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Investigation into the adoption of open government data among students: the behavioural intention-based comparative analysis of three countries

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Abstract

Purpose – Open government data (OGD) are considered as a technology capable of promoting transparency, openness, and accountability, which in turn has a positive impact on innovation activities and creates responsive government, collaboration, cooperation, co-creation, and participation. The purpose of this paper is to explore the adoption of OGD and open data portals among students, in an attempt to discover how governments can improve their actions in this respect.

Design/methodology/approach – This study develops a behavioural intention-based analysis using constructs from the Unified Theory of Acceptance and Use of Technology (UTAUT), which are supplemented with additional constructs that meet the purpose of the study. In total, 10 constructs divided into 33 items constituted the input for our study. Input data for the developed model have been collected through a structured questionnaire distributed between bachelor's and master's level students in three countries – the Czech Republic, India, and Latvia. A Structural Equation Modelling technique was used to analyse the relationships between variables of the model and test 9 hypothesis defined.

Findings – Six constructs have been identified to facilitate significant relationships with behavioural intention. The analysis of the results of the three countries allows us to draw more objective conclusions in respect to the aim of the study and to reveal country-specific aspects that need to be addressed in the future.

Originality/value – This study adds to the existing literature few theoretical and practical aspects. It highlights the role of open data portals as a central point of OGD infrastructures. It enables governments to understand the relationships among the related constructs, improving their actions, and modifying their data infrastructures accordingly.

Keywords Open government data, Open data portal, UTAUT framework, Technology adoption, Questionnaire, Behavioural intention-based analysis

Paper type Research paper

1. Introduction

The government became a worldwide repository of data and information related to citizens, organizations, or public services. The number of open government strategies and initiatives in the last decade has increased significantly and their principles are implemented continuously in more and more countries around the world. Open Government Data (OGD), corresponding infrastructures and ecosystems are the key tools for achieving political, social, economical, cultural, and institutional benefits (Altayar, 2018; Lněnička and Nikiforova, 2021; Wang and Lo, 2016; Wang, 2020; Wirtz and Birkmeyer, 2015). Given that there are different stakeholders linked with the reuse of OGD, further empirical investigation is required in this domain (Malone, 2014).

However, even here, the development of modern Information and Communication Technologies (ICT) must be considered, which has a direct impact on how OGD will be published and how users will consume them. The adoption of the OGD concept among these users has been the subject of

research from its first appearance. Public sector agencies and institutions strive to achieve the maximum effectiveness of such published data. For this purpose, they should know and understand the requirements of individual user groups, particularly with regard to their knowledge, and adapt their actions so that the supply meets the demand as close as possible. At the same time, they should also consider the developments of ICT, which directly affect the tools, channels, and the infrastructure to manage the entire OGD lifecycle. Therefore, public sector agencies and institutions should use tools and channels that are close to users, i.e., they can work with them, and they have approached different groups differently with regard to their requirements and needs. Only with this approach OGD can be reused and the value can be created from them.

The aim of this study is to investigate the adoption of OGD and open data portals among students, including their experience on the subject. Our main intention is that we have chosen one group, which we consider to be one of the most important for OGD-based innovations, while at the same time modifying the evaluation framework to include modern ICT trends (also in line with González-Gallego and Nieto-Torrejón, 2021). These are primarily open data portals and their features aimed to support participation, collaboration, and cooperation of users as well as work with open datasets. In addition, we include requirements for transparency and user trust in OGD producers and publishers. Since OGD as a public e-service is a technology, constructs from the Unified Theory of Acceptance and Use of Technology (UTAUT) and the Technology Acceptance Model (TAM) were recognised to be the most appropriate for the study. Our assumption is supported by their popularity in the literature to which we will refer in Section 2.

Here, students are not perceived as “academics/implementers”, but rather as “academic/users” who can use data for their own research and other professional purposes. We are particularly focused on bachelor’s and master’s level students based in the Czech Republic (CZ), India (IN), and Latvia (LV). The reason for selecting these three countries was two-fold: first, we as researchers are based in these countries, i.e., countries, which we have administered starting from the respondents sampling to analysis of the results in the context of the specificities of the country (economical, technological, and cultural). This is even more important in the light of the sampling, which corresponds to the purposive sampling followed by snowball approach, which is more likely to be successful, when is done by the representative of the particular country (Nikiforova and Lněnička, 2021). In addition, the three countries covered in this study represent both the developed and developing contexts wherein the higher education levels and learning are administered differently, thereby impacting the overall perspectives of the students. Thus, the research questions (RQ) that we are dealing with are:

RQ1: How do students from the CZ, IN, and LV assess the usefulness of OGD and open data portals for their activities?

RQ2: What are the constructs that have the most impact on the behavioural intention for use of OGD and open data portals?

Our study is novel in the sense that we use both the developed and the developing economies as a sampling frame. We also encompass the most recent view on the OGD infrastructure and its requirements in our framework. In addition, such a study is relevant to assess the way in which the OGD are used for academic activities.

The structure of the paper is as follows: Section 2 provides the literature on OGD and open data portals; Section 3 provides an overview of the methodology, framework and model development to-

gether with the hypotheses developed on the basis of the UTAUT and TAM frameworks and constructs of our model defined as a result of the literature review; Section 4 provides the results; Section 5 deals with the discussion and limitations, and Section 6 concludes the study.

2. Background

In recent years, very different studies on the topics related to the intention to use open government-related services and tools have been carried out. Let us briefly cover some of the most expressive.

Jurisch *et al.* (2015) explored factors influencing the intention to use open government services and offers using TAM and UTAUT. Their results indicated the direct influence of perceived advantage, perceived ease of use, geographical closeness of the subject/topic and political activity. In another study by Wirtz and Birkmeyer (2015), an integrative definition of OGD has been derived on the basis on factors like accountability, technology, legal aspects, and trust in government. Fitriani *et al.* (2017) focused on factors that can help governments in formulating policies and strategies. The research model they have developed is based on the Theory of Planned Behaviour (TPB), integrated with the TAM and trust factors. The input data for this model were collected through the survey where the sample was heterogeneous, dominating students, representing a little more than half of the sample. The results showed that, in the case of Indonesia, attitude, subjective norm, perceived behavioural control and trust directly affect the intention to use the open data website. In addition, it was found that the attitude factor is influenced by the perceived usefulness and ease of use, while users' trust to open data website is significantly affected by users' trust to government and technology.

In this respect González-Gallego and Nieto-Torrejón (2021) examined whether and how OGD as a governance strategy can contribute to the trust of Millennials' and Generation Z in public institutions and satisfaction with public outcomes. This study reuses the European Social Survey data that evaluates public attitudes and values in Europe, and the Open Data Barometer. They found that young people are more satisfied when institutional openness is higher and the OGD positively affects both citizens' satisfaction and their trust in institutions. In the light of these findings, the authors encourage public officers to disseminate the implementation of open data strategies to improve the attraction of young people to democratic institutions. Saxena (2017) conducted semi-structured interviews with students in India to explore their views on the usefulness of OGD for them. The results of the interviews carried out refer to the fact that although some PhD students tap OGD in their research work, others use OGD as informational tools to expand their general knowledge. Saxena and Janssen (2017) used the UTAUT framework to assess the behavioural intention to use and accept OGD in India. An increased use and acceptance of OGD was found among the respondents with the greater use of open datasets among men.

Wang and Lo (2016) examined the factors affecting the adoption of the OGD between government agencies using the technology–organization–environment (TOE) framework. The use of this framework produced results which showed a significant positive relationship between the perceived benefits, organizational readiness, and external pressures and the adoption of OGD by government agencies. One of the most recent studies, is Wang (2020), which examines the factors influencing the adoption of OGD in Taiwan from the perspective of individual user innovators, i.e., users who develop new products and services for themselves. Unlike other studies, Wang (2020) does not use any model, using a Social Cognitive Theory that allows the combination of different sources of influence rather than dealing with variables. The study examined the effect of four factors in the adoption of the OGD - computer self-efficacy, tool experience related to “personal factors”, and government support and social influence relating to “environmental factors”. The study revealed only the importance

of social influence and computer self-efficacy. Zuiderwijk *et al.* (2015) used a more traditional approach, introducing a model based on the UTAUT to empirically determine predictors that influences the acceptance and use of open data technologies. Their findings suggest that policy makers should show the benefits of using open data, creating users' awareness that they already use open data when developing policies and strategies. In our study we also give the preference to the UTAUT and TAM frameworks that we complement with other constructs. The rationale for choosing the framework is that the UTAUT framework has been a tried-and-tested one in the Information Systems literature, sometimes referring to the OGD issue (Begany and Gil-Garcia, 2021; Saxena and Janssen, 2017; Talukder *et al.*, 2019 etc.), thereby proving to be an appropriate choice for the purpose of this study. Both frameworks are considered to be able to define and then test the relevant hypothesis and provide insights into constructs that could have a positive effect on behavioural intention to use and accept the technology – the OGD, thereby meeting the objectives of this study.

3. Methodology

3.1 Framework and model development

This study applies the adapted UTAUT framework to explain the behavioural intention to use and accept OGD and data portals. In this regard, the framework is deployed to examine several factors which impact information technologies linked with open data (Saxena and Janssen, 2017; Venkatesh *et al.*, 2003). It is based on the framework introduced by Zuiderwijk *et al.* (2015), which was later adapted by Saxena and Janssen (2017) and Talukder *et al.* (2019). Five items were removed compared to the original framework, such as “my superiors expect me to use OGD”. The main reason for these changes was the context of OGD adoption among bachelor's and master's students, there are usually no labour-law relationships to be included in the model, such as in the case of PhD students (Saxena, 2017). Our main intention was to explore the use of OGD during the higher educational process. The framework, however, is extended by the constructs identified by Purwanto *et al.* (2020), see Table 1 (and Appendix A for definition of these constructs), to emphasize the importance of open data portals in current OGD ecosystems. Thus, in contrast to previous studies, our study:

- 1) extends the previous frameworks by incorporating a *system quality* construct that covers the existence of open data portals as a central point for publishing OGD,
- 2) considers other quality constructs in terms of *information quality* (provided by the open data portal) and *data quality* (provided by OGD and their characteristics),
- 3) includes the *trust construct* that is crucial in efforts for transparent, accountable, and trust-able government,
- 4) focus solely on bachelor's and master's students, including necessary changes in the framework,
- 5) compares data obtained from three countries, making data and conclusions more comprehensive and generalizable.

Table 1: The developed UTAUT-based framework with constructs and corresponding items.

Construct	Corresponding items	Items sources
Performance Expectancy (PE)	PE1: Using OGD is beneficial for me and useful in my daily life.	Saxena and Janssen (2017); Talukder <i>et al.</i> (2019);
	PE2: Using OGD will help me to accomplish my research quickly.	
	PE3: Using OGD will increase my productivity in my study.	

	PE4: Using OGD improves my performance in my study and its quality.	Zuiderwijk <i>et al.</i> (2015)
Effort Expectancy (EE)	EE1: I realize learning to use OGD is easy.	Saxena and Janssen (2017); Talukder <i>et al.</i> (2019); Zuiderwijk <i>et al.</i> (2015)
	EE2: I clearly understand how to use OGD.	
	EE3: I do not have difficulty in explaining why using OGD may be beneficial.	
	EE4: I find OGD portal ease to use.	
Social Influence (SI)	SI1: People who influence my behaviour think that I should use OGD.	Saxena and Janssen (2017); Talukder <i>et al.</i> (2019); Zuiderwijk <i>et al.</i> (2015)
	SI2: People who are important to me (e.g., family, friends) think that I should use OGD.	
	SI3: People who are important to me (e.g., colleagues, study contacts) think that I should use OGD.	
Facilitating Conditions (FC)	FC1: I have the necessary resources to use OGD.	Saxena and Janssen (2017); Talukder <i>et al.</i> (2019); Zuiderwijk <i>et al.</i> (2015)
	FC2: OGD portal is compatible with other systems that I use.	
Voluntariness of Use (VU)	VU1: Although it might be helpful, using OGD is certainly not compulsory for my research or other activities.	Moore and Benbasat (1991); Saxena and Janssen (2017); Zuiderwijk <i>et al.</i> (2015)
	VU2: My research and other activities do not require me to use OGD.	
System Quality (SQ)	SQ1: Structure of OGD portal is user-friendly.	Purwanto <i>et al.</i> (2020); Talukder <i>et al.</i> (2019)
	SQ2: The OGD portal that I engaged with is available at all times and responds at an acceptable speed.	
	SQ3: The OGD portal provides datasets in different file formats and open licenses.	
	SQ4: The OGD portal provides features needed (e.g., data visualization, data request, feedback mechanism, quality rating).	
	SQ5: The OGD portal provides guidance and documentation to download and interpret the data.	
Information Quality (IQ)	IQ1: I get the necessary information through OGD portal.	Talukder <i>et al.</i> (2019)
	IQ2: The OGD portal provides up-to-date information.	
	IQ3: Information from the OGD portal is reliable to me.	
Data Quality (DQ)	DQ1: OGD I engaged with are free from errors.	Purwanto <i>et al.</i> (2020)
	DQ2: OGD I engaged with are complete (i.e., cover all attributes needed, no missing value).	
	DQ3: OGD I engaged with are well-formatted.	
	DQ4: It is easy to link or combine a dataset to/with other OGD.	
Trust (TR)	TR1: OGD providers can be trusted.	Purwanto <i>et al.</i> (2020)
	TR2: The OGD that I engaged with seemed truthful to me.	
	TR3: The OGD I engaged with can be trusted.	
Behavioural Intention (BI)	BI1: I intend to use OGD and data portals in the future.	Saxena and Janssen (2017); Talukder <i>et al.</i> (2019);
	BI2: I predict that I will use OGD and data portals in my daily life.	

BI3: I plan to use OGD and data portals frequently.

Zuiderwijk *et al.*
(2015)

The model used in this study (Figure 1) has nine constructs, which directly predict the behavioural intention to use OGD and open data portals in the future. This leads us to 9 hypotheses that should be tested in this study, where relationships between 9 constructs selected from the UTAUT and TAM frameworks, and the additional constructs selected as a result of the literature review, with Behavioural Intention, are tested. We pose that each of the 9 constructs has a positive effect on behavioural intention for the OGD use. This means that each of the 9 hypotheses is developed as “[Construct \in {Performance expectancy; Effort Expectancy; Social Influence; Facilitating Conditions; Voluntariness of Use; System Quality; Information Quality; Data Quality; Trust}] has a positive effect on behavioural intention to use and accept the OGD” (H1: Performance expectancy, H2: Effort Expectancy, H3: Social Influence, H4: Facilitating Conditions, H5: Voluntariness of Use, H6: System Quality, H7: Information Quality, H8: Data Quality, H9: Trust).

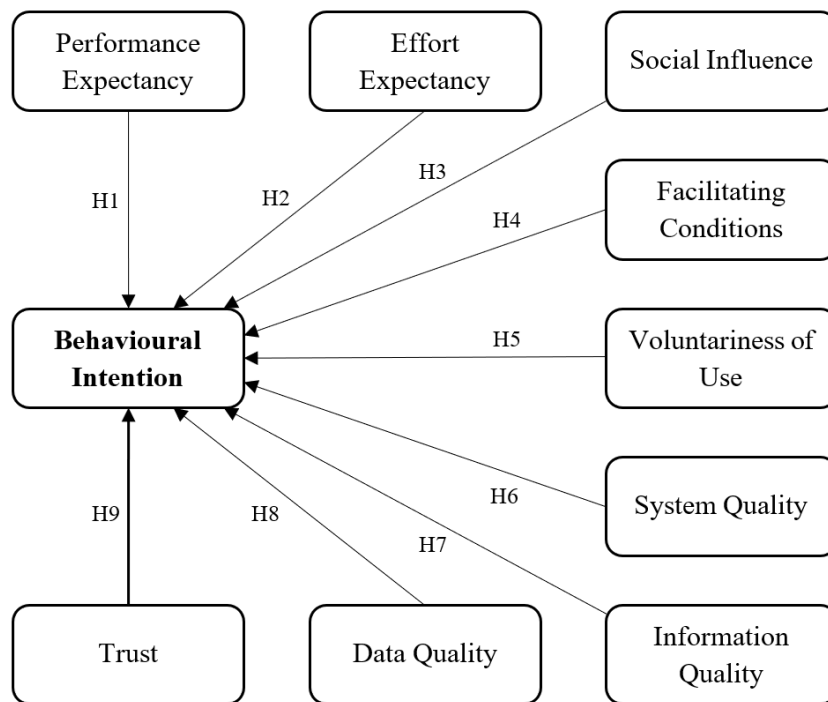


Figure 1: A model for evaluating the behavioural intention for adoption of OGD and open data portals.

The questionnaire consisted of 11 questions regarding students’ demographic information and their experience with OGD and data portals, which are provided in Appendix B, and items for the model in Table 1. Each construct was supplied with the 5-point Likert scale, thereby allowing the respondent to assess it from “strongly disagree” to “strongly agree”. A pilot study was conducted to test the questionnaire for reliability. At first, six academic experts checked its consistency, sequence, and relevance with the measurement items. Then, small groups of students in each country were asked to answer questions and provide feedback. As mentioned above, five items were removed from the framework based on the pilot study.

3.2 Data collection and analysis

The study was conducted with a sample of students as actual or potential users of OGD and open data portals in the CZ, IN, and LV. An online questionnaire was developed for this purpose. The link to the questionnaire was distributed from February to March 2021 through channels selected to be most suitable for students in the CZ, IN, and LV. Depending on the country, these channels varied from

posting an invitation to take part in the survey via social networks to emailing or using learning management systems, or reaching in another way both students and more appropriate employee of the different universities, faculties, tutors or other people, who have access to students. We collected 500 responses – 155 from CZ, 174 from IN, and 171 from LV.

A Structural Equation Modelling (SEM) technique was used to analyse the interrelationships among variables in the model. In this study, we applied Partial Least Squares (PLS)-SEM as an approach for our data analysis using the software SmartPLS. The analysis was designed to (1) evaluate the measurement model on its internal consistency reliability, convergent validity, and discriminant validity, and (2) assess the structural model for considering the causation among constructs based on the coefficients of determination (R^2 values) and the significance of the path coefficients (Hair *et al.*, 2017).

After the dataset with responds in a .csv file format was imported into SmartPLS, the inner model of latent variables that represent each construct was built. By linking the corresponding items to the related latent variables, the outer model was created. The PLS algorithm with the following parameters was applied – weighting scheme: path weighting scheme; maximum iterations: 500; stop criterion: 10^{-7} , and initial weights: 1.0 (Bílková *et al.*, 2015; Wong, 2013). The bootstrapping procedure was conducted to generate T-statistics for significance testing of both the inner and outer model. The Bootstrap result approximates the normality of data (Wong, 2013). The settings were – subsamples: 5000; test type: two-tailed; significance level: 0.05 (Bílková *et al.*, 2015).

4. Results

4.1 Respondents' characteristics and experiences with OGD and data portals

The gender share of respondents was almost equal. Men predominated among the respondents from LV and women predominated among the respondents from CZ. Most of the respondents were bachelor students (86%) and aged from 19 to 22 (66%). As regards the fields of study, computer science, management, and law dominated most, see Table 2.

Table 2: A summary of the respondents' demographic information by country.

<i>Gender</i>	CZ	IN	LV	TOTAL (%)
Male	56	93	100	249 (50%)
Female	99	80	68	247 (49%)
Prefer not to say	0	1	3	4 (1%)
<i>Year of study</i>	CZ	IN	LV	TOTAL (%)
1 st year	31	81	28	140 (28%)
2 nd year	77	51	119	247 (50%)
3 rd year	16	13	3	32 (6%)
4 th year	20	12	18	50 (10%)
5 th year	11	17	3	31 (6%)
<i>Field of study</i>	CZ	IN	LV	TOTAL (%)
Computer science	42	7	149	198 (40%)
Economics	29	7	2	38 (7%)
Law	0	84	0	84 (17%)
Liberal arts	0	31	0	31 (6%)
Management	84	40	7	131 (26%)

Mass communication	0	0	9	9 (2%)
Other	0	5	4	9 (2%)

Table 3 shows the responses to the selected questions about students' experiences with OGD and open data portals. For most of the students OGD are important or neutral. The extent depends on the usefulness of these data for them. If they already used them and found what looked for, they tend to evaluate them as *important* or *very important*. The first impression from open datasets and open data portals, especially their quality, is crucial for further uses. It should be also noted that the number of portals on which open data are available differs in each country and affects the results. Although the centre of data infrastructures is usually a national open data portal, there are also various open data portals operated by cities and regional authorities, where data can be found and used. This is the case for the CZ, where a section with open data is provided on many public organizations' websites. In this regard, 67% of Czech students answered as very important or important. In addition, the availability of OGD is also highly affected by trust in institutions. If there is a low trust in institutions, citizens expect that most information and data will be freely available for everyone to control on what resources are their taxes spent on.

Table 3: Distribution of students' responses to selected questions.

<i>To what extent are OGD purposeful for you?</i>	CZ	IN	LV	TOTAL (%)
Very important	36	16	7	59 (12%)
Important	68	71	53	192 (38%)
Neutral	51	67	94	212 (42%)
Unimportant	0	5	13	18 (4%)
Very unimportant	0	15	4	19 (4%)
<i>How often do you use OGD?</i>	CZ	IN	LV	TOTAL (%)
Daily or multiple times a day	21	19	1	41 (8%)
Weekly or a few times in a week	50	39	9	98 (20%)
Monthly or a few times in a month	37	57	39	133 (27%)
Yearly or a few times in a year	33	27	90	150 (30%)
Do not know	14	32	32	78 (15%)
<i>For what purposes do you use OGD?</i>	CZ	IN	LV	TOTAL (%)
To perform statistical analysis	105	78	82	265 (25%)
For data linking (combining and integrating different datasets)	15	30	19	64 (6%)
To write academic publications	90	96	39	225 (21%)
To perform policy research	2	17	12	31 (3%)
To perform investigations (non-scientific and non-policy)	7	21	27	55 (5%)
For political and policy-making decisions	11	13	13	37 (4%)
For curiosity and/or recreation	83	92	96	271 (26%)
For daily operation in work	15	19	8	42 (4%)
For news reporting	21	19	12	52 (5%)
No use	1	4	6	11 (1%)

In the context of IN, most respondents perceived OGD as purposeful and used OGD more frequently. Most of the Indian respondents tapped OGD for writing academic publications and this was a sizeable number in comparison with the Latvian respondents. In case of LV, first, the gender of respondents

should be addressed since the majority of respondents were male. This is related to the area, which these respondents represented most, namely, computer science, where more than 85% of students are male, that have had a significant impact on the overall result in these terms. Although, as in the CZ, LV has some websites of public organizations', where data are available as open data, (1) an appropriate section, i.e., "open data" is rarely intended for these data reducing their findability, (2) the redirection to the Latvian open data portal happens, (3) users' awareness of this fact appears to be quite low. This may be because the concepts of the open data and open data portal are relatively new for LV, since the national Latvian Open Data Portal was only released in 2017, although the informative activities or more precisely their lack, could also matter.

In addition, the "purposefulness" assessed in this set of questions is also closely linked to the extent to which the data are understandable to the user, as they will only be purposeful for users when they are not only available but also understandable for their further reuse. However, the user-centred analysis of the OGD portals (Nikiforova and McBride, 2021) has revealed that aspects such as "dataset description" and "thematic categories and tags", which constitutes data understandability are assessed for LV to be "partly fulfilled" that is worse than for both the CZ and IN. Therefore, even if users were interested and considered the OGD as purposeful, their interest could be reduced or even disrupted because these aspects have been poorly implemented.

The frequency of use also differs among the countries. In total, the highest value is for yearly or a few times in a year. This answer prevails in Latvia while the Indian students use OGD monthly or a few times in a month and the Czech students use OGD weekly or a few times in a week at most. The use is affected by activities in which the students must work with OGD. If the field of study requires for students to find open data *to perform statistical analysis* or *write academic publications*, then the frequency increases. This assumption is supported by answers on the question dealing with purposes of OGD use. Czech students, which in 73% study economics or management, are encouraged to use datasets from open data portals and other repositories. Overall, the most students use OGD for *curiosity and/or recreation*. For Latvia, a majority of students use OGD for *curiosity and/or recreation* and *to perform statistical analysis*, followed by *to write academic publications*. These results, along with the frequency of use, once again indicates that this concept is new for Latvia.

A further question was related to which features of open data portals students use or have used. The results are shown in Figure 2, while more details on these features can be found in Lněnička *et al.* (2021). Most students use or have used features that enable *learn and explore* capabilities of the portal and the ways how OGD can be reused. Other activities performed by students are related to *search datasets and filter* them by various parameters. Finally, the right datasets are *selected and can be downloaded* in several formats. These categories of features can be used by users with basic computer and Internet skills. However, to fully utilize the potential of all features provided by open data portals, users should have intermediate or advanced skills. Therefore, our study revealed that these features are used only by a minimum of students. Usage of these features is also closely related to the field of study. From 198 students who stated that study computer science most of them were from Latvia. Although like the other two countries we cover, the most popular features are basic features, they are followed by *visualize and interact*, despite the fact that (Nikiforova and McBride, 2021) this feature is not considered by the users as well-implemented.

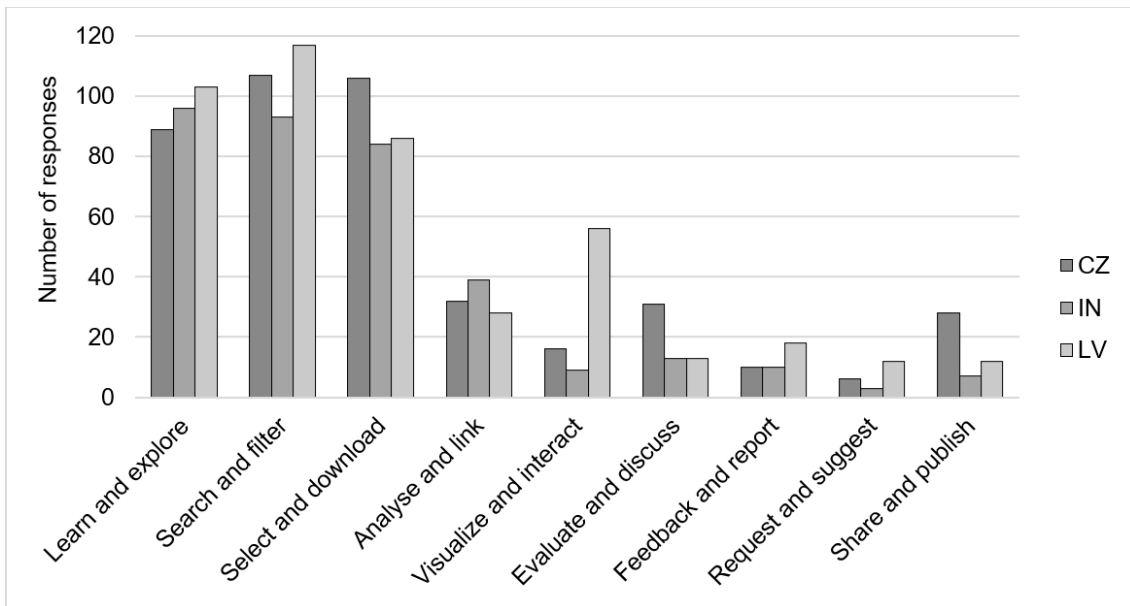


Figure 2: Usage of features on open data portals by students.

The last question dealt with types of OGD that students use or have used. Thematic categories and the number of responses for each of them are shown in Figure 3. Most students use business and economy datasets, especially Czech students, and datasets relevant for education, which they are need for their study. Regarding the current situation about the pandemic, students also use datasets that are related to health. The most popular types of open data in Latvia are related to (1) the current state, i.e., pandemic, resulting in health-related data, (2) user type, i.e., students are interested in education-related open data, (3) OGD trends on the portal, i.e., those which are presented with a higher number of datasets. The latter point also applies to less popular data types, i.e., mapping and crime and justice, which are less represented on the OGD portal and not presented as a separate category. The most popular types of data are also those that are better maintained and constantly updated. Finally, in regard to the Indian students, it may be deduced that students tapped OGD for learning and exploring as well as for searching and filtering the datasets. The propensity to tap OGD for requesting and suggesting datasets or sharing and publishing new datasets was found to be negligible among the Indian students. Taking these findings together, we can conclude on usefulness of OGD and open data portals for students' activities and consider RQ1 to be answered.

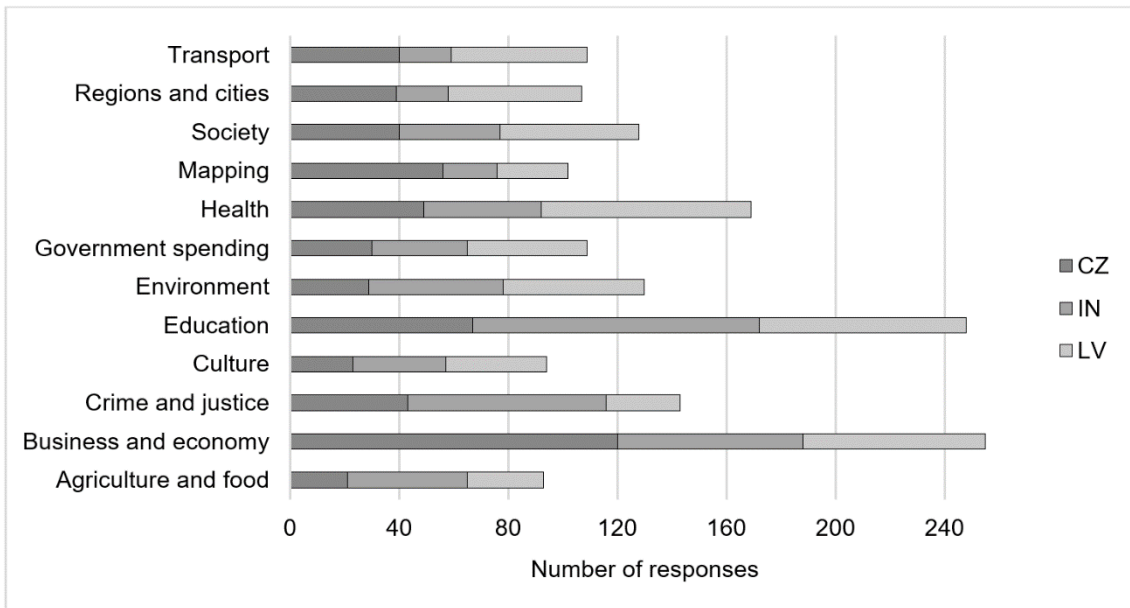


Figure 3: Usage of OGD types by students.

4.2 Measurement model assessment

The measurement model included data from all three countries, i.e., 500 students. Internal consistency reliability is measured by Cronbach's alpha and composite reliability. The values between 0.60 and 0.70 indicate an acceptable level of reliability, and values of 0.80 or greater a very good level. Convergent validity, measured as Average Variance Extracted (AVE), can be accepted when the value is greater than 0.50 (Hair *et al.*, 2017). Our model meets all the conditions. Thus, it can be concluded that the construct measures are reliable and valid. Table 4 summarizes the values of measures for each construct.

Table 4: Measures of internal consistency reliability and convergent validity.

Measure/construct	BI	DQ	EE	FC	IQ	PE	SI	SQ	TR	VU
Cronbach's alpha	0.706	0.748	0.786	0.646	0.722	0.831	0.827	0.796	0.795	0.717
Composite reliability	0.836	0.837	0.861	0.838	0.839	0.888	0.897	0.859	0.878	0.662
AVE	0.629	0.564	0.609	0.724	0.636	0.665	0.743	0.549	0.705	0.545

The square root of AVE value is used to calculate the Fornell-Larcker criterion to assess the discriminant validity. In this case, the discriminant validity is achieved when a diagonal value is higher than the value in its row and column. The results in Table 5 indicate that the discriminant validity is fulfilled. The constructs are further used to test the structural model.

Table 5: Fornell-Larcker criterion analysis for checking discriminant validity.

	BI	DQ	EE	FC	IQ	PE	SI	SQ	TR	VU
BI	0.793									
DQ	0.473	0.751								
EE	0.483	0.525	0.780							
FC	0.305	0.366	0.520	0.851						
IQ	0.475	0.578	0.564	0.466	0.797					
PE	0.585	0.382	0.520	0.337	0.507	0.815				
SI	0.510	0.324	0.422	0.362	0.334	0.556	0.862			

SQ	0.449	0.569	0.543	0.501	0.626	0.407	0.283	0.741		
TR	0.434	0.531	0.431	0.422	0.618	0.351	0.210	0.427	0.840	
VU	-0.163	0.067	-0.048	0.053	0.029	-0.253	-0.161	0.096	0.153	0.738

4.3 Structural model assessment

The quality of the model is assessed by using R^2 values and the significance of the path coefficients (Hair *et al.*, 2017). The R^2 value for BI (0.496) can be considered moderate. Using a two-tailed t-test with a significance level of 5%, the path coefficient will be significant if the T-statistics is larger than 1.96. The results of our case are shown in Table 6. Concerning the behavioural intention to use and accept OGD and data portals, we find that all relationships in the structural model, except $EE \rightarrow BI$, $VU \rightarrow BI$, and $IQ \rightarrow BI$, are significant. The results provide support for the model's predictive relevance regarding the latent variables. Taking these findings together, we conclude on the constructs and their impact on the behavioural intention for use of OGD and open data portals and consider RQ2 to be answered.

Table 6: The assessment results of the structural model.

	Path coefficients	T-statistics	P-values	Result
H1: PE \rightarrow BI	0.247	4.332	0.000	supported
H2: EE \rightarrow BI	0.075	1.567	0.117	rejected
H3: SI \rightarrow BI	0.240	4.986	0.000	supported
H4: FC \rightarrow BI	-0.098	2.063	0.039	supported
H5: VU \rightarrow BI	-0.107	1.644	0.100	rejected
H6: SQ \rightarrow BI	0.155	2.681	0.016	supported
H7: IQ \rightarrow BI	-0.013	0.210	0.833	rejected
H8: DQ \rightarrow BI	0.116	2.153	0.031	supported
H9: TR \rightarrow BI	0.202	3.788	0.000	supported

5. Discussion and limitations

Based on the loadings for items in the measurement model, PE4 (0.865), SI3 (0.871), FC2 (0.936), SQ4 (0.761), DQ3 (0.846), and TR1 (0.870) appear to be the most important factors of each construct. While PE4 concerns the improvement of students' performance in their study and its quality by using OGD, SI3 is associated with the influence of students' colleagues on their decisions to use OGD. Other items are related to data portals and confirm their importance as the central points for working with open datasets. According to FC2, OGD portals are compatible with other systems that students use. It is closely related to the design, structure, and usability of these portals that students found user-friendly and easy to learn how to use them. In this regard, OGD portals provide features that students need to work with open datasets (SQ4) and OGD with which they were engaged were well-formatted (DQ3). Finally, TR1 deals with trustfulness of OGD providers.

Although in previous section we have dealt with an overall view for three countries where all measures were reliable, a single model can be built for each country. This allows us to reveal that, in the country-specific context, four constructs have slightly weaker results in the case of some countries. More precisely, the results of LV were weaker in the case of convergent validity (AVE) for DQ and SQ constructs, where SQ was also a slightly weaker for the CZ. As regards the CZ, the two

constructs were slightly weaker – FC and SQ, where weaker results of FC have only been demonstrated within the scope of Cronbach’s alpha. Both of these results are weaker than we expected, i.e., the principles for each measure we have introduced earlier, but they are all acceptable.

As regards the AVE, extracted ranges for four constructs are between 0.225 (VU for IN) and 0.498 (SQ for the CZ), i.e., is below the recommended level of 0.5. According to Fornell and Larcker (1981) and Hair *et al.* (2017), the AVE may be a more conservative estimate of the validity of the measurement model, and “*on the basis of p*” (*composite reliability*) alone, the researcher may conclude that the convergent validity of the construct is adequate, even though more than 50% of the variance is due to error”. Thus, we can accept the reliability of the measurement items since the value of the three of four constructs is above the recommended level. For Cronbach’s alpha, these weaker results exceed 0.59, which according to George and Mallery (2003) are considered “questionable” but still valid, especially given the scale we have used, since shorter scales tends to find lower Cronbach values compared with longer ones. Thus, given that we have used 5-point Likert scale, we follow Hinton *et al.* (2014) recommendation to accept the result between 0.5 and 0.7, which indicates moderate reliability.

Since both constructs recognized as weaker for Latvia are related to quality, namely Data and System quality, they can be considered as a kind of trend to be inspected in the future. It is also in line with the Open Data Maturity Report (Van Knippenberg, 2020), according to which quality is the weakest aspect of Latvian OGD of four assessed, namely impact, policy, portal, and quality, and the only one below the European Union average. In case of IN, the VU construct has shown significantly lower results than average in both composite reliability and AVE measurements, which is something surprising and difficult to explain. Therefore, this point should be considered as the starting point for future studies on OGD in IN. Similarly, to the LV case, in the case of the CZ, where FC and SQ are found to be weaker for individual measures, the results can be explained by the Open Data Maturity Report, where the portal has the lowest result among the categories assessed. Since FC as well as SQ are at least partly related to the portal, in the CZ’s case the portal could be the main focus for further investigation.

While the quality of the model for IN only, measured as the coefficient of determination, increases to $R^2 = 0.659$, the CZ and LV slightly decrease to $R^2 = 0.482$ and $R^2 = 0.401$, respectively. There are several factors which could have affected these results. As a result, the DQ- and TR- related hypotheses are not supported for the CZ and LV. These results can be discussed in the light of the recent Open Data Maturity report. As regards DQ, which overall result is very weak for LV but relatively high for CZ, after an in-depth analysis of indicators considered, we found that both countries face significant challenges in the “currency and completeness” indicator, which is the weakest data quality-related indicator for both CZ (78%) and LV (62%).

However, the currency and completeness of data are closely link to trust (TR), which has also been found to be weak for both countries with rejected respective hypotheses. Trust is also closely linked to participation and the reuse of data that can have a significant impact on it (Altayar, 2018), which however relates to portal indicators dealing with capabilities for users’ participation, where the CZ shows weak results with slightly better but still weak LV results. It is also finally related to “political impact” indicator dealing with transparency and accountability, where this trend is also valid for both countries. According to Purwanto *et al.* (2020), quality of system, service, and data together with the perception of users about these concepts are those which together build trust. So, given that LV has rejected both DQ- and SQ-, while the CZ DQ- and IQ- related hypotheses, the rejection of TR-related hypothesis results is not a surprise.

Some trends for the CZ and LV can be also explained by the Digital Economy and Society Index (DESI) (European Commission, 2020). The recent DESI has revealed that only 43% of LV's citizens has at least basic digital skills, with 58.3% in the EU and 62.1% in CZ, and 24.5% have above basic digital skills with 33.3% in the EU and 25.8% in CZ. On the other hand, for activities that require basic digital skills only, the difference in results is not as significant as they might be expected. For example, "feedback and report" and "request and suggest" refer to the "e-Government Users" (People who sent filled forms to public authorities, over the Internet, previous 12 months) indicator in the DESI, according to which the CZ (50.8%) has a lower score compared to both, average in the EU (67.3%) and LV (83.1%).

Since open data policies and implementation are considered as part of e-government services, the familiarity of students with available digital public services, i.e., their range and quality, can also affect the adoption of OGD among them. This assumption is also supported by the "Open Data" indicator of the DESI that has been extracted from Open Data Maturity Report, according to which the CZ and LV belong to the middle-performing countries (European Commission, 2020). Therefore, the issues could be not only about OGD and the level of awareness of them, but also at more general level, i.e., digital skills and the demand and supply sides of digital public services. In the Indian context, it must be averred that while the respondents had less familiarity with the OGD, they could relate with the concept when explanation was provided to them. In fact, the respondents were tapping OGD for different purposes without knowing about the concept of OGD. Implicitly, OGD, as a concept, is a novel concept and needs to be institutionalized in the Indian education system for being tapped in value creation.

In addition, some ranking should be linked not only to the skills of students, but also to the features and capabilities of the OGD portals. The example here is the "evaluate and discuss" feature, the low result of which in the case of LV can be explained by its lack on the portal. The same is applicable for IN. Therefore, some of the results obtained during the survey cannot be generalised without addressing the presence of these features on the OGD portals and level of their user-friendliness. Another point is less popularity of the "select and download" feature compared to the CZ. Since this trend is linked to the one we have observed while analysing the assessment of the "purposefulness" of open data, we assume that it could also be linked to the "value" of open data provided to users, i.e., the data provided by the Czech portal may be more valuable or usable for its users. The features for evaluating and discussing as well as sharing and publishing open datasets are used more often by Czech students, supporting the assumption of a low trust in public officials and politicians. Finally, in the case of IN, websites – apart from being less user-friendly – are lacking options for using OGD in compatible formats or are starkly lacking in providing updated data. This lends to difficulty in tapping OGD for usage and adoption.

While in this Section we have discussed the results in the light of some indices, it should be mentioned that there are also other indices that cover the countries included in this study. However, the available data for these indices are either no longer up to date or their methodologies would need to be further clarified in order to draw relevant conclusions. For example, covering all three countries, the Global Open Data Index and Open Data Barometer were lastly published in 2016. The Open Data Inventory ranking from 2020 assesses the coverage and openness of official statistics published online through national statistical offices. This ranking could be seen as a competitor to open data portals and the results of our study can be also affected by the existence of these kinds of channels for open data.

According to our observations working with students, they are rarely familiar with the concept of the OGD and the benefits of their use, which also applies to their teachers and professors, who rarely

draw their attention to them, so their knowledge of OGD is weak. Most of them start using OGD only in the scope of the relevant courses dealing with OGD that are currently under-represented. This is the case even for students representing Computer Science. The personal observation of authors points out that high-schools of countries covered by this study do not teach the OGD-related issues and do not promote their using. That could be the reason for such low results demonstrated by IN for the VU construct, i.e., students do not see the value in the data for their personal needs.

In recent months, however, some Faculties in the University of LV, such as Business and Management, have started inviting colleagues dealing with the OGD to give at least very brief discussion on the topic. It is, however, an exception rather than a rule or continuous trend. As a result, students mostly deal with the OGD either in the OGD-related course or a workshop that are not included in the study program, i.e., optional, or during self-education. These students often become so-called open data enthusiasts, who start developing different kinds of open data-based applications, assessing it as a kind of challenge. The weak participation of young people has been noticed by government and Latvian open data holders, so the open data hackathons for young people have become popular in last two years to attract more pupils and students. These hackathons, however, attract mostly IT-related students. Similar observations are also applicable for the CZ and IN.

Finally, the relevant constructs and items that we included in our model can be the subject of discussion. Although the framework was already validated by Zuiderwijk *et al.* (2015), Saxena and Janssen (2017) or Talukder *et al.* (2019), the developments in the area of OGD as well as proliferating of modern technologies and solutions required its modification. We considered the national open data portal as the centre of our efforts and we chose relevant constructs accordingly. In addition, since our target group were students, we also modified corresponding items. However, other authors may proceed differently. For this purpose, Haini *et al.* (2019) provided a list of 15 factors influencing the OGD adoption that can be incorporated into the model. Husin *et al.* (2019) identified 36 constructs related to the adoption of OGD from previous research, including their frequency of uses.

5.1 Theoretical implications

The theoretical implications of our study concern primarily further development of UTAUT frameworks, constructs, and corresponding items to understand the adoption of OGD and open data portals to enable stakeholders effectively reusing OGD. The main contribution of our study to the existing literature on OGD adoption is that we provided an understanding of the constructs affecting OGD adoption among students. It has confirmed the need of an analysis of existing data infrastructures and repositories since the users' attention should be directed to one point where they can find all relevant information about OGD and use features that help them in working with open datasets. OGD strategies and initiatives are the central point that frames these efforts and should include requirements on data portals. In this regard, new theoretical models should be introduced to interlink all the affected elements. They, however, should be maintained continuously together with other developments that may directly or indirectly affect the use of the OGD and open data portals.

Our study complemented the previous studies in terms of OGD adoption by stakeholders. In this vein, our study provides a baseline for further research on the OGD adoption by other stakeholders like the journalists, NGO activists, public sector officials, farming community, entrepreneurs, private sector and the like. The study focuses on students as they are seen as new force capable of transforming the world and bringing new solutions and innovations. Unfortunately, their knowledge of the OGD and experience in working with them daily is not in line with our expectations, and there is still a signifi-

cant gap in their knowledge. Further research should be undertaken to clarify the intentions of students regarding their knowledge and levels of skills. It is obvious that one model cannot be applied to all forces that shape students' choices and actions. It should be noted that our results showed that only 7% of students use OGD for political contexts, mostly because this is the highest level of OGD reuse and students must learn how to do this using appropriate analytical techniques. This finding is in line with Purwanto *et al.* (2020) who emphasized the need of support provided by knowledgeable, responsive, and emphatic data providers.

5.2 Practical implications

This study offers practical contributions by identifying constructs and corresponding items that influenced the adoption of OGD and open data portals among students. Public officials can use our findings in improving design and features provided by OGD portals, especially on the national level. They should consider different levels of knowledge and skills of users since the issue of digital skills may hinder their efforts. For example, Lněnička *et al.* (2021) developed a list of interactions with OGD portals that users with a certain level of skills should be able to successfully perform using corresponding features on these portals. The ecosystem of a Smart City often includes a data portal through which smart data, usually meeting OGD standards, are published to citizens and other stakeholders (Lněnička and Saxena, 2021). This could be also a further research direction that requires investigation.

The concept of the OGD should be promoted by encouraging young people's awareness and education, since although this concept is not new, the study has revealed that students rarely have knowledge and practical experience in working with OGD. Given that our observations lead to conclusion that universities rarely cover the topic of OGD, it is also a call for academia to launch an educational process on this already daily phenomenon, both by creating new courses and by modifying existing ones with the findings of this study, by drawing youth's interest to the OGD and their potential. This recommendation is in line with Talukder *et al.* (2019) who highlighted the social impact and learning that should rely on building strategies and networks to boost people to use OGD.

6. Conclusions

The purpose of our model was to investigate the adoption of OGD and open data portals among students to help governments in understanding the relationships among the related constructs, improving their actions, and modifying their data infrastructures accordingly. After we analysed how students from the involved countries assess the usefulness of OGD and the open data portals for their activities (RQ1), we focused on relevant constructs to find out which of them have the greatest impact on behavioural intention for use of OGD and open data portals (RQ2). This was done by adopting constructs from the UTAUT and TAM, since the OGD as a public service can be considered as a technology capable of promoting transparency, openness, and accountability, which in turn has a positive impact on innovation activities and creates collaboration, cooperation, co-creation and participation. For the present purpose, the focus remains on the adoption of OGD by students for academic purposes only. In total, 10 constructs divided into 33 items constituted the input for our study and survey conducted, where 9 constructs that could predict the behavioural intention to use OGD and open data portals in the future were verified by testing the respective hypotheses.

Overall, 6 out of 9 hypotheses were supported with 3 of them, more precisely on behavioural intention relation to effort expectancy, voluntariness of use, and information quality, rejected. Thus, 6 constructs have been identified to facilitate significant relationships with behavioural intention. The data

collected in a survey of 500 bachelor's and master's level students from three countries, the CZ, IN, and LV allows us to claim the objectivity of the results.

Although the use of the three countries allowed us to claim more comprehensive and objective conclusions, it also allows us to set further directions for each country's research, as the results for each country concerned differed and pointed to several weaknesses. Therefore, the presented study brings not only general findings on the adoption of OGD among students, but also brings value at national level of all three countries. As regards the common point on the countries covered, we found that knowledge on the OGD (portal) and their use are rather individually, since high-schools in these countries are not promoting the use of OGD, which has therefore had a negative impact on both the results of the analysis and the overall use and reuse of OGD and all the efforts from the public officials. As a result, students mainly use basic features on open data portals with very little focus on more advanced features. Educational events and activities can therefore be seen as a priority for sustainable and long-term supported development of OGD among young people and their consequent reuse for economic and technological value.

Our study held significance in terms of ascertaining the usage and deployment of OGD among a relevant section of stakeholders of the academia – the students themselves. Further studies may be conducted taking a different set of stakeholders like the voluntary or non-voluntary sector representatives who might lend their perspectives as to how and why OGD is purposeful for them, if at all. The study took sample from a developing country vis-a-vis two European countries and further research is warranted wherein more developing or developed countries may be considered. In addition, the use of the “engagement” construct, recently presented in Begany and Gil-Garcia (2021), can be further introduced and assessed.

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Appendix A: Constructs and their definition

Construct	Definition	Source
Performance Expectancy	the degree to which a person believes that using the system will facilitate him or her for attaining benefits in job performance	Venkatesh <i>et al.</i> (2003)
Effort Expectancy	the degree of easiness associated with the implementation/use of the system	
Social Influence	the degree to which an individual understands that important others' perceptions he or she should try the new system	
Facilitating Conditions	the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system	
Voluntariness of Use	the degree to which use of the innovation is perceived as being voluntary, or of free will	Moore and Benbasat (1991)
System Quality	performance of the information system in terms of reliability, convenience, ease of use, functionality, and other system metrics	Petter and McLean (2009)
Information Quality	characteristics of the output offered by the information system, such as accuracy, timeliness, and completeness	
Data Quality	the degree to which the data are free from errors, complete, appropriately formatted, and ready for their reuse	Based on Purwanto <i>et al.</i> (2020)
Trust	the degree to which the data can be trusted	Based on Purwanto <i>et al.</i> (2020)
Behavioural Intention	desired output, i.e., the readiness and willingness to use OGD	Based on Venkatesh <i>et al.</i> (2003)

Appendix B: Students' demographic information and experiences with OGD and data portals

Country of origin	Which country do you belong to? CZ, India, Latvia
Gender	Are you male or female? Female, Male, Prefer not to say
Year of study	What is your year of study? 1st-, 2nd-, 3rd-, 4th-, 5th- year, Other.
Age group	What is your age group? 15-18, 19-22, 23-26, 27-30, Above 30
Level of study	Are you a Bachelor/Master student? Bachelor student, Master student

Field of study	Which of the following fields of study best describes you? Computer science, Economics, Law, Liberal arts, Management, Mass communication, Other
Purpose of use	To what extent is OGD purposeful for you? Very unimportant, unimportant, neutral, important, very important
Frequency of OGD usage	How often do you use OGD? Daily or multiple times a day, Weekly or a few times in a week, Monthly or a few times in a month, Yearly or a few times in a year, Do not know
Purpose of OGD usage	For what purposes do you use OGD? To perform statistical analysis, For data linking (combining, and integrating different datasets), To write academic publications, To perform policy research, To perform investigations (non-scientific and non-policy), For political and policy-making decisions, For curiosity and/or recreation, For daily operation in work, For news reporting, Other
Usage of features on OGD portals	Which features on open data portals do you use or have you used? Learn and explore, Search and filter, Select and download, Analyse and link, Visualize and interact, Evaluate and discuss, Feedback and report, Request and suggest, Share and publish
Types of OGD	Which of the following types of OGD do you use or have you used? Agriculture and food, Business and economy, Crime and justice, Culture, Education, Environment, Government spending, Health, Mapping, Society, Regions and cities, Transport, Other