# Transparency in Czech Regions: Evaluation of Open Data Availability for Public Awareness

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***Abstract*—Innovations in information technology have created opportunities to improve living conditions for citizens and residents. One key development is the smart city concept, which offers benefits like ambient-assisted living. However, residents need to express their needs and evaluate whether legislators take meaningful steps to address them. Effective monitoring of policy decisions is necessary not only at the city level, but also for larger administrative units such as regions or the entire state. Effective monitoring requires leveraging open government data with appropriate tools to prevent misinformation and empty political promises. Assessing the availability and quality of these data is the key to achieving these objectives. The regional elections in autumn 2024 were an impulse for us to assess the transparency of Czech regional councils–specifically, how easily citizens can access and understand information about policy decisions that affect them. In addition to analysis of the available data and assessment of the transparency of the regions, our results include a process to achieve this goal, applicable to other OGDs, and unified datasets and visualizations confirming the universality of the tools we have developed.**

***Index Terms*—Open Government Data, Smart City Sustainability, Regional Council, Government Transparency**

## I. Introduction

Cities are expanding in both size and population, as highlighted in global forecast reports [1]. For example, the United Nations predicts that the number of people living in urbanized areas will increase to 6.5 billion by 2050 [2]. As a result, the role of smart cities has become more crucial than ever in ensuring the well-being and efficiency of urban life. This rapid growth led to the rise of large cities, often referred to as megacities [3]. These urban centers are typically surrounded by smaller towns and rural areas, forming interconnected regions where economic, social, and infrastructural ties influence development and cooperation. One approach that supports the sustainability of megacities is the smart city concept [4]. India, recognizing the challenges posed by its highly populated regions, has launched an initiative to develop 100 smart cities to improve urban infrastructure and livability [5].

To express the needs of the citizens both the goals of the smart city and the smart city itself must be described in a structured manner. While no structured approach to the so-called *smart city modelling* exists the study by Anthopoulos et al. [6] offers a comparison of currently utilized methodologies. The aim of these modelling approaches can range from factors like living conditions of individuals to larger concepts like smart governance [7]. Smart governance systems utilize the advances in the information and communication technologies, and also addresses the changes in the sociopolitical culture of societies, to enhance the decision-making and implementation processes [8].

Building on this, open government promotes collaboration between public administrations and the general public, promoting transparency and democratic engagement [9], [10], [11]. By increasing accessibility to information, open government initiatives enhance accountability and encourage public participation in decision-making [12], [13]. This can be achieved simply by publishing government data as open data [10], [14]. These data must be available online in machine-readable format, allowing citizens and businesses to reuse them to develop new products and services [15]. They are often accessible through dedicated *governmental web portals* [14] (like the US government's *data.gov*).

Although the sustainability of smart cities, smart government, and open data is often questioned [16], [17], research offers a more optimistic perspective. Several studies [18], [19], [20] conclude that these concepts are not only sustainable [19] but also mutually reinforcing [18], [20]. The sustainability of smart government can be influenced by various factors, including the quality and availability of data [17], [21], [22].

In this paper, we focused on data from Czech regional councils—there are 14 regions in total, with Prague being both a region and a capital city. According to Act No. 129/2000 of the Collection of Laws of the Czech Republic [23], their main responsibility is to decide on strategic issues, budget allocation, and the overall direction of the region. This has a direct impact on the daily lives of residents: from the quality of roads and public transport to education, health, and access to social services.

The aim of this work was to assess regional governance based on the available data for the 2020–2024 term. During this political period, Czech regional policy faced challenges

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such as the COVID-19 pandemic, budget cuts, and increased unemployment. Political changes reflected the influence of new parties, while regions benefited from EU funds for development and renewal. As regional councils made key decisions affecting citizens' lives, the availability and transparency of voting data became crucial for public oversight. With the upcoming elections, it was essential to ensure that political programs are based on verifiable data rather than potentially misleading interpretations by the media or third parties [24].

A key part of this research involved extensive data mining from various sources and formats, unifying them into a standardized model, as presented in our previous work [25]. This approach enabled a structured and comparable assessment of regional governance. Our results have been presented to the public under the *Zastupko*[1] project created for this purpose. The analysis provided a comprehensive overview of the activities of the regional councils, examining transparency, data availability, and quality. These outputs were designed for the general public, allowing them to form opinions based on real data before the regional elections in autumn 2024.

## II. State of the Art

Understanding the current landscape is essential for evaluating the foundations and practical implementations of the system. This section introduces open (government) data, defines the source data relevant to this study (Subsection II-A), and provides an overview of advanced open government data applications related to voting data (Subsection II-B).

### A. Open (Government) Data and Regional Councils

The term *open data* refers to information provided by public entities that is freely accessible, reusable, and shareable by anyone without any copyright or usage rights restrictions [26]. The *open government data* (OGD) refers to a specific type of data that overlaps both the open data and the government data domains [27]. Public authorities are the key providers of open data, generating large volumes of reliable information in various domains such as transport infrastructure, demographics, employment, finance, or legislation [28]. By making these datasets publicly accessible, authorities create a valuable information base that can support planning, transparency, and innovation [29], [30].

OGD are emerging at all levels of government—EU, national, regional, and local—and many services based on them have a cross-border impact, making it essential to address all levels [31], [32]. However, a global study [33] on OGD initiatives found that regional initiatives are among the less represented, in this case just 17% of the 156 initiatives evaluated.

OGD can be accessed through various platforms, including national data portals and government websites [34], [35]. One approach to open government data portals involves individual smart city platforms[2], where each city manages its own data [36]. Another approach [28] focuses on a centralized national platform that consolidates data from multiple regions into a single system[3].

Each level of government has elected bodies with members representing citizens with varying competences based on national laws. These representatives meet regularly to discuss issues and make decisions. In the Czech Republic, there are regional and city councils, but there is no legal obligation to publish minutes of their meetings or voting records. However, there are a small number of councils that publish their votes on the Czech Data Portal[4].

Source voting data typically consists of records that either detail each councillor's votes or provide information on each vote, including the date, description and votes of all present councillors. When using structured formats, the most common are CSV, JSON, or XML. The diversity of these data sets remains an issue that could be addressed by adopting open data standards [37]. Current efforts focus on various data models, such as Popolo[5], but no global standard has yet been established. In our effort, we are trying to implement a robust data model that can describe the voting of representatives at different levels of government. An initial version of the model[6] has been already published [25].

### B. Advanced Utilization of Voting Data

Raw data have little inherent value; their economic worth comes from a well-balanced mix of high-quality open data and a supporting value chain [38]. This is because the true value emerges when data are processed, analyzed, and integrated into meaningful insights. Various studies have explored the processing of voting data from a specific authority (like the US *House of Representatives*), analysing different aspects of decision-making. Some have focused on identifying voting patterns [39], [40], detecting pairs or blocs of councillors with similar voting behaviour [41], or measuring party polarization using the concept of modularity from network science [42] and cohesion [43]. To gain these insights, researchers have employed methods such as data mining techniques and statistical models (like discrete Principal Component Analysis).

In addition to individual analyses, some projects develop web-based solutions. Non-scientific initiatives like EveryPolitician[7] focus on collecting and sharing data on politicians worldwide, while Parltrack[8] enhances European Parliament transparency. Scientific projects such as LegisLatio [44] and CivisAnalysis [45], [46] emphasize research and specialized visualizations. However, none of them provides open and universal outputs that are applicable to voting in

[1] Visualizations from the voting of Czech councils: https://zastupko.cz/

[2] The data portal of the Finnish capital Helsinki, which was ranked in [36] among the best: https://hri.fi/en_gb/

[3] OGD Platform India, a single-point of access to datasets and apps in open format published by ministries or departments: https://www.data.gov.in

[4] Czech Data Portal: https://data.gov.cz/english/

[5] Homepage of the Popolo project: https://www.popoloproject.com/

[6] Initial version of our data model: https://github.com/zastupko/data-model

[7] Homepage of the EveryPolitician project: https://everypolitician.org/

[8] Homepage of the Parltrack initiative: https://parltrack.org/

different institutions. We initially applied our solution to city councils [25] and now demonstrate its suitability and extensibility to other institutions such as regional councils.

## III. Requirements

To enable voters to make informed decisions, the solution should meet several key requirements. These are derived from our experience, analyses of the needs of the target user, and the limitations observed in existing solutions examined in Subsection II-B. The main requirements for being able to analyse data from different regions include:

*1) Data Model Unification*: The system needs to be able to integrate various data sources into a unified data model, allowing comparisons between the datasets and their analysis.
*2) Data–Driven Analysis*: The system should rely only on data directly sourced from governmental bodies and derived or aggregated values.
*3) Integration and Visualization:* The system needs to be able to integrate publicly available statistical data with the voting results and present them in a clear and understandable way to the general public.
*4) Reusability and Adaptability*: It is required for both the system and the entire process to adapt to various types of authority bodies or future elections.

The requirements define a three-step workflow process consisting of data acquisition, data integration and feedback, and visualizations. The process is illustrated in Figure 1. To ensure the long-term usability of the solution, users also need

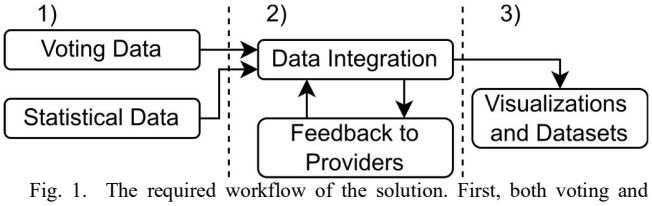


Fig. 1. The required workflow of the solution. First, both voting and statistical data must be acquired. Next, the data needs to be integrated, and any issues with the data are addressed in collaboration with the governmental data providers. Finally, the processed data is made available to the target consumers through visualizations and unified datasets.

it to be available online anytime and anywhere. In addition, keeping the data up-to-date is essential as new records are constantly being created.

## IV. Proposed Process

To facilitate the requirements defined in Section III, we used our solution, which was previously applied to city councils [25] with additional features. The solution already meets three of the four outlined requirements (points 1, 2, and 4). We incorporated the requirement 3 by adding the option to integrate statistical data like the data from Czech Statistical Office (CSO). The data are then visualized in the map form, which allows the users to quickly comprehend the values and how they relate to each of the regions. This makes the statistical and aggregated data more easily understandable. The overall process is shown in Figure 2.

At the beginning of the process, it was necessary to explore

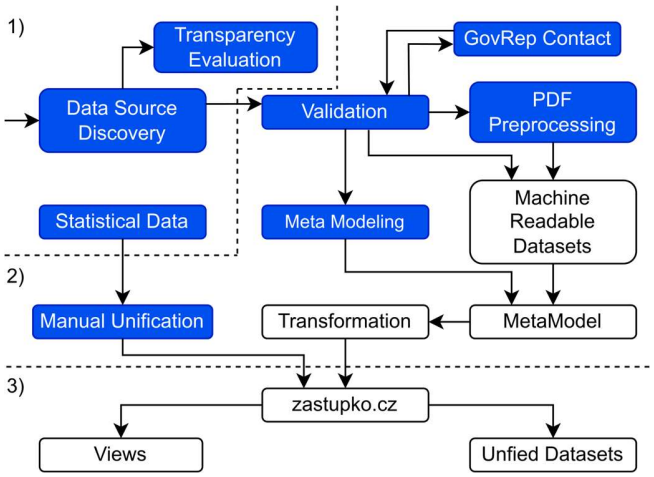


Fig. 2. Solution Workflow: Overview of the data acquisition, ETL, and visualization process. Blue blocks represent manual actions, while white blocks indicate repeatable processes.

the data sources. With only one dataset available in the National Open Data Catalog (Prague), the primary sources were the official websites of individual regions. This required analysing their structure and extracting relevant documents containing voting records. As part of this research, the transparency of each region was assessed. The available data was validated and the region office was contacted if problems were identified. In some cases, invalid references to voting were found, which some regions have corrected.

Subsequently, the extraction of votes from the collected data of the regional councils was carried out. For CSV, XML, or HTML formats, a meta model describing the structure of the document(s) was immediately created. In the case of multiple documents, typically some structural change occurred during the term of office. If there were multiple documents, an additional meta model was created; in cases of a small number of documents, records were entered manually using the administration module in our system. For PDFs, preprocessing was conducted using auxiliary scripts to convert the data into machine-readable JSON format, followed by the creation of an appropriate meta model.

With the created meta models, it was already possible to proceed to data transformation, the output of which were datasets of regions in our data model. These datasets could then be imported into the visualization application available under the *Zastupko.cz* domain. In addition, statistical data from the CSO was an additional input, which provided further information on the regions. These data were available in tabular format in different files, therefore manual processing was necessary. The resulting visualisations have been made publicly available[9], with detailed information about each region accessible from the homepage. Those for which the necessary data were not available are distinguished by a dashed line. In addition, datasets[10] are publicly available in a unified format.

[9] Visualizations of Czech Regional Councils: https://kraje.zastupko.cz/
[10] Datasets of Czech Regional Councils: https://kraje.zastupko.cz/datasety

## V. Results

We successfully processed over 10,000 votes from 9 regional councils (including Prague, where elections were not held because it is included in the municipal elections). Basic statistical data on the processed regions is presented in Table I. All datasets cover the 2020–2024 term, except for Prague, where leadership is determined in municipal elections, resulting in a term runs 2022–2026. For the remaining 5 regions, automated processing was not possible, but at least basic visualizations of political entities and representatives were created manually. This was done using the system's administration module, which enables user-friendly data entry.

TABLE I
SUMMARY STATISTICS OF THE PROCESSED DATASETS

| Region Name | Number of Representatives | Number of Meetings | Number of Votings |
|---|---|---|---|
| Hradec Králové | ♂ 31, ♀ 14 | 27 | 1,661 |
| Moravian-Silesian | ♂ 52, ♀ 13 | 17 | 1,765 |
| Olomouc | ♂ 43, ♀ 12 | 20 | 1,069 |
| Pardubice | ♂ 35, ♀ 10 | 20 | 497 |
| Pilsen | ♂ 36, ♀ 9 | 30 | 1,315 |
| Prague | ♂ 45, ♀ 20 | 16 | 1,131 |
| South Bohemia | ♂ 43, ♀ 12 | 34 | 1,561 |
| South Moravia | ♂ 56, ♀ 9 | 26 | 654 |
| Vysočina | ♂ 37, ♀ 8 | 29 | 1,033 |

The source data from the processed regions showed several problems, mainly related to their availability and usability. In many cases, finding the relevant data required considerable effort, as they were neither systematically organised nor easily identifiable. In addition, there were cases where machine-readable data was available, but incorrectly encoded, leading to issues with accents. Another problem was the lack of notification of newly published records, which required manual follow-up to ensure that meetings that took place just before the election were added. The main challenge, however, remains the absence of information available as a dataset that would ideally be accessible via a national catalog and updated on a regular basis.

In addition to these general problems, specific issues were identified within the datasets themselves. For example, the Prague dataset contained only approved votes, which made it impossible to get a comprehensive overview of all votes. Many regions did not record the political affiliation of the representatives, making it impossible to track party membership throughout the electoral period. Some regions also lacked a uniform data format for the entire election period, which further complicated automated processing. In this case, we also used the administration part of our system and entered some records manually, as this was easier than creating a corresponding meta model. A notable example is the Moravian-Silesian region, where voting records specify how each representative voted but do not include the subject of the vote. In the dataset, this information has been replaced with a generic placeholder and the corresponding vote number.

Besides the analysis of the data from individual regional councils, comparative analyses across regions were conducted[11], one of them is shown in Figure 3. These included evaluations of political entities (e.g. the total number of entities per region), council activity (e.g. the number of meetings or the average number of votes per meeting) and demographic actors (e.g. gender representation). Furthermore, relevant data from the CSO were incorporated to provide context, such as regional population figures, income and expenditure balance (Figure 4), and average gross wages. The selected data are intended to illustrate regional economic conditions, which are essential to ensure long-term stability, growth, and the overall standard of living in each region.

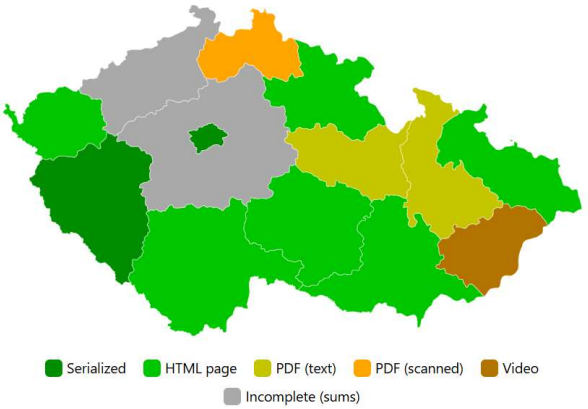


Fig. 3. One of the most insightful analyses reveals the state of data availability across the country: a few regions provide serialized data (2), while others publish voting results in HTML format (6) or as PDFs with selectable text (2). Some regions offer only scanned documents (1) or meeting video records (1), while in certain cases, voting results are available solely as aggregated vote totals (2).

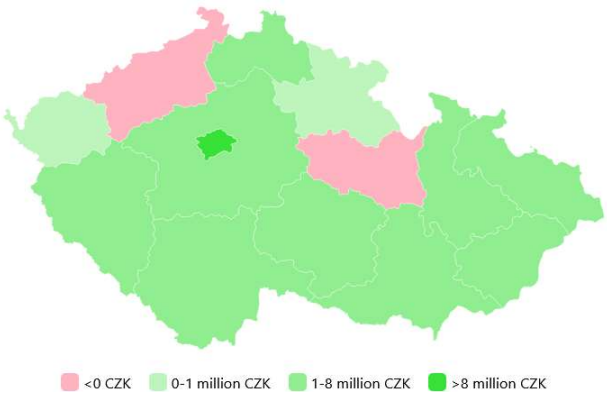


Fig. 4. The regional revenue and expenditure balance represents the difference between a region's total income and expenses. A positive balance indicates a budget surplus, where revenues exceed expenditures, while a negative balance signifies a deficit. The map illustrates data from the period 2020–2023, highlighting a substantial surplus in Prague's budget (nearly 70 million CZK) and, conversely, an overall deficit in some counties.

## VI. Discussion

Our initiative provided a practical test of collaboration with stakeholders throughout this process. During the data collection phase, we have already communicated with regional authorities, some of which responded proactively to reported issues. Others acknowledged their technical limitations in

[11] Analyses of Czech Regions: https://kraje.zastupko.cz/analyzy

providing voting data in a machine-readable format, though they indicated that this might change under future leadership. Unless the situation changes, the transparency of problematic regions will remain at the same low level. Once the visualizations were completed, all regions were informed; however, none expressed interest in further collaboration.

Meanwhile, the analytical tool has been made available to the general public and has seen a steady increase in user interest since it was first launched in August 2024. As expected, interest peaked during the week of the election. The tool also included open datasets that found further use: the unified data model enabled data journalists [47] to utilize the data for their own analyses and visualizations.

The election results were then provided by the CSO [48]. Public interest in regional politics remains a challenge, as evidenced by the 32.91% voter turnout in the fall 2024 elections, which was the second-lowest participation rate since 2000. However, a week before the elections, severe flooding hit large parts of the country. This likely caused a decrease in both attendance at the election itself and in interest in the results we created. The election results further reinforced the observed trend of a significant gender imbalance between councillors, with women making up only 21% of the 685 elected representatives.

Our analyses offer insights into the state of data and transparency at the regional government level. The datasets have a uniform format and are available without any restrictions. Ideally, the datasets should be published in a national catalog, but registration of a dataset in the catalog has to be done through a data box associated with a recognized association, legal entity, university or business subject, etc. The resulting visualizations are clear, easy to understand, and data-driven, which is crucial for their credibility. However, some manual data collection was necessary. For example, CSO data are spread across numerous CSV files, each available for download on separate subpages of its portal. In contrast, the Slovak Statistical Office offers a more advanced approach by providing its data through an API[12].

The maintainability of the solution remains a challenge at this stage. As mentioned earlier, voting data are difficult to collect due to its diverse formats and fragmentation into smaller segments (e.g. by meeting) across individual regions' websites. Furthermore, despite our best efforts, the region analysis for the 2020–2024 term remains incomplete. This is largely due to the unavailability of information or a lack of willingness from regions to enhance its transparency. Examples include completely unavailable voting records or meetings published only as video recordings. There is great potential for improvement, whether driven by authorities that recognize the value of transparency or by stricter legislative requirements at the regional level.

## VII. Conclusion

This paper examined the availability of OGD from regional authorities and the current state of such data in the Czech Republic. It was based on an existing general model for council decision data and an information system providing visualizations for the public [25], now applied to a new level of government—regions. Data from 9 out of 14 regions have been successfully processed, indicating significant room for improvement. The processed data also faced problems such as incomplete data, e.g. missing information on political affiliation. Overall, the results confirmed both the universality of the developed concept and the presence of a user group interested in these outputs. In summary, the outputs include an assessment of the state of data from the regional councils, a process for their analysis, unified datasets and visualizations presenting the collected data in a comprehensible way. In the future research, it would be valuable to focus on further processing of the source data to derive new insights, such as identifying long-term voting patterns, assessing policy impacts, or exploring relationships between political entities. Expanding the analytical capabilities of the system could provide a deeper context for decision-making and improve public understanding of governance.

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