016. Universal and contextualized public services: Digital service innovation framework. *Government Information Quarterly,* 33, pp.211-222.

Bertot, C. J. and Jaeger, P. T., 2008. The E-Government paradox: Better customer service doesn't necessarily cost less. *Government Information Quarterly,* 25(2), pp.149-154.

Bertot, J., Jaeger, P. T. and Grimes, J. M. 2012. Promoting transparency and accountability through ICTs, social media, and collaborative e-government. *Transforming Government: People, Process and Policy,* 6**,** pp.78-91.

Bertot, J. C., Jaeger, P. T. and Hansen, D., 2012. The impact of polices on government social media usage: Issues, challenges, and recommendations. *Government Information Quarterly,* 29**,** pp.30-40.

Bonsón, E., Royo, S. and Ratkai, M., 2015. Citizens' engagement on local governments' Facebook sites. An empirical analysis: The impact of different media and content types in Western Europe. *Government Information Quarterly,* 32(1),pp.52-62.

Bonsón, E., Torres, L., Royes S. and Flores. F., 2012. Local e-Government 2.0: Social media and corporate transparency in municipalities. *Government Information Quarterly,* 29(2), pp.123-32.

Briggs, X. S., 2008. *Democracy as problem solving: Civic capacity in communities across the globe.* Cambridge, MA: MIT Press.

Charalabidis, Y. and Loukis, E., 2012. Participative public policy making through multiple social media platforms utilization. *International Journal of Electronic Government Research (IJEGR),* 8**,** pp.78-97.

Davidsson, P. and Findahl, O., (2016). *Svenskarna och Internet 2016*. En undersökning om svenskarnas internetvanor. [The Swedes and the Internet 2016]. Avaiable at: https://www.soi2016.se. [Accessed 19 January 2017]

Dimitriu, M. 2008. Bringing citizens closer to public administration. Innovative ideas leading to an increased public participation within the decision making process. *EGPA Annual Conference.* Rotterdam,The Netherlands, 3-5 September 2008.

Dixon, B. E., 2010. Towards e-government 2.0: an assessment of where e-government 2.0 is and where it is headed. *Public Administration and Management,* 15(2), pp 418–454.

Demchak, C. C., Friis, C., and La Porte, T. M., 2000. Webbing governance: National differences in constructing the public face. In: G. D. Garson ed.. *Handbook of Public Information Systems*. New York: Marcel Dekker, pp.179-196.

Ellison, N. and Hardey, M., 2013. Developing political conversations? Social media and English local authorities. *Information, Communication & Society* 16(6), pp.878-898.

Erlingsson, G. Ó. and Ödalen, J., 2013. How Should Local Government be Organized: Reflections from a Swedish Perspective. *Local Government Studies* 39(1), pp.22-46.

Fischer, G., 2015. ‘‘Faustian Bargains’’ and design trade-offs: frames of reference for quality of life in the digital age. University of Colorado, Boulder.Available at: http://l3d.cs.colorado.edu/~gerhard/papers/2015/design-tradeoffs-v1-2015.pdf [Accessed 29 November 2016], pp.1-12.

Fornell, C., 1992. A national customer satisfaction barometer: The Swedish experience. *The Journal of Marketing*, 56(1), (Jan., 1992), pp. 6-21.

Fornell, C., Johnson, M. D., Anderson, E. W., Cha, J., and Bryant, B. E., 1996. The American customer satisfaction index: nature, purpose, and findings. *The Journal of Marketing*, , 60,(4), pp.7-18.

Gil-Garcia, J.R. and Pardo, T.A. 2005. E-Government success factors: Mapping practical tool s to theoretical foundations. *Government Information Quarterly*, 22(2),pp.187-216.

Giritli Nygren, K. and Wiklund, H. G., 2010. En IT-styrd förvaltning – en fjärde förvaltningsdoktrin? In: K. Lindblad-Gidlund, A. Ekelin, S. Eriksén and A. Ranerup, eds.. 2010. *Förvaltning och medborgarskap i förändring.* (In English: Ongoing changes in public administration and citizenship – established practice and critical perspectives). Lund: Studentlitteratur, pp.215-227.

Grönlund, A., 2005. What’s in a Field – Exploring the Egovernment Domain. *Social Science Computer Review*, 21(1), pp.55-72.

Helbig, N. C., Gil-Garcia, J. R. and Ferro, E., 2009. Understanding the complexity of electronic government: Implications from the digital divide literature. *Government Information Quarterly* 26(1), pp.89-97.

Khan, G. F., Yoon, H. Y., Kim, J., and Park, H. W., 2012. From e-government to social government: Twitter use by Korea´s central government. *Online Information Review*. 38(1), pp.95-113. https://doi.org/10.1108/OIR-09-2012-0162.

Kim, P. S., Halligan, J., Cho, N., Oh, C. H., and Eikenberry, A. M., 2005. Toward participatory and transparent governance: Report on the Sixth Global Forum on Reinventing Government. *Public Administration Review*, 65(6), pp.646–654.

Linders, D., 2012. From e-government to we-government: Defining a typology for citizen coproduction in the age of social media. *Government Information Quarterly*, 29(4), pp.446-454.

Medaglia, R. and Zhu, D., 2017. Public deliberation on government-managed social media: A study on Weibo users in China. *Government Information Quarterly,* 34(3), pp.533-544.

Meijer, A. and Bekkers, V.,2015. A metatheory of e-government: Creating some order in a fragmented research field, *Government Information Quarterly*, 32, pp.237-245.

Mergel, I., 2013. A framework for interpreting social media interactions in the public sector. *Government Information Quarterly,* 30**,** pp.327-334.

Montin, S., 2007. *Moderna kommuner* [In English: Modern municipalities]. Malmö: Liber.

Mossberger, K., Wu, Y. and Jimenez, B. S., 2017. Developments and challenges in e-participation in major US cities. In: Y. C. Chen and M. J. Ahn, eds. 2017. *Routledge Handbook on Information Technology in Government***,** New York and London: Taylor & Francis, pp.219-238..

Mossberger, K.., Yonghong, W. and Crawford, J., 2013. Connecting citizens and local governments? Social media and interactivity in major US cities. *Government Information Quarterly,* 3(4), pp.351-358.

Norström, L. and Hattinger, M., 2016. Efforts at the Boundaries: Social Media Use in Swedish Local public governments. In: E. Tambouris eds. 2016 *International Conference on Electronic Participation.* Springer International Publishing, Switzerland, pp. 123-137.

OECD, 2013. *Measuring well-being and progress,* Available at: http://www.oecd.org/std/Measuring%20Well-Being%20and%20Progress%20Brochure.pdf [Accessed 7 August 2017] :

Orlikowski, W. J. and Iacono, C.S., 2001. Research commentary: Desperately seeking the "IT" in IT research-A call to theorizing the IT artefact. *Information Systems Research,* 12(2), pp.121-134.

Pratchett, L., 1999. New technologies and the modernization of local government: an analysis of biases and constraints. *Public Administration*, 77(4), pp.731–750.

Reddick, C. and Anthopoulus, L., 2014. Interactions with e-government, new digital media and traditional channel choices: citizen initiated factors. *Transforming Government: People, Process and Policy,* 8(3), pp.398-419.

SALAR, 2011. *E-förvaltning och e-tjänster i Sveriges kommuner 2011*. Stockholm: Sveriges kommuner och landsting [In English: The Swedish Association of Municipalities and Regions]]: Available at: http://webbutik.skl.se/sv/artiklar/e-forvaltning-och-e-tjanster-i-sveriges-kommuner-2011.html [Accessed 30 March 2016].

SALAR, 2014. *E-tjänster och appar – hur är läget i kommunerna? E-Förvaltning och E-Tjänster i Kommunerna 2014.* Stockholm: Sveriges kommuner och landsting [In English: The Swedish Association of Municipalities and Regions].

SALAR, 2016. *eBlomlådan*. [In English: The Swedish Association of Municipalities and Regions] Available at: http://eblomladan.skl.se/ [Accessed 3 March 2017]

SCB, Statistics Sweden, 2013. *Undersökningen om den lokala demokratin i kommuner och Landsting 2012*. Available at: http://www.scb.se/Statistik/ME/ME0002/_dokument/ME0002_DO_2012.pdf [Accessed10 April 2016].

SCB, Statistics Sweden, 2015. *SCB:s medborgarundersökning.* Available at: http://www.scb.se/sv_/Vara-tjanster/Insamling-och-undersokning/SCBs-medborgarundersokning/Resultat-2015/ [Accessed 10 April 2016].

Sæbø, Ø., Rose, J. and Skiftenes Flak, L., 2008. The shape of eParticipation: Characterizing an emerging research area. *Government Information Quarterly,* 25(3), pp.400-428.

Simmons, P., 2014. Challenges for communicators in future Australian local government. *Procedia -Social and Behavioral Sciences,* 155, pp312-319.

Susskind, R. and Susskind, D., 2015. *The Future of the Professions. How technology will transform the work of human experts*, Oxford, UK: Oxford University Press.

Swedish Agency for Economic and Regional Growth Analysis, 2014. *Bättre statistik för bättre regional och landsbygdspolitik.* Rapport (2014:04), Östersund: The Growth Analysis. Available at: https://tillvaxtverket.se/download/18.607baaf915a3b6cb29683ff1/1487858988356/rapport_2014_04_[Accessed 15 February 2016].

Taylor-Smith, E. and Lindner, R., 2010. Social networking tools supporting constructive involvement throughout the policy-cycle. *Workshop held at EDEM 2010 4th International Conference on Electronic Democracy*, Centre for E-Government, Danube-University Krems, Austria, 7th May 2010. Available at: https://www.researchgate.net/publication/44222539_Social_networking_tools_supporting_constructive_involvement_throughout_the_policy-cycle [Accessed 10 April 2016].

United Nations, 2016. *United Nations E-Government Survey 2016: E-Government in Support of Sustainable Development*. New York: United Nations. Available at: http://workspace.unpan.org/sites/Internet/Documents/UNPAN97453.pdf. [Accessed 15 August 2017].

Wang, X. and Wan Wart, M., 2007. When public participation in administration leads to trust: An empirical assessment of managers' perceptions. *Public Administration Review* 67(2), pp.265-278.

Yun, H.J. and Opheim, C., 2010. Building on success: The Diffusion of E-government in the American States. *Electronic Journal of e-Government*, 8(1),pp.71-82. Available online at:www.ejeg.com, [Accessed 10 September 2017].