

Visualization of Large Databases as a Factor of Democratization in the Activities of Government Bodies

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Abstract

This article discusses aspects of using large databases to visualize statistical and information flows in order to increase the transparency and accountability of government bodies, as well as public information.

Keywords: data science, database visualization, data dashboard, statistics, data analysis, public administration, dashboard design, government transparency and accountability, public awareness, feedback.

Governments are increasingly using data in all aspects of their operations. Data science in government is concerned with extracting, interpreting, and presenting information from unstructured and structured data, which can be either private or public. An important area of data science is the visualization of data in dashboards. The interactive dashboard is filled with data visualization that is updated automatically in real time and remains relevant at any time. Usually these are numerical indicators presented in the form of graphs and charts, and clicking on one of them filters all the data on the screen and displays only what relates to the selected value.

Government data scientists need a deep knowledge of statistics and data analysis to interpret data, as well as knowledge of how to use methods and tools to predict and visualize results. By combining disciplines, new ideas and applications can be created and communicated through dashboards. However, the data scientist must also have an understanding of other elements such as policy development, organization, legislation, and community values. This knowledge allows them to interpret the data in the context of their use.

Data science is an important area for governments as they collect a large amount of data in various fields (geography, traffic, social security, energy, etc.) that can be combined or supplemented with data from smart devices and other sources such as discussion boards, forums, social networks and

private sector data ¹. Making informed decisions depends on the use of high quality data ². Data can help create new innovative applications ³ to improve societal values such as security, transparency and accountability.

In data science, sharing, using and interpreting data are key aspects of bridging the gap between government and the public. Special platforms can be created for data exchange ⁴. The use of data and related tools is likely to influence public policy making, resulting in new applications, but may also affect public engagement ⁵. Dashboards can be used to provide information to government decision makers ⁶, as well as to enable the public to closely monitor government actions, participate in and improve decision-making processes. Dashboards should promote transparency, credibility and enable citizens to participate in decision making ⁷.

Recently, data science and dashboards have been gaining more and more attention in the public sector. A dashboard is often created with a web page that visualizes all kinds of data for a specific purpose. As such, dashboards are becoming an important means of communicating and interacting with the public for transparency and accountability.

Few (2006) ⁸ defined dashboards as "a visual display of the most important information needed to achieve one or more goals, consolidated and organized on a single screen so that the information can be tracked at a glance." This definition can be challenged because governments may have several sometimes conflicting goals and do not recognize the possibility of interference. In addition, dashboards allow you to zoom in on more detailed information and may not be limited to a single screen. Therefore, you can define dashboards as "a visualization of a summary set of data for a specific purpose, which makes it possible to see what is happening and initiate actions."

The examples show that the design of a dashboard depends on many factors, including the information available and its purpose. While other goals exist, dashboards often aim to empower the public through transparency and accountability ⁹. Dashboards are a tool for reducing information asymmetries ¹⁰. Information asymmetry is a situation in which one party has more information than

¹ M. Janssen, R. Matheus, A. Zuiderwijk Big and open linked data (BOLD) to create smart cities and citizens: Insights from smart energy and mobility cases Electronic Government, Springer (2015), pp. 79-90

² IN Chengalur-Smith, DP Ballou, HL Pazer The impact of data quality information on decision making: An exploratory analysis Knowledge and Data Engineering, IEEE Transactions on, 11 (6) (1999), pp. 853-864

³ Making Sense of Data-Driven Decision Making in Education: Evidence from Recent RAND Research.

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⁴ A. Brown, J. Fishenden, M. Thompson, W. Venters Appraising the impact and role of platform models and government as a platform (GaaP) in UK government public service reform: Towards a platform assessment framework (PAF) Government Information Quarterly, 34 (2) (2017), pp. 167-182

⁵ S. Ganapati Use of dashboards in government-been there and done that modified 12:00, 11 Nov 2011 by admin|page history (2011)

⁶ D. Maheshwari, M. Janssen Dashboards for supporting organizational development: principles for the design and development of public sector performance dashboards Paper presented at the proceedings of the 8th international conference on theory and practice of electronic governance, ACM (2014), pp. 178-185

⁷ MK Allio Strategic dashboards: Designing and deploying them to improve implementation Strategy & Leadership, 40 (5) (2012), pp. 24-31

⁸ Information dashboard design: The effective visual communication of data
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⁹ M. Janssen, J. van den Hoven Big and open linked data (BOLD) in government: A challenge to transparency and privacy? Government Information Quarterly, 32 (4) (2015), pp. 363-368

¹⁰ B. Bugaric Openness and transparency in public administration: Challenges for public law Wis. Int'l LJ, 22 (2004), p. 483

the other party ¹¹. By providing data, dashboards can help reduce information asymmetries by providing a more complete picture of a particular situation. Overcoming information asymmetries should lead to greater transparency.

Governments can also develop dashboards to make their own decisions based on information gained from citizen participation. Reasonable and evidence-based decisions and policies need to be more trusted by the public. Designing the right dashboard is a challenging task.

There are many pitfalls that can prevent you from achieving your intended benefit. If the data is not cleaned properly beforehand, its use can lead to inappropriate analysis. Higher data quality comes at a cost and may not always be necessary. Data improvement techniques can partially solve the problem of poor data quality. Proper vocabularies for metadata (ontology, semantic web, etc.) can solve another problem related to understanding and interpretation. Datasets should also have appropriate information quality, such as timeliness and granularity, as well as systemic quality, such as the ability to be accessed in a variety of formats.

Dashboards can provide both overview and detail views at the same time, can create transparency, and can be used to promote accountability and encourage engagement. Public use of dashboard data does not lead to transparency and accountability per se. Benefits can only be gained if dashboards are properly designed. To do this, it is important to understand the risks and challenges that come with developing dashboards.

The quality of the data varies and the quality of the data should match the quality required for dashboards. In addition, it is not only about technology, but also about how the results created by data scientists will be used. For example, experts have found ¹²that data sharing is more driven by persuasion mechanisms and technical interactions. Even if the dashboard is technically well designed, detecting fraud or identifying strange patterns is useless if legitimate agencies do not have the means to further investigate those patterns. This requires institutions capable of tracking the results of data analysis. The use of data results requires institutional changes, including to ensure accountability. Only official bodies such as ombudsmen, ministries, politicians and judges can hold organizations accountable. Lourenço (2015)¹³ analyzed open data portals and found that they often lack organizational and structural elements to support public accountability.

Thus, the development and use of dashboards can be associated with many risks and challenges. One of the main risks is the misunderstanding of information, which can lead to incorrect conclusions about the data. It also raises the question of whether dashboards can lead to transparency and accountability. Dashboards can help increase the level of transparency, but a lot depends on the right design. As long as there is information asymmetry, there will be no complete transparency.

Developing dashboards can be costly. Their development and operation can require a lot of resources, and there are not enough specialists in data processing and analysis. This may result in no new developments and no standardized predefined representation in the long run. If data comes from different departments, or if dashboards have multiple owners, quality can be degraded. There is also a risk that politicians and civil servants will boycott or not use the dashboard due to the difficulty of

¹¹ MC Jensen, WH Meckling Theory of the firm: Managerial behavior, agency costs and ownership structure *Journal of Financial Economics*, 3 (4) (1976), pp. 305-360

¹² EW Welch, MK Feeney, CH Park Determinants of data sharing in US city governments *Government Information Quarterly*, 33 (3) (2016), pp. 393-403

¹³ R. P. Lourenco An analysis of open government portals: A perspective of transparency for accountability *Government Information Quarterly*, 32 (3) (2015), pp. 323-332

adopting new technologies or the possible loss of political power in decision-making processes.

Cleaning and processing data is an integral part of developing dashboards. Meeting legal requirements to anonymize public data to protect people's privacy is both a risk and a challenge. This is a risk because it is possible to identify people even when using anonymous datasets. This is a difficult task, since anonymizing datasets requires certain knowledge and skills and comes at a cost. Statistical analysis also helps reduce outliers and "bad data" that lead to poor results. Using low quality data can lead to incorrect or inaccurate decision making. Even correct data can be misinterpreted by people.

Dashboard design should be transparent and accountable, but faces many risk-related issues.

While dashboards are often used for policy evaluation, they can support the full cycle of policy development, including policy formulation, implementation, and evaluation. Dashboards should help citizens create an understanding of the current situation, avoid lengthy search processes and information overload. For this reason, creating citizen dashboards requires design that is relevant and responsive to the situation of citizens. Balancing issues such as privacy, information overload, and developing an overview at a glance is a challenge. A good dashboard is user-centric and provides insight, however, for some citizens, this may not be enough. Although dashboards in different areas may take different forms, there may be users who want to access the raw data. Because of the diversity of possible users of the data, it is essential to identify both the societal issues that need to be addressed and the needs of the users.

Conclusions

Dashboards can be used by governments to interact with the public. Developing dashboards requires data science activities to extract data from various sources, integrate them to generate new insights through the use of data, and develop visualizations. Dashboards are tools for presenting data on an integrated visual display and initiating actions. Dashboards are likely to become more important as more data becomes available. Dashboards can play a critical role in providing information about the situation and helping to improve and develop the situation. The identified benefits of dashboards are related to the creation of an overview and the ability to increase details. Transparency can be created by overcoming the information asymmetry between civil society organizations and the public. However, the benefits can only be gained by properly designing dashboards. The examples show that dashboards can provide many benefits, but also that developing dashboards is not a trivial activity that comes with many risks and challenges.

The introduction of dashboards can be useless if their implementation is not accompanied by organizational changes. Dashboards should be used not only to communicate with the public, but also to get feedback from them and stimulate interaction. Searching for new information or uncovering corruption is useless if there is no way to deal with feedback or further investigation by legal authorities. Participation in dashboards, where citizens have the opportunity to provide data and discuss results, is critical to achieving benefits. In addition, a poorly designed dashboard can lead to misunderstandings of the data and undermine the public's trust in the government.

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