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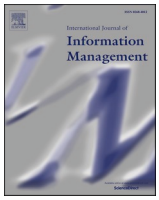

Research article

Digital transparency and the usefulness for open government

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ABSTRACT

Open Government efforts are criticized for providing limited value. Instead of looking at a value, we investigate the usefulness of web-based open government portals and apps. Specifically, we investigated the relationship between digital transparency and usefulness. We analyzed perceived digital transparency and usefulness in a survey of 112 respondents using Partial Least Square (PLS) and Structural Equation Modelling (SEM). The results show that perceived functionality, transparency, and efficiency influence usefulness but that functionality of apps and efficiency are more important than transparency. Usefulness can be created without having high levels of transparency, as the public wants answers to their questions. Apps should be designed for efficient use, as users have limited time and resources. Apps having pre-defined functional views can be useful to provide quick insight but might limit transparency by not offering other views and insights. Opening raw data using portals can provide higher levels of transparency, although more time and effort are needed to analyze. Both portals providing access to raw data and apps having pre-defined views are needed for open government and transparency as they serve other stakeholder groups and purposes.

1. Introduction

Open government is a global phenomenon driven by the need to boost innovation, create transparency and improve accountability (Bertot, Jaeger, & Grimes, 2010a; b; Janssen, 2011). The creation of digital transparency is often viewed as one of the key objectives of open government. By opening data and providing functionalities to manipulate them, transparency can be created (Hossain, Dwivedi, & Rana, 2016). Digital transparency refers to the creation of transparency by opening data and providing functionality for processing the data using all kinds of websites. Digital transparency should result in the use of open government data. However, the use lags behind (Zeleti, Ojo, & Curry, 2016), and open government efforts are often criticized for generating limited value by not opening data that can be useful for the public (Hossain et al., 2016; Janssen, Charalabidis, & Zuiderwijk, 2012).

Open government can be achieved by opening data to the public (Luna-Reyes, Bertot, & Mellouli, 2014). Web-based portals and applications (apps) serve as an interface to the public and create active and passive transparency to an external audience (Rui Pedro Lourenço, 2016; Matheus & Janssen, 2013). Open data portals often provide access to raw data, whereas web-based apps are developed for a specific purpose. Yet, how open government can be best implemented is underresearched (Tai, 2021).

Although digital transparency looks appealing and simple, in practice, it is more challenging to achieve (Bertot, Jaeger, & Grimes, 2010a; b). Some areas, like open budgeting, are well developed (Lourenço, 2023), whereas, for other domains, the creation of transparency is more challenging. Many open government initiatives result in limited usefulness (Luna-Reyes et al., 2014). Some websites are cumbersome to use, whereas others only provide a shiny picture of what the government wants the public to see. An underlying question is an alignment between the website design and what the public wants to see (Matheus, Janssen, & Maheshwari, 2018). Máchová & Lněnička (2017) stress the need for offering all kinds of functionality on websites to create transparency.

Websites and apps should help to create digital transparency in open government (Bertot, Jaeger, & Grimes, 2010a; b). There are many definitions and conceptualizations of transparency. For example, Ward (2014, p. 46) defined transparency as "*being able to 'look into' these agencies and see how they operate*", whereas Corradini, Polini, Polzonetti & Re, (2010, p. 303) conceptualized transparency as "*the ability of the administration to make citizens aware of the delivery process and of its execution state, improving the citizens' perceived trust in this way*". In general, there is an agreement that transparency in open government is the ability to gain insight into the government by the public (Matheus &

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Janssen, 2015, p. 1). Many apps provide some insight for citizens, but this might not be sufficient as citizens might still not understand what is happening. Citizens have various levels of education, experience, and digital skills (Matheus & Janssen, 2020), resulting in different needs for digital transparency. Hence, digital transparency is about seeing what is happening in the government through digital open governmental portals and apps. These portals and apps can enable citizens to understand what is happening inside the government without the need to work in the government or to be present daily in public offices. Therefore, we take a slightly different view in this research than the contemporary public administration literature and define digital transparency as *a stakeholder's ability to understand what is happening in the government using portals or apps*. Our definition streses that stakeholders are diverse and might have different transparency needs. Furthermore, the definition stresses the focus on usefulness of transparency for the stakeholders. For the sake of brevity, we will use the term transparency to refer to digital transparency.

Usefulness can be enhanced by developing efficient and transparent applications by providing a pre-defined view to the public. Governments can create such applications, but they can also be developed by third parties intermediaries (Shaharudin, van Loenen, & Janssen, 2023). Apps often give some insights from a single perspective, whereas other perspectives might give different insights. For example, if only budget information is shared, then no insight is gained into resource utilization. Therefore it is often advocated that raw data should be opened using open data portals (Attard, Orlandi, Scerri & Auer, 2015). The use of raw data might consume a lot of time and the use of all kinds of functionality for processing the data. On the other hand, providing pre-defined views can be more efficient to use but might not be useful nor provide the transparency the public is looking for. The actual level of insight needed is often difficult to determine, as which views are appropriate to create transparency is dependent on the needs and might change over time (Cahlikova & Mabillard, 2019). This paper focuses on both portals for opening raw data and applications that create data for their users. Portals provide all kinds of data, whereas the second provides one or more pre-defined views that can be used in an efficient way.

Although there is much research into open government, empirically investigating the usefulness and factors influencing usefulness remains scarce (Tai, 2021). Much of the research is not actionable and focuses on relationships between openness, accountability, trust, and transparency (Aladwani & Dwivedi, 2018; Grimmelikhuijsen, 2012; Ohemeng & Ofosu-Adarkwa, 2014; Welch & Hinnant, 2003). In particular, the functionality needed and the efficiency are typically neglected. This paper addresses this void in the literature. This paper aims to develop a model for open government usefulness and to analyze the relationship between transparency and usefulness. Identifying these factors can help designers of transparency applications and public policy-makers to create open government applications and accompanying policies that are more useful.

This paper is structured as follows. In the following section, the background of our study is outlined, and the research hypotheses are formulated. In Section 3, the research methodology is described. The results are presented in Section 4 and discussed in Section 5. Conclusions are drawn, and suggestions for future research directions are made in Section 6.

2. Theoretical background

In this section, we develop the hypothesis underlying our research. Bessa-Vilela, Caramelo-Gomes, & Morais, (2017, p. 728) argue that digital portals and applications demand certain functionalities to be useful for a diverse group of people with different skills. The proper design requires to balance transparency and functionality (Bessa-Vilela et al., (2017, p. 734). All kinds of functionality are needed to create transparency for the public (Alexopoulos, Loukis, & Charalabidis, 2014). Portals often have comprehensive functionalities, whereas apps provide simple functionality for the public. Various functionality can help the users of portals and apps to create transparency within a certain time frame. Functionality for visualization is essential to interpret and to create transparency. Our first hypothesis takes into consideration that Functionality positively influences Perceived Transparency.

H1. : Functionality positively influences the Perceived Transparency.

Most people have limited time to be involved in open government, although there are exceptions. For example, NGOs might have the resources to drill into all kinds of detail and do detailed analyses (Shaharudin et al., 2023). Jetzek, Avital, and Bjørn-Andersen (2013) emphasize users' limited time and resources and the need for efficiency as a value-creating mechanism. Máchová & Lněnička (2017) stress the need for processing and integrating Functionality in an efficient manner to create Perceived Transparency. Ready-made apps minimize the time of the public, whereas functionality for the processing of data can accelerate efficient use. Alexopoulos et al., (2014, p. 67) emphasize that efficiency should be created to improve users' use of open data. This results in our second hypothesis. We hypothesize that Functionalities present in open government data portals and apps positively influence users' Perceived Efficiency in processing open data.

H2. : Functionality positively influences the Perceived Efficiency.

Portals and apps should help to create transparency. Creating transparency can be a cumbersome task, and functionality can help to create transparency in an efficient manner. Functionality can enable efficient use (Alexopoulos et al., 2014), for example, by providing functionality for data processing or by already providing a pre-defined view to the public. Governments can create such applications, but they can also be developed by third parties intermediaries (Shaharudin et al., 2023). Máchová & Lněnička (2017) argue that functionality is needed to integrate data in an efficient manner to transform the data into a useful format. Our third hypothesis suggests a positive relationship between Perceived Transparency and Perceived Efficiency.

H3. : Perceived Transparency positively influences the Perceived Efficiency.

Máchová & Lněnička (2017) stress the need for having all kinds of functionality to enable useful open government websites. Zuiderwijk, Janssen, and Parnia (2013) and Alexopoulos et al. (2014) provide a list of functionality requirements to create users' usefulness. Rui Pedro Lourenço (2015) observed that governments should decide properly about what data is released and what functionality is needed to process the data, since the nature of the data being disclosed might influence the level of perceived usefulness by citizens and external users of the opened datasets. Due to the aforementioned, our fourth hypothesis is that Functionality positively influences the Perceived Usefulness of open government data portals and apps.

H4. : Functionality positively influences the Perceived Usefulness.

The more transparent a website or app, the higher the usefulness for open government (Lean, Zailani, Ramayah & Fernando, 2009). Scholl & Luna-Reyes (2011) suggested a positive relationship between transparency and usefulness. The creation of transparency results in usefulness, as transparency helps to find the answer to the questions to reach the desired objectives of users. Data disclosure not always results in greater transparency or usefulness of these datasets opened in open data portals. More data might result in the drowning of data and less usefulness of the portal. The study of Weerakkody, Kapoor, Balta, Irani, and Dwivedi (2017) showed that open data portals might enable citizens to see the usefulness of this data by increasing transparency. Our fifth hypothesis aims to identify if Perceived Transparency influences Perceived Usefulness.

H5. : Perceived Transparency influences Perceived Usefulness.

Jetzek et al. (2013) emphasize users' limited time and resources of

users. Too much data might also take more time to process or even result in data overload. Perceived Usefulness might depend on the Perceived Efficiency of the use of the website or App to find the right answers within a short timeframe. In other fields, this relationship is found, e.g., Dillon, McDowell, Salimian, and Conklin (1998) found that nurses would perceive higher perceived use if bedside-computer systems were efficient for them. A similar conclusion was drawn by Jeng (2005) in the research on digital library users. Efficiency is essential as open data portals often consist of many functionalities, and many activities are needed (Zuiderwijk et al., 2013). Inefficient and cumbersome activities might result in a lack of use. Hence, our sixth hypothesis takes into consideration that transparency applications bring citizens Perceived Efficiency in their work, which will increase their perception of usefulness.

H6. : Perceived Efficiency is positively related to Perceived Usefulness.

Máchová & Lněnička (2017) argue that all kinds of functionality for creating transparency result in usefulness. There is no empirical research discussing the relationship between functionality and usefulness mediated by Transparency, although there is literature about the relationship between functionality for transparency on the one hand and transparency and perceived usefulness on the other hand. Nilashi, Jannach, bin Ibrahim, Esfahani, and Ahmadi (2016) suggested that functionality and perceived usefulness are somehow influenced by transparency. We expect that functionality helps to create transparency, and in turn, transparency will result in higher levels of perceived usefulness. Considering the novelty of this relationship, our seventh hypothesis aims to identify whether the relationship between Functionality and Perceived Usefulness is mediated by Perceived Transparency.

H7. : The relationship between functionality and Perceived Usefulness is mediated by Perceived Transparency.

In a similar vein, there is no empirical research testing the relationship between functionality and perceived usefulness mediated by efficiency. Alexopoulos et al., (2014, p. 67) list of functional requirements suggests that the functionality enables to create usefulness in an efficient manner. Máchová & Lněnička (2017) and (Zuiderwijk et al., 2013) argue that all kinds of functionality for creating transparency result in usefulness which requires efficient use. However, there are articles suggesting relationships between functionality and efficiency, and usefulness and efficiency as discussed before when we posed those hypotheses. Considering the novelty of these relationships, we have our last hypothesis, the relationship between functionality and usefulness is mediated by efficiency.

H8. : The relationship between Functionality and Perceived Usefulness is mediated by Perceived Efficiency.

Our hypothesis result in the model presented in Fig. 1. These eight hypotheses will be tested in this research by collecting data from citizens.

3. Research methodology

3.1. Data collection

The data used in this study were collected through a survey distributed to users of applications to increase transparency. The questionnaire developed for the survey was pre-tested by seven colleagues experienced in surveys and quantitative research. Their remarks and suggestions were used to improve some formulations, which led to the final version of the questionnaire. We then surveyed users in the Transparency portals and apps conducted in the OpenGovIntelligence (OGI) Project (http://www.opengovintelligence.eu/). OGI was a project funded by the European Commission (EC) within the Horizon 2020 framework (H2020), which developed all kinds of applications for creating transparency. These pilots agreed to email the link to this questionnaire to their users and asked them to fill out the electronic form. In total, 187 valid responses were gathered from Belgium, Estonia, Greece, Lithuania, England, and Ireland from September to November 2019. A reminder was sent after three weeks. The responses are anonymous, and no detailed demographic data was collected. This should ensure that respondents feel comfortable responding, fetching honest answers, and complying with the privacy requirements. The questionnaire was meant to be short and to the point so that it could be distributed to end-users without gathering personally identifiable information in compliance with the ethical guidelines to avoid the collection of personal information if not necessary. Hence, there were no questions to collect demographic data.

3.2. Data processing

We used Partial Least Square (PLS) as recommended by Pavlou & Gefen (2005). More details of the PLS method is described in Section 4.2. Besides PLS, we followed McDonald & Ho (2002) guidelines, selecting

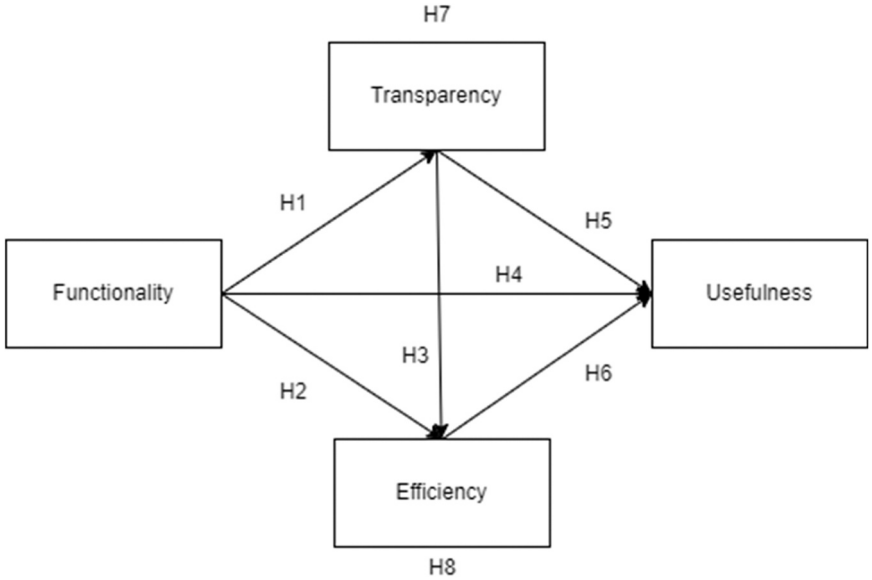

Fig. 1. Conceptual model of digital transparency and usefulness for open government.

SEM as it is able to analyze the structural relationship between the measured variable and latent constructs. As a SEM step, absolute fit indices are tested to identify whether a priori model fits or does not. McDonald & Ho (2002) stated that "*given the complexity of structural equation modelling, it is not uncommon to find that the fit of a proposed model is poor*".

This paper used SmartPLS 3 and SPSS 24 to conduct the SEM analysis. All our variables were intended to be measured as reflective constructs using multi-item scales, meaning they are meant to be latent (not directly observed) variables. All items were measured using a 1–5 Likert scale.

4. Results

4.1. Descriptive statistics

The data originates from Belgium, Estonia, Greece, Lithuania, England, and Ireland. In total 112 people were surveyed, as shown in Table 1. The ethics committee did not recommend collecting demographic data, and no hypotheses were formulated. We kept the questionnaire short and did not collect demographic information, however, the pilot participants primarily filled in the questionnaire. Hence, the questionnaire was filled in by those persons having an interest in and experience with digital transparency. The persons in charge of the pilots indicated that there were two types of groups. One group consisted of experienced persons who were highly skilled and able to analyze raw data, whereas the other group had hardly any skills and was primarily interested in creating digital transparency. Both groups are included in the sample.

4.2. Partial least square (PLS)

Partial Lease Square (PLS) was utilized for data analysis using SmartPLS 3.0 software. PLS is appropriate for the analysis of complex models with latent variables and small sample sizes (Pavlou & Gefen, 2005). Previous IS studies successfully applied this technique, which found that it is an effective method for data analysis (Shirish, Chandra, & Srivastava, 2021; Wamba, 2022). By applying the recommended two-stage analytical procedure, the measurement model was evaluated first, followed by examining the structural relationships (Hair, Black, Babin, Anderson & Tatham, 1988).

4.3. Measurement model

Three types of validity were tested: content, convergent, and discriminant validity. Content validity, the assessment of the chosen measures' appropriateness in capturing the full domain of constructs (Straub, Boudreau, & Gefen, 2004), was examined by checking for consistency between the measurement items and the existing literature. This was completed at the questionnaire design stage. Convergent validity, which checks for the indicators for a construct correlation with one another in comparison with the indicators of another construct (Petter, Straub, & Rai, 2007) was tested by using factor analysis (Table 2). The output depicts a strong correlation between each item and its corresponding construct, demonstrating convergent validity.

Table 1
Descriptive Key Demographic Variables.

#	City / Country	Number people interviewed
1	Trafford England	28
2	Lithuania	22
3	Estonia	10
4	Belgium	2
5	Ireland	26
6	Greece	24
	TOTAL	**112**

Table 2
Cross Loadings.

	Eff	Func	Tr	Usefulness
Eff1	**0.920**	0.44	0.334	0.598
Eff2	**0.829**	0.222	0.336	0.412
Func 3	0.377	**0.88**	0.337	0.617
Func1	0.291	**0.766**	0.071	0.382
Func2	0.288	**0.803**	0.016	0.433
Tr1	0.306	0.238	**0.87**	0.412
Tr2r	0.355	0.128	**0.873**	0.428
Useful1	0.477	0.376	0.414	**0.762**
Useful2	0.484	0.462	0.457	**0.869**
Useful3	0.509	0.647	0.338	**0.854**

Convergent validity was also tested by examining composite reliability (CR) and average variance extracted (AVE) for the indicators (Hair et al., 1988)). As can be seen from Table 3, CR values range from 0.836 to 0.898, which is above the suggested CR threshold of 0.7 (Chin, 1998). AVE values were above the recommended threshold of 0.5 (Fornell & Larcker, 1981) and ranged between 0.688 and 0.767. Cronbach's values ranged from 0.684 to 0.772, fulfilling the threshold criteria (Morgan, Cleave-Hogg, DeSousa & Tarshis, 2004).

Discriminant validity was verified by checking the square root of the AVE (Fornell & Larcker, 1981). The square root values of AVE are all greater than the corresponding intern construct correlations (Table 4), demonstrating satisfactory discriminant validity.

Additionally, Heterotrait-monotrait (HTMT) ratio criterion was also checked (Hair et al., 1988). The HTMT should be lesser than 0.85 to discriminate between factors. The results in Table 5 demonstrated that HTMT is less than 0.85, meeting the HTMT criterion for discriminant validity. As a result, the suggested outputs indicate a satisfactory measurement model.

4.4. Common method bias (CMB)

CMB was accessed by performing the full collinearity variance inflation factors (VIFs) test (Kock, 2015). The degree of common method bias was measured with Harman's single-factor test. Harman's single-factor test was conducted by including all the items in a principal component factor analysis. Based on the analysis, the cumulative

Table 3
Construct reliability and validity.

	M (SD)	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)
Eff				
Eff1	3.76 (0.78)			
Eff2	3.49 (0.72)	0.704	0.868	0.767
Func				
Func1	3.79 (0.73)			
Func2	3.73 (0.74)			
Func3	3.85 (0.79)	0.760	0.856	0.669
Tr				
Tr1	3.09 (0.54)			
Tr2	2.78 (0.61)	0.684	0.863	0.760
Usefulness				
Useful1	3.40 (0.66)			
Useful2	3.48 (0.74)			
Useful3	3.62 (0.75)	0.772	0.868	0.688

Table 4
Correlations and Fornell-Larcker criterion (Discriminant validity).

	Eff	Func	Tr	Usefulness
Eff	**0.876**			
Func	0.397	**0.818**		
Tr	0.379	0.21	**0.872**	
Usefulness	0.591	0.606	0.482	**0.830**

Table 5
Heterotrait-monotrait (HTMT) ratio criterion.

	Eff	Func	Tr	Usefulness
Eff				
Func	0.504			
Tr	0.549	0.273		
Usefulness	0.781	0.746	0.669	

variance extracted was 28.84%, which is well below the 50% threshold (Harman, 1976; Podsakoff, MacKenzie, Lee & Podsakoff, 2003), indicating an absence of common method bias.

The results (Table 6) show that the pf values the full VIF for each construct are below the recommended threshold of 3.3 (Kock, 2015), suggesting that the proposed research model could be considered free of CMB.

The hypotheses were tested using SEM. First, we discuss the demographic data, followed by the common method bias. To test the hypothesis, we estimated a measurement model to find whether our items were able to measure the intended concept. Finally, we present the structural model.

4.4.1. *Structural model*

We used Smart PLS 3 to assess the hypothesized relationships based on explanatory power (R2), for model quality. Additionally, we followed standardized root mean square residual (SRMR) for model fit (Henseler, Hubona, & Ray, 2016). The SRMR value of the research model is 0.10 which is close to the recommended threshold value of 0.10 (Henseler et al., 2016). In order to test the hypotheses' significance, the bootstrapping re-sampling methods (5000 re-samples) (Hair et al., 2011) and 95% confidence interval (Chin, 1998) was used.

The results of the structural model evaluation are presented in Table 7. It can be concluded that H1-H6 are strongly supported. In addition to testing direct effects in the proposed research model, various mediating effects were also tested. The table shows that one indirect effect is significant, supporting hypothesis H8.

The model exploratory power (R-square) is 0.576.

Fig. 2 shows the resulting final model. Functionality influences the level of Perceived Transparency (H1) positively, Functionality influences the expected Perceived Efficiency (H2) positively, and Functionality also positively influences the Perceived Usefulness (H4). The level of Transparency influences the Perceived Efficiency (H3), and the level of Perceived Transparency influences the Perceived usefulness (H5). The Perceived Efficiency influences the Perceived Usefulness (H6).

Table 6
Full collinearity statistics (VIF).

	VIF
Eff2	1.419
Eff3	1.419
Func 4	1.527
Func1	1.492
Func2	1.606
Tr1	1.369
Tr2r	1.369
Useful2	1.399
Useful4	1.906
Useful3	1.737

Table 7
Hypothesis testing.

Hypothesis	Path	β	P values	Results
H1	Func -> Tr	0.210	0.044	Supported
H2	Func -> Eff	0.332	0.001	Supported
H3	Tr -> Eff	0.309	0.000	Supported
H4	Func -> Usefulness	0.421	0.000	Supported
H5	Tr -> Usefulness	0.272	0.000	Supported
H6	Eff -> Usefulness	0.321	0.000	Supported
H7	Func -> Tr -> Usefulness	0.057	0.098	Not supported
H8	Func -> Eff-> Useful	0.106	0.010	Supported
	Q^2 predict		SRMR	
Efficiency	0.131		0.10	
Functionality	0.017			
Usefulness	0.347			

Functionality positively influences the expected Perceived Efficiency and the Perceived usefulness. However, functionality does not influence any level of Transparency and expected usefulness (H7). The latter shows the complex relationship between functionality, Perceived transparency, and Perceived Usefulness. More functionality might help some stakeholder groups to increase Perceived Transparency and Usefulness, whereas others are helped by less and simpler functionality.

The survey results show that functionality, Perceived Transparency, and Perceived Efficiency are key considerations for developing useful open government applications. On the one hand, functionality can lead to customized apps having a pre-defined view, being used in an efficient manner, and providing transparency resulting in high levels of Perceived Usefulness. The Functionalities are used for customization but have the disadvantage of having a pre-defined view. On the other hand, diverse Functionalities can be used to process raw data more efficiently, resulting in higher levels of Perceived Transparency and Perceived Usefulness. This requires a wide range of functionalities.

5. Discussion

Open government initiatives are often criticized for not providing value (Janssen et al., 2012; Jetzek et al., 2013) and being useful (Luna-Reyes et al., 2014), whereas usefulness is essential for creating open government. In the ideal world, the public has the time and capabilities to make sense of open government data. In reality, they have limited time and resources Jetzek et al. (2013), and they need advanced functionality to create transparency Máchová & Lněnička (2017) and to ensure usefulness (Luna-Reyes et al., 2014). Our SEM models suggest that having the right functionalities are the basis for ensuring a useful open government.

Our model provides insight into the value creation by open government. There are two primary types to create open government data. The types differ in the type of functionalities and the way open government data is processed. The first type is to build fancy apps readily for use by the users based on an analysis of their needs. This results in providing them with a pre-defined view that they can be used in an efficient manner and provides the transparency needed to make the results useful. Apps are developed to provide often a single, or only a few views, and are user-friendly and visual. This is a useful approach for repetitive applications, but the disadvantage is that no other views can be created that might result in different or new insights. For some stakeholders, this might not result in the transparency they are looking for (Rowley, 2011). The second type is based on providing raw data using portals. Raw data needs extensive work in understanding, combining, analyzing, and visualizing data, which activities are often time-consuming (Alexopoulos et al., 2014). Functionality is needed to analyze the data in an efficient manner, and then diverse ways of transparency can be created by users to make the results useful. This results in deep insights and higher levels of Perceived Transparency, however, it usually requires much analysis and a lot of work. This might only be useful for those with the time and ability to make sense of raw data. This is a relatively small

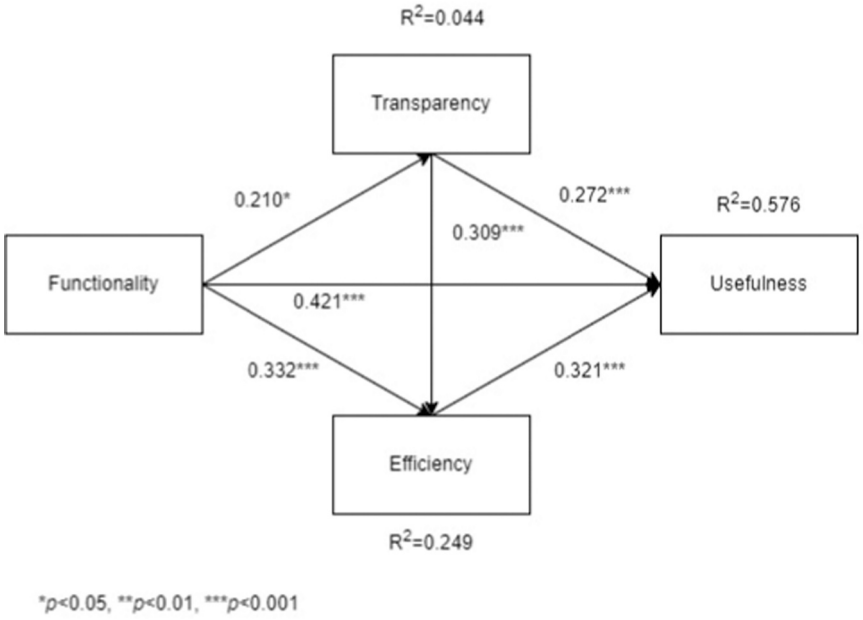

Fig. 2. Results of structural model test.

group when looking at the whole populations, however, almost half of the population in our sample.

The public should be viewed as a collection of diverse stakeholders having their own interests (Rowley, 2011). Transparency depends on the eye of the beholder and what one is looking for. For one person, open data portals might result in transparency, whereas the same portal might result in no or limited transparency for another person. The public wants answers to their questions, but their questions might be different. This makes the development of digital transparency non-trivial. The results suggest that both apps and releasing raw data are needed to create transparency. Some of the users will prefer the use of apps, whereas others, who have more time, and the capabilities to analyze the data in-depth, will prefer to have access to the raw data. Both ways require different functionalities, which enhance the Perceived Efficiency of use, create higher levels of Perceived Transparency and result in the Perceived Usefulness of open government data.

Functionality can enable efficient use (Alexopoulos et al., 2014). Most portals contain comprehensive functionalities (Zuiderwijk, Janssen, & Davis, 2014) and are less efficient to use. Yet, Perceived Efficiency influences Perceived Usefulness. This suggests that efficiency is important considering when creating and creating portals as this influences the Perceived Usefulness.

Transparency usually requires the inclusion of different views. Higher levels of Perceived Transparency can be created by including diverse functionalities (e.g., filters, maps, graphs, tables) and making raw data available. Then, letting the public analyze the data from their desired perspectives is possible. Although this is more time-consuming and requires understanding how the data is collected, it creates higher levels of transparency. Yet, usage consumes time, and there is a need to focus on efficiency to be able to advance the understanding within a short time frame. The results of complex analysis of open government data can be useful, but the outcomes might not be. The risk is that much time is spent on analysis that might not result in useful analysis. Hence, higher levels of transparency come at a price.

Citizens might perceive transparency differently. The literature has various transparency definitions (Bannister & Connolly, 2011; Bertot, Jaeger, & Grimes, 2010a; b; Helbig, Styrin, Canestraro, & Pardo, 2010; Luna-Reyes et al., 2014; Ward, 2014). Our findings suggest that transparency is highly contextual and that the portals and apps might have different ways of creating transparency. Apps are efficient and can show results at a glance having high usefulness. As the context changes, also the influence of the factors changes. Portals should ensure efficient use to be useful. In other words, digital transparency needs to be created in an efficient way. Transparency should always take into account the stakeholder group for whom transparency is created.

5.1. Research contributions

There is much discussion about the value of open government (Hossain et al., 2016; Jetzek et al., 2013; Luna-Reyes et al., 2014). In contrast to other research, we looked at the usefulness of open government apps and websites, as, in the end, transparency can only be created when websites and apps are used. Usefulness is hardly considered in existing models (Grimmelikhuijsen, 2012). The scant attention given to perceived usefulness is surprising, as only use can lead to an open government.

Open data portals have many functionalities and activities that are needed to create digital transparency (Zuiderwijk et al., 2013). Perceived efficiency is also given limited attention in research (Kassen, 2013; Zuiderwijk et al., 2013), whereas our research shows that efficiency is important. Users are diverse and have limited time and use open government data in different ways. As such, the public should not be considered a homogenous group in further research. Different groups have different needs, and further research should focus on how to create some level of transparency for different user groups.

Transparency is a complex construct. Functionalities are needed to create transparency. Yet full transparency is often not needed nor required. Apps can be very useful and provide the necessary insight; without needing that the government becomes fully transparent. Raw data can provide more insights but might be less efficient, and the question is if the insights are useful. Some might be, whereas others might not. There is a need for further theorizing to understand better how digital transparency for citizens can be created in different contexts.

5.2. Practical implications

Open government efforts have often not realized their potential and resulted in disappointing results (Zeleti et al., 2016). Much of the current research has focused on value-creation mechanisms which are hard to bring into practice. Instead, our research shows that the key to open

government is creating websites and apps that are useful for the public. Digital Transparency should be viewed from diverse stakeholder's point of view. Hence, Digital Transparency should be and views as the ability of a stakeholder to understand what is happening in the government using portals or apps. By taking this view, the practical contribution of a portal for the users is stressed.

Digital transparency is an ambiguous concept that is hard to define. By emphasizing the usefulness for stakeholders, the focus becomes more clear. The point of view of stakeholders should bet taken to bring digital transparency into practice.

Our research provides fresh insights and shows that functionalities and efficiency are key for contributing to perceived usefulness. All too often, the open data portals are complex and they cannot be used in an efficient manner (Kassen, 2013). Open government initiatives should focus either on efficiency by showing a single view or a limited number of views or on creating higher levels of transparency by releasing the raw data (Matheus, 2017). Apps can be efficient and provide quick insight but have pre-defined views determined by their developers, limiting transparency to these pre-defined views, whereas opening raw data can provide higher levels of transparency by enabling the creation of additional views by the public but need more functionalities and have a longer time to use. A trade-off between these aspects is required, and for open government policy-makers and designers, this implies that both easy-to-use apps and comprehensive portals are needed. Both serve different purposes and create different types of transparency. Apps are often focused on the general public having limited knowledge about statistics and manipulating data (Janssen, Matheus, Longo & Weerakkody, 2017). Data is put in context to make it easy to understand and manipulate within a limited time. This approach's disadvantages are that a pre-defined view is given and that not all manipulations are possible. This does not result in complete transparency (Cukierman, 2009; Fung, Graham, & Weil, 2007), however, it helps to create some level of transparency and can be useful. In contrast, data portals can be used by citizens having the expertise and the time to analyze data (Matheus et al., 2018). This can provide greater insight resulting in higher levels of transparency, however, this is only feasible for experts and the usefulness of the results can vary. Hence our findings stress the need to consider the diversity of stakeholders. Furthermore, the findings highlight the need to develop different websites and apps for different stakeholders.

5.3. Limitations and future work

Although the current study provides some useful analysis of factors influencing digital transparency from the citizen's perspective, there are some limitations. The sample consists of citizens who are often familiar with open data, or at least that open data is available for their needs. In retrospect, we found that persons who were not familiar with open data were hardly included in the sample. As such, our sample is only representative for experienced users. This might not be surprising, as only those who are familiar with the use of open data for transparency are probably interested in filling in the survey.

We followed Grimmelikhuijsen (2012) by developing a realistic view of transparency. We refrained from including typical public administration constructs like trust and openness. For further research, we recommend developing models that integrate constructs like trust, accountability and openness, which are often used in public administration research.

Digital transparency is not easy to realize. There is a need for further theorizing to understand better how datasets and functionality can be used to create digital transparency for citizens. Governments should not just assume that apps or portals achieve transparency. We recommend developing design methods for supporting governments to create digital transparency. Citizens can be involved in the design process of creating transparency to understand their needs better. Governments should explore a variety of means to create transparency and not focus on a single way. Different strategies need to be researched to fulfill the need of citizens.

6. Conclusions

Transparency will only be created if open data is useful for the public. This paper is one of the first papers investigating the usefulness of open government initiatives from a user perspective. The SEM model shows that having the right functionalities for the apps and websites is the basis for increasing the perceived usefulness. Functionalities can increase transparency, resulting in higher Perceived Efficiency and Perceived Usefulness. Dedicated attention should be paid to the citizens' different needs and ensure efficiency as the time of citizens and other users is limited. We recommend classifying different types of users in further research and testing models which can use constructs like trust, accountability, and openness (Bannister & Connolly, 2011; Helbig et al., 2010).

Transparency is a complex and ambigious construct. Transparency can increase the credibility of open government, but usefulness might not always need transparency. Apps result in higher efficiency for the users, but only provide insight from one or a few pre-defined views. The level of transparency is limited, as other views are not covered. Opening raw data requires many functionalities that are less efficient than pre-defined apps. However, these enable users to create their own views and find insights that are not pre-defined, resulting in higher levels of Perceived Transparency, but this might not result in higher Perceived Usefulness. Whereas open government apps do not create complete transparency, they can be used by a broad public and their Perceived Usefulness can be higher. Raw data is perceived as efficient to use but can enable higher Perceived Transparency levels, which is only feasible for a limited number of persons. Hence, higher levels of transparency come at a price. In further research, we recommend creating a classification for transparency initiatives considering the context variations. Some types of initiates are likely to be affected by other factors. For example, the functionality of open data portals for raw data will likely differ from ready-for-use apps. These influence the Perceived Efficiency, level of Perceived Transparency, and, ultimately, the Perceived Usefulness.

Author statement

The authors confirm that this is original work and is not submitted elsewhere.

Declaration of Competing Interest

The authors confirm that this is original work and is not submitted elsewhere.

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Appendix A. - Overview of Latent Constructs, Item Questions, and Sources

Latent Constructs	Measurements (Questions)	Source
Usefulness	Useful1:The App helps me to make better decisions	Romi (2013)
	Useful2: The App is useful to me	Romi (2013)
	Useful3: The App helps me to achieve my goals	Delone & McLean (2003)
Transparency	Tr1: The App helps to increase transparency	Matheus & Janssen (2013)
	Tr2: More functions in the Apps are needed to create transparency to support decision making	Matheus & Janssen (2013)
Functionality	Func1: All functions in the App works properly	Alexopoulos et al. (2014);Matheus & Janssen (2013)
	Func2: I found the various functions in the apps are well integrated	
	Func 3: The visualizations provided by the App enable better interpretation of data	
Efficiency	Eff1: The Apps reduce time spent looking for information	Delone & McLean (2003)
	Eff2: The Apps reduce the costs of finding information	

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