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Impact of open government data in decision making processes: the case of Estonian local governments

Master's thesis

Technology Governance and Digital Transformation

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I hereby declare that I have compiled the thesis/paper independently

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ABSTRACT

This master's thesis explores the integration of Open Government Data (OGD) and data-driven decision-making within Estonian local governments, particularly in the education sector.

The study identifies key enablers and barriers affecting the use of open government data, and how it influences decision-making processes. As those enablers and barriers are often context based, it is important to test existing theories and findings in specific environments. In total 9 local government managers and a government representative was interviewed, and document analysis was conducted.

Empirical findings from the Estonian local government management level indicate that while various data sources are utilised and overall attitude towards data use is positive and data usage seeps into the decision-making policies, there is potential for more consistent and meaningful use. Obstacles such as data quality and individual workload hinder data-driven practices. Further, a lack of targeted data analysis skills and partially missing stakeholder perspectives in the development of national data bases impede effective decision-making.

The thesis suggests that to amplify the influence of open data in making informed decisions, emphasis should primarily be on supporting necessary skills and organizational work transformation at the institutional level. Improvements in the quality and presentation of open data are necessary, also network possibilities for more sense making. The potential implications of this study could provide valuable insights and affect future strategies to endorse data-driven decision-making in local governments. This in turn could lead to more informed policy planning and improved educational outcomes.

Keywords: open government data, data-driven decision making, local government, education policy

1. INTRODUCTION

The internet and digitisation have ushered in a new era of distributing government collected data back to society, commonly known as open government data (OGD). This concept is built on the principles of raising the trust in government, transparency, innovation, and public engagement (Jetzek *et al.,* 2014; Kim 2018). By making government data readily available, it can promote data driven and evidence- based decisions in different sectors (Silva *et al.,* 2022 pp 218), fostering improvement of an organisations (Marsh *et al.,* 2006; Wirtz *et al.,* 2022). Open data can lead to „faster and more accurate decision-making, resulting in increased efficiency and effectiveness of operations "(Matheus *et al.,* 2018, pp 4).

Even as data driven decision making is not a direct outcome of open government data as it occurred much earlier (Marsh *et al.,* 2006), what has evolved are the systems and technologies to facilitate data-driven decision making and providing data sets that were not reachable before (Isaacs 2021, pp 78-80).

Inspired by the potential benefits, a lot of importance has been attached to open government data. According to the United Nations, in 2022, 117 countries had legislation, policies or regulations in place on open government data (UN 2022, pp 38). The number of countries that have set up open government data portals has increased markedly, rising from 46 in 2014 to 153 in 2020 (UN 2020, pp 151). At the same time, research on open government data is still quite new and is referred to as an area that needs more empirical research and theoretical discussions (Gonzales-Zappata *et al.,* 2015; Magalhaes, & Roseira, 2020; Safarov *et al.,* 2017; Wirtz *et al.,* 2022), especially on effects of OGD (Safarov *et al.,* 2017; Zhao *et al.,* 2022). Need for further investigation stems from the complexity of the topic, as the enablers and barriers directly impact data use and effectiveness, and vary across organisations, cultures, countries, and even regions and municipal units (Barry & Bannister, 2014; Susha *et al.,* 2015; Zhao *et al.,* 2022).

The objective of this master's thesis is to integrate open government data and data-driven decision-making theories and to investigate the influence and effects of opening government data on educational decision-making at local government level in Estonia.
The existing literature on the influence of open government (education) data on decision-making

in local governments is rather limited. There are examples of research done on local government decision making level by scholars like Zuiderwijk, Jannsen, Sieber etc. Zuiderwijk and Janssen *et al.,* (2012) and Sieber & Johnson (2015) have examined the usability of open data from the citizen's perspective. While those articles didn't focus exclusively on the educational sector, they did provide insights into how data is used in local government decision-making and the barriers that prevent more effective use of open data (Zuiderwijk *et al.,* 2014; Sieber & Johanson 2015). An article on "Open data policies, their implementation and impact: A framework for comparison" by Zuiderwijk, Janssen & Dwivedi, proposing a framework for comparing open data policies and their implementation across different levels of government (Zuiderwijk et al., 2014c). Scholars like Schildkamp, Marsh, Isaacs and many more have researched decision making enablers and challenges in education sector (Isaacs 2021; Marsh *et al.,* 2006; Schildkamp 2019). The list is not exhaustive and different research and theoretical frameworks proposed for the topic can provide valuable insights to open government data use and its impact in decision making both at the local government level and education sector.

The current thesis will identify the enablers and barriers that have contributed to the potential effect of open data usage and its impact in specific contexts. The study zooms in on local governments and the education sector (schools providing education from 1.-9 and 10.-12 grades). The author of this thesis will explore how the Estonian school owners in general education, in this case local governments, have turned open government data into a governance instrument.

What makes Estonia as an insightful case study, is partially based on Estonia being one of the fastest rising countries for digital transformation in the world (UN 2020, pp 12, pp 50). At the same time, Organisation for Economic Co-operation, and Development (OECD) OURdata Index: 2019, is placing Estonia at the 24th place among 32 countries in open government data availability, accessibility, and government support for data reuse (OECD 2020, pp 20). Different Estonian strategic plans address the open (government) data goals and challenges from different angles. The need for innovative solutions, efficient communication, and greater use of open and large data is emphasised, while recognizing that the quality of e-services is uneven and requires improvements in sustainability. The lack of data analysis skills among stakeholders, as well as the interoperability and user-friendliness of information systems, is also highlighted (Estonia 2035, pp 12; Estonia - Education Strategy 2021-2035, pp 9). Estonia's Digital Agenda 2030 is declaring that by 2030 "We make all the decisions of the state using high quality data. The findability, quality, and speed of use of data provide decision-makers with analytical support and make processes more efficient"

(Digital agenda 2030, pp 22). On the other hand, there are 79 local governments[1] who despite their size face the complex challenge of both policy-making and managerial tasks, which include governing the school network and driving local educational policies (HaS §7). This dual responsibility positions them as both end users or stakeholders of data provided by the government and decision-makers whose actions may impact a broad array of organisations and individuals, including schools, headmasters, teachers, and students.

To understand the Estonian and local government context and to explore the usage of open data in decision making author will explore the following research questions:

1) What kind of data and information is made available by the state in the field of general education?

2) To what extent local governments are using open government data as a governance instrument in the context of general education?

3) What are the key enablers and barriers faced by local governments in using open government data for decision-making?

Based on findings, the author seeks answers to what policies or support measures can be implemented to enhance the use of open government data in school governance and decision-making processes.

In theoretical discussions, the author examines existing literature related to the implementation of open data, as well as discussions associated with both data- driven decision making. The empirical section is grounded in a theoretical framework that adopts a stakeholder perspective, identifying local governments as the end users of open government data. The analysis seeks answers to the previously posed research questions through interviews, legislative analysis, examination of open data portals as enablers, and analysis of local government education sub-committee protocols and long-term development plans. In conclusion, the study presents findings and recommendations with the goal of strengthening the impact of open data on decision-making processes in local governments, which play a crucial role in shaping educational policy.

Hopefully, the current master thesis provides added value, especially to discussions in Estonia about how to increase the influence of open data and its usage. In addition, it could contribute to the discussions in the field of education, where the role of the school owners to fulfil their tasks

[1] Local Governments | Rahandusministeerium (fin.ee), last visited 10.05.2023.

and obligations based on evidence, have been studied rather little. The study could provide possible solutions for supporting school owners in their everyday work.

2.THEORETICAL FRAMEWORK

The theoretical discussion is synthesised from two streams of literature: the characteristics of open government data and how data driven decision making (e.g., evidence-based decision making) takes place.

In building up the theoretical framework, author will explore:

1. The concept of open government data
2. The aims, enablers, and challenges of open government data movement
3. Data driven decision making and its relations to evidence-based decision and policy making.
4. The challenges and opportunities associated with implementing data driven and evidence-based decision making, particularly in relationships to the use of open data.

The theoretical framework provides an opportunity to outline the main enablers and challenges that could encourage the use of open data in decision-making processes at the end - user (local government) level.

2.1 Open government data (OGD) movement

Exploring the impact of freely distributed (government) data by stakeholders (end users), the theoretical framework draws upon existing discussions about open government (OG) open data (OD) and open government data (OGD). There are shared and complementary features when characterising the content of these terms. Open government data may be viewed as a hybrid of open government and open data general concepts (Sayogo *et al.,* 2014), a combination of those essentially different movements (Gonzalez-Zapata *et al.,* 2015) or still 3 different concepts that are closely related to each other (Wirtz *et al.,* 2022), OGD being the last to emerge (Silva *et al.,* 2022).

According to the Open Knowledge foundation, open data is understood as "any content, information or data that people are free to use, re-use and redistribute — without any legal, technological or social restriction"[2].

This concept is not inherently tied to any sector but has arisen from the innovation and diffusion of information and communication technology, which allows for a previously unattainable level of data accessibility (Janssen *et al.*, 2012). Governments, as primary producers of open data, have already collected and funded this data through taxpayer contributions (Jetzek *et al.*, 2014, pp 102). Having resources for it, public sector has emerged as the main producer of open data (Janssen *et al.*, 2012; Kim, 2018; Wirtz *et al.*, 2022).

The broad consensus in the definition of open government data is combination of various formats and types of datasets collected by means of public funding and/or provided by public sector organisations without restrictions (Kassen, 2018; Kim, 2018; Sayogo *et al.*, 2014). Further, Sayogo *et al.*, (2014, pp 1898) adds elements to this definition, asserting that OGD should only publish data that is consented by law, including privacy, confidentiality, and security principles, and that the public should be able to access data through a single data portal.

The drive to open governmental data is not only shaped by open government strategic initiatives but also by technological advancements that facilitate the creation of new services (Huijboom, & Van de Broek, 2011, pp 4). This dynamic can be seen as a symbiotic relationship where the state and technology mutually benefit from IT development that provide novel opportunities for delivering OGD (for example, through AI), while open (government) data offers valuable data to spur innovation and growth in various sectors (Wirtz *et al.*, 2022, pp 2382).

The existing literature gives us different positive effects that OGD can create. There is a strong potential for usability in both public and the private sectors (Wirtz et al., 2022 pp). OGD is seen as a driver of efficiency (Jetzek *et al.*, 2014; Puron-Cid *et al.*, 2012), transparency (Jassen *et al.*, 2012; Kassen 2013; Jetzek *et al.*, 2014; Kim 2018; Wirtz 2019), citizen participation (Jassen *et al.*, 2012; Jetzek *et al.*, 2014; Wirtz *et al.*, 2019), collaboration (Wirtz *et al.*, 2019) and innovation (Jassen *et al.*, 2012; Jetzek *et al.*, 2014; Magalhaes & Roseira 2020). OGD could eventually lead to the generation of economic value (Jetzek *et al.*, 2014, Kim 2018) by improving business intelligence, R&D or business processes (Magalhaes & Roseira 2020). It is also expected to result in better government or policy decisions (Jassen *et al.*, 2012; Puron-Cid *et al.*, 2012) where the availability of government datasets can contribute to a more transparent, accountable, and strategic

[2]Open Knowledge Foundation, What is open? (okfn.org), last visited 13.05.2023

decision-making process (Puron-Cid *et al.*, 2012, pp1). Safarov *et al.*, (2017, pp 8-9) observes that, according to a review of the literature, the primary purpose of using OGD by end-users is to foster innovation, which significantly surpasses other uses such as data analytics, decision-making and others.

When it comes to the achieved effects of OGD, Ruijer & Meijer (2020, pp 614-615) point out that there is a gap between the theoretical view of open government data in contributing to transparency, participation and service delivery, and the actual practice. Safarov *et al.*, (2017) indicates that it is sometimes very difficult to distinguish between desired effects and established effects, meaning that very often the focus is on desired outcomes and not the actual ones. Some researchers claim more straightforwardly that the usage and the impact of open government data is so far rather limited (Seo, 2017; Wang & Lo, 2016), and users have complained that it is difficult to create new values through open government data (Seo, 2017).

As open government and open data are often conceptually linked, the volume and quality of published government data are common indicators of open government success. Despite some debate over the strength of this linkage, much open government research still centres on the publication of open government data, examining factors like the number of datasets, their characteristics, their reuse, and the entities reusing them (Maanen 2023, pp e3-2). Next the author will explore further in-depth possibilities that hinder or support the possible impact in achieving OGD goals.

2.2 Enablers and barriers of Open Government Data impact

The enablers and barriers of OGD are varied in different organisations, cultures, or countries, or even in municipality units (Barry & Bannister, 2014; Susha *et al*., 2015; Zhao *et al.*, 2022), making the context important when carrying out the research about OGD (Susha *et al.*, 2015).

The primary challenges will bring us back to the government level where the lack of appropriate governance mechanisms can explain the gap between the promises of open data and what has been realised (Janssen, *et al.*, 2012). The cap is influenced by governments "technical capacity, financial resources, human resources, organisation culture, legal and policy" (Zhao, *et al.*, 2022 pp 2). Different perspectives and attitudes regarding opening data can be found at the political level, where enthusiasm might be overshadowed by risk perception of public managers in areas like privacy violation, legal liability, misuse, and misinterpretation of data (Zuiderwijk & Janssen,

2014a). There is also an underlying assumption that when open data is made available, it aligns with the needs and requirements of users (Ruijer & Meijer, 2020, pp 630) or making more data available aims directly to present a solution to a certain problem that has been addressed (Maanen, 2023, pp e3-3).

It is important for governments to attend the needs and demands of stakeholders when developing and implementing open government data policies. Without such a focus, the data is less likely to be effectively used, thereby limiting its potential impact (González-Zapata & Heeks, 2015; Janssen *et al.,* 2012). Drawing on various discussions, González-Zapata & Heeks (2015) developed a comprehensive framework that outlines four distinct perspectives of open government data and the associated stakeholder profiles within each, often described OGD segments: bureaucratic, technological, political, and economic perspective. The bureaucratic perspective, for instance, emphasises actions carried out by government officials and technical staff to enhance public service delivery. This includes the development and implementation of regulations, strategies, and processes, which ultimately aim to improve efficiency, effectiveness, and policy formulation. Understanding the bureaucratic perspective, allows for the identification of the needs of government officials, public servants, and technical staff. The framework helps to identify predominant stakeholders' groups and find stakeholders whose opinions are missing. This supports the implementation of effective OGD policies and processes that meet the expectations of these stakeholders, ultimately leading to more efficient and responsive public service delivery. By embracing a stakeholder-centric approach, this method allows for more focused and user-oriented research within the open government data domain, although country context should be taken into the consideration when implementing it (*Ibid.,* 2015).

The key to reach possible data users and project the appropriate dataset to the users is the creation of an open government data portal. The first important enabler is the overall architecture of open government data. To optimally use open data, it should be presented on user-friendly platforms that provide straightforward, reliable, and publicly accessible infrastructures and provide possibilities like „advanced search, automated content analysis, cross- indexing with other data sources, and data visualization tools"(Robinson *et al.,* 2009 pp 161). In 2010, Sunlight Foundation proposed principles that ensure optimum accessibility, availability, and re-usability of open data. Completeness, primacy, timeliness, access, easily readable formats, and low costs for the users could be named (cross ref Sayago, 2014 pp 1898). Sayago suggests that factors like manipulation of data and engagement possibilities should be included to measure the usability of portals (Sayago, 2014). This is supported by Kim (2018, pp 20) saying that data should allow downloading

or modification, reuse and redistribution, combination possibilities with data from different fields, also adding that no discrimination should occur that prevents specific individuals or groups from using the data.

According to Kim, quality of data is largely dependent with more linking, suggesting that different data linkage leads to better possible utilisation and outcome (*Ibid*., pp 19). Still, many agencies, ministries, or federal level organisations often create their own service delivery systems because open data platforms are typically offered at various institutional levels, making nationwide digital integration and cross sectors data usage particularly challenging (Kassen, 2018, pp 115).

A potential risk with open government data portals is that contextualization has been neglected already at the stage of policy formulation: "There is a risk that public organisations will copy each other's policies without considering the contextual differences in which they operate" (Zuiderwijk & Janssen, 2014c, pp 27). Kassen (2018, pp 122) also points out that in a case of highly centralised approach by the governments to implement open data-driven reforms may be efficient in terms of cost and time, leaving little room for discretion at the local level.

Creating a dashboards and vizualising data can help speed up decision-making for both policy makers and the public (Matheus *et al.,* 2018, pp 4). Still, whatever form of data distribution is used, it is important to understand a significant number of enablers that may turn into obstacles and result in risks when utilising the open data from those portals. Or as refered by Gabriel Puron-Cid, we need „ adequate human resources [to be] developed, available data [...] collected, datasets […] built up, and sophisticated technologies […] integrated with one another„ (Pruno-Cid *et al.*, 2012, pp 9).

The most common challenges and barriers that hinder the full usage and impact of open government data by end users (stakeholders), have been systemised by the author to 3 different groups: data-provider, individual end- user and at organisation (as end- user) level barriers.

Barriers caused by data provider: limited or low quality of the data (Barry & Bannister, 2014; Huijboom & Van de Broek, 2011; Matheus *et al.,* 2018; Zuiderwijk & Janssen, 2014a); offering data in non-user friendly format (Huijboom & Van de Broek, 2011; Janssen *et al.,* 2012; Matheus *et al.,* 2018; Safarov *et al.*, 2107), insufficient data published (Zuiderwijk & Janssen, 2014a); lack of opportunity to provide feedback to the open data producer (Zuiderwijk &Janssen, 2014a); poor data integration (Matheus *et al.*, 2018; Safarov *et al.*, 2017); no explanation of the meaning of the data (Jassen *et al.,* 2012). Based on the literature, the author suggests that these variables indicate

a misalignment between open data accessibility policies and the actual needs of the data user, also possible obstacles to effective sharing possibilities at the government level.

Individual challenges could grouped as: digital divide, the lack of knowledge, skills or capability to use the data (Barry & Bannister, 2014; Janssen *et al.*, 2012; March, 2012); information overload (Huijboom & Van de Broek, 2011; Janssen *et al.*, 2012; Zuiderwijk & Janssen, 2014a); absence of contextual information as data is often collected for a specific purpose that is not known by the user (Janssen *et al.*, 2012).

Organisational barriers that could influence the individual attitudes and motivation include: insufficient tools for using open data (Zuiderwijk & Janssen, 2014a); overall organisation culture e.g. organisational attitudes and beliefs (Barry & Bannister, 2014; March, 2012); lack of commitment at the management level (Sieber & Johnson, 2015; Wang & Lo, 2016).

This list is far from complete, indicating some of the examples that literature has pointed out as key factors that could prevent the successful implementation of open government data. Interactions and the timing of the various barriers are often neglected (Ruijer &Meijer, 2020, pp 614). For example, overall organisational culture and its attitudes can both influence the data distribution from the government side and data usage at stakeholder organisations (Barry & Bannister, 2014; March, 2012; Zhao *et al,*. 2022). Also, when it comes to organisational perspective, managerial attitudes often play an important role when talking about the enablers of data usage (Ruijer & Meijer, 2020, pp 631). Data scientists, on the other hand, need to understand policymaking and legislation that allows them to position the data in the right context and to understand its use and implications (Matheus *et al.*, 2018 pp 1).

Those barriers can also easily turn into risks. Jetzek *et al.,* (2014, pp 111) talk about data quality risks in relation to data that are not updated frequently enough that could cause new types of information to be based on old survey data. The lack of contextual information on the other hand, can make it challenging for users to understand and interpret open data effectively, which in turn may limit its utility in decision-making processes (Janssen *et al.*, 2012).

As there are many layers in the taxonomy of enablers and barriers, this brings us back to the discussions of Ruijer and Meijer, who focus on the changing role of the government, emphasising that OGD should be viewed as an innovation process and different barriers could rise during different adoption period (Ruijer & Meijer, 2020, pp 617). As they point out, governments need to become a facilitators and partners in the reuse of open data *(Ibid.,* pp 614). Finding a match

between provision and usage of open data is a complex process of right timing, learning, interaction, and networking within government organisations, between government organisations and the wider community over time *(Ibid.,* pp 630).

In conclusion, discussions on open government data suggest that to analyse its impacts, one must consider the contextual, individual, and organisational behavioural patterns of various parties throughout different adoption periods. The structure and policies at the government level, including the organisation of data sharing and understanding of their changing role as facilitators, can significantly influence data usage. Simultaneously, personal, and organisational attitudes can also have a substantial impact.

2.3 Using open data in decision- making

The rise of data-driven decision-making (DDDM) is considered as a possible benefit of open data and open government data developments (Silva *et al.,* 2022, pp 218). Technological advances and data processing capabilities have led managers to rely more on data for decision-making (Brynjolfsson & McElheran, 2016, pp 133). DDDM, a part of Data Science, allows managers to extract knowledge from data and make informed decisions rather than relying solely on intuition (Provost & Fawcett, 2013) making data-based insights crucial for organisational improvement (Wirtz *et al.,* 2022).

While research on DDDM has primarily focused on the private sector and its impact on performance and productivity (Brynjolfsson *et al.,* 2011), it has gained attention in public governance, particularly in connection with open government data initiatives (Silva *et al.,* 2022). For example, in the education sector, Williamson (2015) emphasises the importance of digital database instruments and infrastructures for understanding, governing, and managing education at both national and global levels, signifying a shift toward data-driven governance with significant implications for the sector.

To understand the DDDM movement better and identify possibilities to make data more meaningful, it is relevant to discuss how data can be converted into the in decisions. Russell L. Ackoff (1989) has described a “Data-Information-Knowledge-Wisdom” approach where data is a set of symbols that represent properties of objects without context and on its own it lacks any specific meaning. Information on the other hand is data that has been given context and organised to be useful. Information is intended to answer questions like "who," "what,"

"where," and "when". Knowledge is the value received from information, turning it into instructions. Wisdom is the ability to apply knowledge effectively (*Ibid.,* 1989). Weinberger (2010) points out that there is a discontinuity between data and information as they are stored in computers, versus knowledge and wisdom which are human endeavours. This hints that knowledge is achieved through deciding which information is relevant, and how it is to be used, where beliefs, institutional processes, social roles etc. play an important part (*Ibid.,* 2010).

Chun Whei Choo (2006) introduced a Knowing Organisation (KO) approach. The Knowing Organization holds a distinct advantage through its access to information and knowledge, which empowers it to strategize intelligently or demonstrate creativity. It has effectively integrated information use to sensemaking, sense making to knowledge building and knowledge building to decision making. Choo sees sense making as something that involves interpreting and understanding the available data or information to create a coherent and comprehensible picture of the situation or context. The model emphasises the importance of understanding the social, cognitive, and technological aspects of organisational information processing to optimise organisational performance and adaptability. "Its [KO] actions are based upon a shared and valid understanding of the organisation's environments and needs and are leveraged by the available knowledge resources and skill competencies of its members" (Choo, 2006, pp 339).

Marsh *et.al.,* (2006) echoes that merely having raw data is not enough to ensure its effective use as it must be organised and combined with situational understanding through analysis and summarization to create information. This information becomes actionable knowledge when data users synthesise it, apply judgement to prioritise, and weigh the relative merits of possible solutions. Knowledge can inform various decisions, such as setting goals, assessing progress, addressing needs, evaluating practices, reallocating resources, or improving processes (*Ibid*., 2006; Marsh., 2012)

Decisions generally fall into two categories: to inform, identify, or clarify (e.g., identifying goals or needs) and those that use data to act (Marsh *et al.,* 2006, pp 3). This should be followed by assessing the effectiveness of those actions (*Ibid* et.al., 2006). Data has another important angle when used in decision making - it has its meaning only when setting appropriate targets or goals against which to compare data with (March 2012; Schildkamp & Poortman 2015). Or as Schildkamp puts it: „data collection needs to be related to the goals, sense-making should revolve around goals, action should be directed towards the goals and /data-based/ evaluation should focus on whether or not the goals were achieved" (Schildkamp, 2019, pp 258). It was also noted in

DDDM research done with private companies in United States that the existence of measurable targets at strategic level could indicate the more extensive data use in monitoring and controlling the overall performance (Brynjolfsson & McElheran 2016, pp 134).

Isaacs (2020, pp 80) warns us, big data and data science tend to focus on quantitative data that is easily aggregated for statistical only analysis. “Educational decisions are fundamentally about the quality of teaching and learning” (*Ibid.*, pp 80), requiring critically informed questions about what data to collect, curate and interpret (*Ibid.*, pp 80). This interpretation brings us closer to evidence-based management discussions where “decisions and organizational practices are informed by the best available scientific evidence“(Rousseau & McCarthy 2007, pp 84), converting research data principles into practices for addressing organisational issues and making decisions (Rousseau, 2006, pp 256). It could be seen as dynamic process through which any evidence is obtained, interpreted, and used as a basis for decision making, combining it with decision-makers' competences or values and stakeholders' preferences (Baba, V., & Hakemzadeh, F., 2012). Evidence is more reliable when its method of production fits with the type of managerial question, includes contextual factors or is being consensual (*Ibid*., 2012).

Previous discussions show that using data and information in decision making is a multi-layered process where both individual (managerial) and organisational factors count. Where decisions are made through context and analysis of a vast amount of data or evidence, one can expect the need for various resources and competences. For example, at the industrial level, DDDM has been primarily concentrated on the following characteristics: large scale companies, owning and using information technology, having skilled workers, and significant levels of awareness (Brynjolfsson & McElheran 2016, pp 137). Schildkamp (2019, pp 3) refers to 4 different sets of data that are part of data -based decision making at schools: formal (like achievement tests), informal (collected classroom observation information), research evidence and big data. Possible usage of those different types of evidence and sense making could indicate the need for skilled leaders and teachers (*Ibid.*, 2019).

Acknowledging the complexities and challenges associated with individuals' capabilities, leadership, and cooperation, is crucial. Marsh *et al.*, (2006) stress the significant role of commitment and collaboration among administrators and leaders in shaping data use patterns and fostering it within the context of DDDM. There are also significant risks if the cooperation between different positions does not take place. At the managerial level Ackoff (1989, pp 4) outlines that if cooperation is lacking between managers and system designers, it could end up

with managers getting misinformation. Conditions and circumstances in different decision-making levels are likely to influence the nature of the DDDM process (Marsh *et.al.,* 2006) therefore creation of analytical thinking cannot be only left to the analytical scientist, but it must be projected to other employees who can incorporate that data into decision making processes (Provost & Fawcett, 2013, pp 56). It is also important to establish mechanisms for communication across different segments of an organization, ensuring a more unified understanding and use of evidence across the organization and mitigate the development of divergent evidence subcultures (Coburn & Talbert, 2006, pp, 492).

Information overload causes decline in information usage in decision making. Filtration of irrelevant information and condensation of relevant information should be provided by management information systems to prevent this overload for managers (Ackoff 1989, pp 4). Lack of time (Marsh *et.al.,* 2006) or lack of access to appropriate and quality data (Marsh et al., 2006; Schildkamp & Poortman, 2015) could be seen as barriers to carry out data- driven decision-making practices. External pressure and internal motivation to use data (Marsh et al., 2006), staff skills, capabilities e.g., data literacy (*Ibid.,* 2006; Schildkamp & Poortman, 2015), also the timeliness of data can affect ability to turn data into information and actionable knowledge or even lead to mis usage (Marsh *et al.,* 2006). Isaacs is even more concrete (2021, pp 80-81), declaring that while digitalisation has enhanced the efficiency of information transmission, persons` interpretive frameworks, or the methods and systems we use to understand and process this information, have not improved correspondingly. Consequently, passive reception of information, where we simply consume information without actively processing or interpreting it, has become the norm (*Ibid.,* pp 80-81).

Based on literature, the author concludes that effective data-driven decision-making (DDDM) depends not only on the presence of (raw) data and information but also on acknowledged importance of human interaction. The comprehension of the context in which data is situated, along with an individual's skills, beliefs, and roles within an organisation, greatly influences the conversion of data into well-informed and evidence-based decisions (Baba, V., & Hakemzadeh, F., 2012; Schildkamp, 2019; Weinberger *and others*). Hence, a comprehensive understanding of the interplay between technologically provided data and human factors is essential for successfully implementing DDDM in any organisation.

According to the author, similarities between successful open government data and data-driven or evidence-based decision-making that need to be recognized in further research include:

1) A shared goal of informed decision-making and better outcomes.
2) Importance of understanding the context (cultural, organisational) and user preferences and needs.
3) Recognition of factors influencing evidence or data usage both at the individual or organisational settings, such as organisational (e.g., technological) capabilities, individual skills, availability, credibility, and relevance e.g., quality of data or evidence.

The Author concludes that in various contexts and environments, researchers delving into the potential impact of open government data encounter a multitude of complex enablers and barriers. These constraints inevitably limit their exploration to aspects of open data, enabling them to focus only on certain factors. In addition, the relentless evolution of technology perpetually unveils new opportunities, offering an abundant resource for diverse studies.

3. METHODOLOGY

The empirical part of the master's thesis entails qualitative research, using semi-structured interviews, open data web page analysis and document analysis at the local government level. The qualitative approach was chosen as it allows for a deeper and more detailed examination of the case (Patton, 2002, pp 14).

Empirical analysis follows the theoretical discussion, searching for possible enablers and barriers to user engagement with OGD at local government level and in the field of education. It searches for evidence on how an increasing amount of data provided by the government has been used in strategic goal setting and implementation and if there is a concrete (growing) connection between DDDM and open government data provision.

Empirical analysis was divided into 4 different sections:

1. The initial mapping of open government portals was conducted, focusing on major sources of data and information relevant for data-driven decision-making in local education following the discussions of Sayogo *et al.,* (2014), Kassen (2018), and Kim (2018). To gain better insights to data distribution incentives, an interview was conducted with a Ministry of Education and Research representative. For getting more detailed information regarding data provision, 2 different written information requests were made at the expert level of MoER.
2. To understand the possible jurisdiction and identify the possibilities, tasks, and responsibilities of local government in decision making, three legal acts were analysed: Republic of Estonia Education Act (HaS RT I, 15.03.2022, 4), Basic School and Upper Secondary Schools Act (PGS RT I, 11.03.2023, 74), and Local Government Organisation Act (KOKS RT I, 23.02.2023, 5).
3. In total, eight interviews were conducted, 7 with the local government representatives and 1 with the representative of the Ministry of Education and Research (MoER) in Estonia (Appendix 2).

Using the form of an interview next to the document analysis allows the author to obtain information about a specific process and ask the interviewees clarifying questions (Johnson, 2002, pp, 90). Semi-structured interviews allow for a more thorough understanding of reactions, experiences, and reasons for the development of certain attitudes (Rubin, Rubin, 1995, pp 90).

4. To examine decision-making processes at different managerial levels and evaluate the overall data – driven organisational culture, 80 education sub-committee protocols from seven municipalities over a year (between March 2022-April 2023) were analysed. Seven local government development plans, and two education sub-strategies were reviewed for instances of data-driven or evidence-based decision making, such as setting measurable long-term strategic goals. It allowed for the identification of both long-term and short-term objectives and their connection to data driven decision-making at the local government level. This analysis was undertaken to evaluate the hypothesis that the presence of measurable targets at the strategic level correlates with more extensive data use for performance monitoring and control (Brynjolfsson & McElheran, 2016, pp. 134). Also, it helps to understand the impact of political leadership attitudes on everyday decision-making.

Individual interviews with local governments were held six times, in one case tree people took part and a group interview was conducted, so in total nine people participated in interviews.

All interviews with the local government representatives were carried out using the same interview plan (Appendix 1). The interview with the representative from MoER addressed questions regarding the reasons behind government implementation tactics with open data portal Haridussilm as a case study.

Local governments were sampled as shown in Appendix 3. The aim was to contact the head of education departments. Research carried out by Coburn and Talbert (2006, pp 491) suggests that frontline central office administrators may play a key role in mediating between conceptions of evidence at the top of the district and those at bottom, meaning schools. Most of the interviews were done with non-political officials, but in two cases, politically pointed officials, who also fulfilled the role at managerial level, were available.

Not all LGs selected to the initial sample were willing to participate in the research. One of the LG decided to not participate as they admitted that they are not following their development plan nor using any open government data whatsoever. The person felt that the Haridussilm portal as a

source of information is useless and didn't agree to elaborate further. The second LG noted that currently the positions at the education department and deputy mayor were not fulfilled and there is no-one who would be able to answer those questions. The third representative denied the interview as she was very new to the position as education manager and due to that might not have sufficient information or knowledge regarding the practices of data use. This raises the question by the Author if those seven who agreed to participate, have already a certain (positive) attitude towards the data driven decision making and open data usage.

The interviews lasted an average 30 to 40 minutes (Appendix 2), were all recorded, and transcribed. All recordings will automatically be deleted after a certain period by Microsoft Teams program. The Microsoft Excel program was used to analyse the transcriptions of the interviews, where keywords were added to the transcripts and interview answers referring to the same factor were grouped.

All interviews were conducted in the Estonian language and quotes were translated afterwards into English. Every municipality (I1-I7) and person (V1- V9) was given a code to ensure anonymity of the interviewees. Also written responses (M2-M3) and interview (M1) from the MoER were given a code.

Education sub-committee protocols were available for public use at open document management systems at each municipality. Long term development plans were available at open web sites.

4.EMPIRICAL ANALYSIS

4.1 Open Government data on education in Estonia

In Estonia, the disclosure of public sector data as open data is regulated by the Public Information Act (AvTS RT I, 07.03.2023, 11). It includes all information captured and documented in any way and on any information medium and whose general use is not restricted by law. Access to open data includes the right to reuse the data, i.e., to use it for purposes other than those for which the data was originally collected. If a licence is set for the data, the licence must be followed when using the data (AvTS §3; AvTS§4; AvTS §8).

Estonian Government has created an open data portal avaandmed.eesti.ee. Through this portal everyone has access to different open datasets published by public, private or third sector. Re-use of the data is permitted under a licence described by the dataset publisher. The biggest education data distributor through this website is Statistics Estonia. All other education data sets, including a couple owned by the local cities, are mostly projecting the general data about the educational institutions that is taken from the data portals held by the Ministry of Education and Research.

In Statistics Estonia, general education statistics is provided for evaluating the educational system and school education planning. Open portal stat.ee projecting mostly statistics related to students. One can search the number of general education schools and number of pupils in each school, the average number of pupils in a classroom, the number of first-class pupils; the number of basic school and upper secondary school graduates; the number of upper secondary schools for adults; the number of educational institutions for pupils with special needs. Statistics are published by school type, county, mother tongue of pupils and school level. In addition, blog articles are created about the outcomes of data analyses. Stat.ee provides "Dashboards", including for local governments to easily get visualised data about their statistics.
In addition, Estonia has an education information collecting system called EHIS[3]. EHIS is based on governmental degree "Establishment of Estonian Educational information system and its

[3] www.ehis.ee, last visited 12.04.2023

statues" (Government 2004, RT I, 07.10.2022, 4). It's a national register that gathers data about the education system as such. It holds data on students, teachers and lecturers, graduation documents, study grants and scholarships, study and training institutions, curricula, training and activity permits, economic activity notices etc.

EHIS has both public and log in possibilities. The public view of EHIS is an environment that can be accessed by all interested parties. It is possible to perform various searches, although there is relatively less information regarding general education. One can search information about a specific school and see, if the school has licensed to teach at certain levels, the owner of the school, teaching language and the contact information, or control the validity of graduation documents.

To create a bridge between data at EHIS and make a kind of education dashboard from it, in 2013 (Interview M1) Ministry of Education and Research created Estonian education information portal „Haridussilm". This open portal provides information from basic, general, secondary, vocational, and higher education, language and youth fields and reflects indicators related to participation in lifelong learning and success in entering the labour market. Haridussilm provides an overview of the indicators of the national educational strategy and the progress towards them at different levels: from state to local government to school level. International student and teacher surveys PISA and PIIAC and annual educational overviews done by MoER are also published. Haridussilm does not provide raw data but already processed and aggregated information, more like a dashboard. According to Matheus *et al.,* (2018, pp 4) dasboards can lead to „faster and more accurate decision-making, resulting in increased efficiency and effectiveness of operations".

Although Haridussilm was created in 2013, there is no information publicly available on the concept nor has it been described in any legal act (Interview M1). Based on the webpage, the motto of Haridussilm is "smart decisions with the help of Haridussilm" indicating that one of the possible aims could be influencing the data driven or evidence-based decision making in education. There are no limitations in accessibility of data, most of the data is frequently updated, although we could point out that Haridussilm offers more information than data itself. Most of its information is published once a year, mostly in spring. This is related to the fact that EHIS has one of the fixation dates for some data collection 10.11 (Government 2004, § 22) and data is made available from there on, although it needs cleaning and appears on open data portal months later (written response, M2). There are certain data sets that must be inserted to EHIS monthly (Government 2004, §22, §30) although this is not published accordingly. Next to EHIS, Haridussilm is also connected to other data sources, like EIS -Estonian Examination Information

system. The portal only contains educational information, so it is not possible to simultaneously compare it with information from other fields such as social or youth affairs.

Based on webpage analysis and interview with the representative of MoER (interview M1), the manipulation of data is limited, as this level refers to the portal that presents data allowing for limited analysis and provides limited online features to enable users to manipulate data (Sayogo *et al.*, 2014, 1899). Haridussilm has no features regarding the engagement, as it does not provide tools and or systems for users to engage with government and/or other users. Those kinds of forms could be "community, forum, feedback and comments" (*Ibid.*, 2014, 1901).

When targeting the possible enablers of data usage, it became clear that during the last development of Haridussilm, school owners (e.g., local municipalities) were not considered as a specific target group in data usage. Although some representatives of local governments were interviewed during the design process and were included to the pilot, they were seen under the segment of education specialist and analysts, not considering their specific tasks or skills as local government managers. There is also no information collected about who are the main users of open data portal nor what are the main challenges that the users face when using it. Lack of human resources was the main factor why this is not done (interview M1).

The Ministry of Finance, who is the owner of a website called omavalitsus.ee is also providing certain information regarding the education for local governments. Omavalitsus.ee provides a certain score on each indicator and its level of achievement in each municipality providing information on how well local governments are doing in education. This information is partly taken from the same source (ehis.ee or haridussilm.ee), meaning they are duplicating each – other, some added info is available regarding the strategic planning, staff members where info is based on surveys[4] etc.

4.2 From data to information and knowledge

There are different ways to measure the quality and outcome of education and use it in decision making processes. The data that is primarily used to evaluate educational programs and success, at the state and federal level, are standardised achievement tests or student assessment data (Isaacs,

[4] www.minuomavalitsus.ee, local government units dashboard, information available mostly in Estonian. Last visited 14.05.2023

2021; Marsh *et al*., 2006; Schildkamp 2019). In Estonia, the Ministry of Education and Research (MoER) is monitoring the schools based on performance indicators and has made this information available for all. Performance indicators consist of information created by the state on certain educational issues. Indicators are in direct connection with Estonian education strategies or development plans, although currently they do not comply with the one that was adopted in 2021 and the changes are postponed until the further notice (written response, M3). The Minister of Education and Research established a decree „Performance indicators of preschools, elementary schools, upper secondary schools, vocational training institutions and continuing education institutions' (Minister of education and Research, 2018). The explanatory note of the decree refers to the importance of those indicators as "it is essential for all stakeholders ([…] school owners, community, [...] government) to have an overview of the learning environment, teaching, and upbringing activities, and learning outcomes. This is necessary to make appropriate decisions - for example […], when implementing support measures (school owners and/or government). Indicators also help the community, including the school owners to shape an adequate assessment of their school that allows them to make appropriate decisions. It is in the public interest that the educational institution is evaluated based on indicators developed by consensus, which support the creation of a favourable development environment for students. The given indicators are a basis for evaluating the activities and performance of the educational institution and its manager". Next, we are looking into the performance indicators in Table 3 (Appendix 4) to assess the quality of these indicators to predict possible usage.

The author has discovered three challenges in the meaningful interpretation of performance indicators. First, the interpretation of indicators is limited due to missing data. Input to some of the performance indicators (marked "a" in table 3) is coming from a volunteer based nationwide satisfaction survey for students in grades 8, and 11[5]. Results are displayed only about schools that have participated in the survey. Also, indicators are published if at least five students have answered the satisfaction survey per grade indicating that in the context of the Estonian school network, data of small schools may be missing. Based on the sample data analysis form Haridussilm school score card view[6], in the 2020/2021 school year, approximately 20% of schools offering basic education are lacking that information.

[5] Riiklikud rahulolu- ja koolikeskkonna küsitlused | Haridus- ja Noorteamet (harno.ee), information only available in Estonian. Last visited 23.04.2023.

[6] www.haridussil.ee, information available only in Estonian. Last visited 3.05.2023

Secondly, there is still some data that is not collected at all - for example “frequency of using digital solutions in learning and educational activities” or information is not projected through the Haridussilm school score card view to the potential users – like “proportion of students participating in hobby activities”. There are some indicators where the information is not distributed, like information about the grades (e.g., added value of education). According to the information given by the representative of the MoER (interview M1), it shouldn’t be the usual practice, although, as Haridussilm has recently gone through a renewal, it could have happened that it is already projecting the indicators set by the current strategy and not ministerial degree. Out of 13 performance indicators for basic schools, only seven offer comparable and trend-showing. Thus, slightly more than half are applicable.

Thirdly, Haridussilm enables us to compare different data and information about different schools, school types, municipalities, and its trends throughout the years. In case of performance indicators, the comparison with the average value comes in. According to the information given by the MoER (written response, M2), the strong outliners have not been taken out when calculating the average of the indicators. Information of the mean value could give the wrong impression, neither does it give any indication, if the overall average is high enough to describe the quality of education.

In conclusion, not only raw data but also examples of aggregated data and information in education are made accessible to open users for decision making. It is anticipated that local governments could utilise this information in their decision-making processes. Local governments can compare their education performance against other municipalities or state average and have quite detailed information about the school network, student achievements and students’ well-being. Although, questions remain about the added value of presenting average data or how much contextual value it provides at local settings. The author addressed those questions further during the interviews.

4.3 Local government responsibilities in education

School owners in Estonia can be local governments (municipalities or cities), state (Ministry of Education and research) and private entities (PGS §1). At the level of legislation (mostly PGS), there were close to 60 different obligations and tasks signed for LG. Some of the obligations were described as the ones of the owner and some ones as the obligations or possibilities of the LG. Both school owner tasks and obligations and those only given to the local municipality were analysed. The tasks encompass compulsory education from grades 1-9 and secondary education

from grades 10-12. Although pre-school education is excluded, interviews showed that local governments' owner roles, including decision-making areas, are not distinctly different.

To better understand whether LG has possibly more need for data to inform, identify, or clarify (e.g., identifying goals or needs) or to act (Marsh *et al.*, 2006, pp 3) daily, the author categorised tasks into four groups: governance, school network (including building maintenance), staff, and students.

1. Governance: Local governments form a school board of trustees, approve school development plans, budgets, and statute. They set strategic education goals in their jurisdiction and allocate budget accordingly. LG has a right to carry out official supervisions over schools.

2. School network and infrastructure: LG is responsible for establishing enough school places, ensuring the mental and physical safety of students and staff, and creating learning environments that meet safety, health, and curriculum requirements. They oversee school re-organizations and closures, manage resources such as health services and student catering and regulate some practical issues like managing class sizes, and address absenteeism, intervening when parents are unreachable. LGs keep records of children subject to compulsory schooling and ensure compliance with compulsory schooling.

3. Staff management: LG establishes remuneration principles, supports the availability of qualified teachers and support specialists, manages hiring processes for school heads and establishes procedures for employee composition. They create opportunities for implementing support specialists' services.

4. Student support: LG supports students with special needs, is involved in assessing school readiness, providing basic education for older individuals, arranging foreign student placements, and assisting graduates with learning difficulties.

In summary, this overview indicates that local governments have been given specific tasks in long-term strategic planning for the entire school network as well as for individual schools, while daily decisions are rather related to student placement, fulfilling compulsory school age, and to some extent, ensuring the necessary number of teachers. This would indicate that information provided by Haridussilm could have more impact in long time planning, EHIS internal view for more everyday activities.

A certain challenge is associated with precisely to whom the tasks have been assigned. In 2021, the Ministry of Finance commissioned an expert opinion on “Local governments implementation of management models and organisation of the local government possibilities of regulation in the law", which shows that in different laws, the authorization of tasks assigned to LG is regulated somewhat inconsistently. As an example, in Basic School and Upper Secondary Act, it is often not clear who has authority on what task and to what extent can the person who has received this authorization, in turn, delegate the performance of the task further to: municipality/city, municipality or city government, school principal, as well as school owner. This creates disputes about who is authorised to decide things (Sootla *et al.*, 2021, pp 36-38). According to that, it is not possible to address what kind of boundaries or expectations in decision making regarding LGs tasks are specifically left at the managerial level and further research through interviews is conducted considering the aforementioned areas.

4.4 Popular data sources

Given the complexity of decision-making responsibilities, the author explored the areas of education management covered by local government representatives during interviews, identifying instances where national databases or other evidence were used in planning or executing these tasks. Most frequently the use of the population register was mentioned by the interviewees (I1-I7) as an important source when making school network decisions, being consistent with the local government's responsibility to ensure compulsory education for school-aged pupils. The need to forecast the number of school-aged children and allocate school places is existent both annually and on an ad hoc basis. Local government population and school-aged children forecasts (in some cases at specific villages or city areas) were also the most used datasets in local government development plans. Occasionally, analysis commissioned from private sector were used for that purpose.

Regarding data or information on teachers (and specialists), pupils, and schools’ performance, the Estonian Education Information Portal EHIS was most frequently used, primarily its internal view (interviews I2, I3, I4, I5, I6, I7). The Arno portal was also mentioned a couple of times (interviews I2, I4), which is a software system for managing educational services accessible to educational

institutions and parents, but it is not a database per se; rather, it facilitates data exchange between EHIS and the Population Register[7].

Haridussilm was less important for local governments in obtaining data that would influence their activities. Statistics Estonia (Interview I2) and omavalitsus.ee (interview I4) were both mentioned only once. However, Haridussilm was well known to all respondents, and it was mostly considered a positive development by the state (interviews I2, I3, I6), allowing a quick overview of schools and their performance indicators. At the same time, one-third of respondents (interviews I2/V3, I3, I4), also those with a positive attitude towards it, did not use the information on Haridussilm either at all or had not used it for a long time echoing its irrelevance for everyday actions and decision. One of the interviewees had participated in the Haridussilm testing pilot, and although she thought very highly of it, she admitted that she never uses the data or even visits the portal.

Satisfaction and school environment survey reports were mentioned almost by all interviewees (I1, I2, I3, I5, I6, I7) as a source of valuable information. The local governments reportedly (interview I3) have access to these school-specific reports through an electronic environment as they are not publicly available.

Two interviewees (I1, I3) mentioned the once-a-year overviews of school comparisons provided by the Ministry of Education and Research in PDF format. It was seen as a very positive example of information distribution. Upon inquiry to the Ministry (written response, M2), it was revealed that these overviews were an initiative by the supervision department, which compiles a local government-based summary once a year based on education performance indicators presenting existing data in PDF format. As the same information is available online, it could indicate the challenges in IT skills at the level of managers.

4.5 Policy planning - setting educational goals and monitoring their progress

Local governments usually set overarching educational objectives within their development plans. The author analysed the development plans of seven local governments and two education sub-plans, examining the data sources used, the objectives set, and how the progress of these objectives was assessed.

[7] www.arno.ee, last visited 10.05.2023.

The author points out that it would have been ideal to compare these development plans with those from the previous period to track possible changes in data usage and connections with decision making. However, a significant administrative reform took place in Estonia in 2017, resulting in the merge of many local governments and the creation of new administration units[8]. Due to the timeline, current development plans are either about to expire or have recently expired, making comparisons with the previous period impossible.

Local governments usually review their development plans annually, in line with the budget planning process. On some occasions they have made minor changes to the plan's content (interview I1, I3, I4). However very few concrete examples were provided where the current development plan's objectives were thoroughly analysed throughout the period of validity. Those examples were related to teachers - monitoring was conducted about the average age of teachers (interview I1) and teachers' qualification (interview I5). Drawing on this monitoring process, administrators endeavoured to aid schools in recruiting new teachers, or in discerning the underlying reasons why existing teachers didn't meet their qualification requirements.

It was noted that the availability of data, including the presence of performance indicators, had provided input into what data could be used at the local government level planning. Student exam results, teachers' qualification levels, student satisfaction were just some of examples of information used. Existing development plans still often lacked direct links between background analysis information, related objectives, and their measurement. Data sources were frequently not specified. Goals were not measurable in two out of seven cases. In several cases, the goals and potential measurement indicators didn't align clearly.

This aligns with Schildkamp's (2019, pp 8) discussion about the tendency to use available data or information, rather than seeking data that could effectively evaluate goal achievement. It was also evident that development plan, which was adopted in 2023, had many more connections in terms of set objectives and the use of open data and national indicators in measuring them.

Attitude towards using more data and evidence-based planning was certainly there. Almost all interviewees noted that the current development plans are outdated. It was sensed that there is a need for more attention on thorough analysis and setting objectives that can be proven to be achieved (interviews I1, I3-I5, I7).

[8] Administrative Reform | Rahandusministeerium (fin.ee), last visited 14.05.2023

4.6 Everyday management decisions and data usage

Most frequently, data-based decisions were related to the local government's obligation to provide a place of study. A few interviewees (I4, I5, I5) specifically mentioned data on Ukrainian war refugees and children since 2022.

To assess the need for study places, the interviewees mainly analysed population register data – residence, birth rate, migration, as well as the number of children in kindergarten, the number of children being of compulsory school age, etc. This data is analysed both continuously and annually during the allocation of school places, also when setting overall school network plans for a longer period. In addition to first grades, there is a need for individual school places in other grades due to both internal and international migration. Opening the data has changed this work: “I had so many and big excels myself when I started working some 20 years ago, all this [opening data] has made it much easier” (V1).

However, when planning school places and making network decisions, the only data mentioned were numerical indicators, considering the number, registration, age, and movement of children and young people. None of the interviewees mentioned any other data or information that could for example indicate the quality of the school and placement decisions based on that.

The second major area in everyday education management at the local government level is information on children with special educational needs (SEN), the formation of special classes, and the search for support specialists in case of an increase in the number of children (interviews I4, I5). This data is not publicly available data due to its sensitive nature. Mainly, this information is gathered through the internal view of the EHIS or is requested directly from schools.

Several references were made that occasionally there is a need to compare the teacher salaries in neighbouring municipalities and/or cities (interviews I1, I2, I3, I5, I6). Monitoring teacher salaries was primarily aimed at maintaining the competitiveness of their local government in the context of teacher shortages. Occasionally salary adjustments were made, although it was acknowledged that resources are not always available. Data was also used to ensure the legality of decisions (interviews I4, I5) - for example, information on teacher qualifications was used to assess the fulfilment of various local-level competition. The need to justify procurement arrangements or use data in drafting regulations was also mentioned, although no specific examples couldn't be provided. In rare cases (interviews I1, I5), there was need for cross-use of data in youth work and

hobby education: “We try to link, for example, the educational data with youthwork to see who neither study nor work."(V1)

There were few examples when data or other evidence played a role in influencing decisions (interviews I3, I5, I7). This was supported by the minutes of the education sector committees, although which generally did not include such discissions. It could be influenced by the practice and level of detail of minute-taking.

One local government commissioned a separate analysis about a significant change in the school network. In another local government both the interview and document analysis showed that a paper about the education sector situation with proposals for further action was commissioned from a private company for the new development plan. Similarly, one city had created a multi-year project for the formation of a specific competence centre, one of the outputs being a separate analysis of the current situation and future opportunities.

In rare cases, existing analyses were used, or surveys were conducted - for example, an analysis previously compiled by the Ministry of Social Affairs was used when deciding on the starting time of a school day. Another municipality had collected feedback from students and parents a few months after the implementation of a new starting time for schools. In one case a survey was conducted in relation to supporting swimming education for school children. Although, half of all documented cases were examples from one local government's education committee, so in general, analyses, including self-conducted analyses or statistics, are rarely used at the sub-committee level for planning or evaluating educational decisions based on a 13-month observation period.

It should be noted that since none of the separately commissioned analyses mentioned above have been completed or there are no records of actual decisions based on the research within given period, it is not possible to assess whether the ordering of such an analysis ultimately shapes decisions or whether more strategic proposals, for example at the level of a development plan or its action plan, are reached. Nor was there any straight correlation between strategic development goals of LG and evidence/data usage in discussions over the one-year period.

4.7 Data as a monitoring tool

The most prevalent activity with open data was monitoring. Data viewing and monitoring, including from the Haridussilm or national satisfaction surveys, were most often mentioned in the

context of school management. In those cases, specific school data is rather viewed and sometimes discussed with school principals (Interviews I1, I2, I5, I6). Local governments have organised roundtables with school teams where certain indicators were discussed (I1, I5, I6). Following these discussions, different courses of action were taken. On one occasion, a school principal chose to dismiss a teacher based on the school's final exam results or this information led to the hiring of an additional support teacher. Therefore, although local governments can highlight specific issues, in several cases, the final decisions remain in the hands of the school principals.

Using open data and performance indicators in development discussions with specific school principals was varied. Generally, half of interviewees had looked at the school's performance or other school-based data from Haridussilm beforehand, while the other half had not (Interviews 12, I3, I4, I7). There was also one local government where no development or cooperation discussions had taken place within the last year. In one case, the school's data and indicators were discussed with a new, starting school principal so that “They could develop the schools themselves" (V7).

For those who did not use data and information in conversations with school principals, the reasons varied - for example, a 360-degree school principal assessment model were used, or more relaxed meetings took place: "I would scare them off if I immediately threw at them some data" (V9).

Several interviewees noted that they look at school-based performance indicators when there is a reason to look at them on a school basis - for example, when a complaint is filed about a school principal, in which case data is used to check whether the complaint might have merit or not. In such cases, satisfaction information with the school is used the most (interviews I4, I7).

Six of seven cases managers reported observing evidence-based analyses and goal monitoring in school self-assessments and development plans. There is supposedly growing awareness among school principals about data sets and the need for analytical work (interviews I1, I5, I6). A case was also noted where political reasons prevented local government interventions, specifically when substantive discussions on development plans were not initiated due to pending decisions about the school network.

Details were scarce about managers` intervention points in school-level development plan processes. One local government has an e-solution for school development plans with educational indicators, though they primarily ensure that goals are stated and quantifiable, rather than intervening more deeply in the development plan formulation process.

Document analysis revealed that several times, representatives of schools were invited in various local governments to introduce their schools, including talking about numbers and results. All these meetings were left as information points, and it was not possible to assess whether such direct information requests led to subsequent decisions regarding the school's long-term goals.

4.8 Enablers and barriers of data usage at end user level

4.8.1. Data Quality and Contextualisation

During the interviews with local governments, several obstacles were mentioned regarding the usability of existing open data. For example, the data in Haridussilm was criticised for being updated too infrequently (interviews I2, I4). It was pointed out that if real-time data provision is not possible, updating the dataset at least twice a year - in the fall and spring - should be the minimum, also the data in the fall should be available as early as September. No specific timeliness issues were noted for other data portals.

To assess data quality and context, the author asked what data local governments currently need to request themselves to properly organise their work and what is not already available and whether there are practical obstacles preventing the usage of existing data at the local government level. Here the answers were again diverse. One department head directly stated: "I am not very optimistic that at the national level it is possible to publish data that is necessary for local governments, it is very resource-intensive" (V2) implying that, in fact, national level data is almost unusable for management decisions due to the lack of context.

Five out of seven interviewees indicated at different stages of the interviews that the amount of additional data requested is small or decreasing over time because of open data. One interviewee referred to data collection overload "the state and various researchers keep asking too much about everything that comes to mind," (V3). Despite that impression, during the conversation, multiple cases emerged where additional data was requested from schools or other municipalities. “I would like to collect even more data, but there simply isn't enough human resources for it, although there is a need” (V6). Only two local government representatives claimed that they no longer ask for additional data because everything seems to be available. However, one of the respondents admitted that perhaps she just doesn't know what to ask for.

The most common need was to get more detailed information than provided by the state. This concerned class sizes at the city district or school level and comparing the salaries of specific subject teachers with neighbouring local governments. In two cases managers investigated the paths of both primary and secondary school graduates in more detail than provided by the state.

The complexity of the internal view of EHIS posed a challenge, as it demanded extra manual work to individually filter necessary data. There were several instances where additional data requests had to be made to the Ministry (Interviews I2, I7), but the process was occasionally discontinued due to the excessive steps required. One local government conducted their own surveys to gauge stakeholder satisfaction with schools, typically augmenting national surveys with questions specific to their activities or school events.

While a feature exists to compare schools within local governments and the Estonian average, it becomes complex when schools vary greatly in type and size. For instance, it was pointed out that comparing a small primary school with 30 students to a large high school or average school with a school with a high ratio of SEN students isn't sensible, thus making it difficult to draw conclusions from such comparisons within a single local government.

Evaluating the data used in development plans, it's observed that self-collected information is used almost equivalent to national level open data. However, these documents often lack references to data sources, leaving the questions unanswered. Interviewees mentioned using self-collected data in various contexts, like discussions with school principals, special education planning, and tracking teacher education graduates for future job offers (I4, I6,). It was repeatedly mentioned that should more context related data be available at national level; it would be utilised in the decision-making process.

Within the school performance indicators, nearly half are missing for grades 1-6. Notably, graduation results and broader satisfaction surveys are absent, prompting a separate satisfaction survey development for 6th graders together with a research university. One interviewee wanted to have data on per-student education costs and teacher turnover, but no such information is currently available. There are also issues in obtaining data about students assigned special support in regular classes or about students in private schools in the city or pupils movement inside one region (interviews I2, I4, I6, I7).

In general, it can be said that the Haridussilm was mainly referred to as having an excessive level of generalisation and timeliness issues, while the EHIS login view was referred to as having a complex data array, which sometimes hindered the ability to perform analyses, especially due to

limited skills and time. Based on interviews and document analysis, it cannot be claimed unequivocally that municipalities use their own collected data more actively in decision-making than data collected at the national level.

Regarding raw data quality, criticism was mainly directed at teacher qualification data, as these are entered into EHIS by school principals themselves. Interviewees pointed out that, it often turns out that the data quality is inadequate and does not correspond to reality (Interviews I2, I4). However, there are no resources to check or clean this data set, for example, by the municipality itself. One municipality also asked schools for data on SEN students to verify if the data in EHIS internal view were correct.

The use of satisfaction survey data is also not straightforward. It was pointed out that if LG wants to compare schools in terms of teacher, parent, or student satisfaction with other factors than those shown in performance indicators and displayed in Haridussilm, it is extremely laborious. "We have provided feedback that if I wanted to look at other factors in satisfaction surveys than just those in performance indicators, I would have to actually do well…take paper and pen and like 5 monitors and start comparing them – because satisfaction survey reports are static and school-based. The data simply aren't comparable and processable [...] We have had this question, for example, whether we have a problem in one school or not, and it took like two days to compare satisfaction questions with others" (V9).

4.8.2. Personal and organisational attitudes and skills

Interviewees generally expressed a positive attitude towards data usage and evidence-based decision making, although occasionally expressing some scepticism. Despite various challenges, and some apparent personal attitudes inhibiting data usage, none explicitly stated that data isn't necessary for decision-making or that open data shouldn't be utilised. A few sceptical remarks surfaced, like "Come on, I don't sit in the Haridussilm every day" (V2), "We know a lot about schools ourselves and don't always have to look at the data" (V6), and "In small schools, data usage is smaller as everything is known anyways" (V1). Yet, these attitudes weren't dominant when talking about data implementation. There was noticeable interest and curiosity towards the topic, alongside an acknowledgement of insufficient skills for conducting data analyses.

Like self-perception, there was a certain scepticism towards how the local government behaves as an organisation and its belief in data-driven management. If goal measurement isn't prevalent in other policy areas, there's also resistance to change in education. Despite data evidence, local political decision-makers frequently place more trust in their own knowledge and convictions (Interviews I4, I7).

Most interviewees (I1, I3, I4, I5, I6) admitted that better knowledge of different data sources, how to perform data analysis, assess impacts, or use data in decision-making would influence data driven decisions. Although a few had attended information seminars introducing the Haridussilm platform or had other relevant training, it was considered insufficient. Merely knowing that data exists is not enough for its actual use: "There is a significant lack of analytical skills. We look at trends based on gut feelings. We constantly feel that a specialist could do this better" (V1). The significance of the need and its recognition by officials themselves is also evident in the 2021 study commissioned by the Ministry of Finance, which pointed out that the field of education-youth work-culture is often the responsibility of the same official(s) in small local governments. Although education specialists felt that their upskilling needs are low, the training priorities in this area were related to various research activities (impact assessment, preparation of analyses, data processing, service design) and the digital skills and management activities (change management, strategic management, etc.) required for this (Õunapuu, et al., 2021, pp 34, 81).

Those interviewees who had relevantly recently held a managerial position at school or at the state level, brought it up as a reason for believing and knowing in OPG and DDDM, also public managers at state level and school heads receive constantly different training.

“State is training their public servants and officials from every different angle, we were so pampered, there is not much for local level staff” (V9).

4.8.3. Organisational enablers and barriers

One interviewee referred that, for him, coming to work at local government level had been an eye-opener, including how little IT solutions are used consistently at the local government level for various processes: "In comparison to previous workplaces, at the municipal level, there is 15-year setback in IT solutions" (V9). It was suggested by him that in situations where data is generally not always trusted and scepticism prevails, the change could be only seen if a significant number

of officials from various fields become "data believers", as one person usually can’t change the organisational beliefs.

One of the main obstacles of using data in decision making was lack of time. Excessive workload and fragmentation between different policy areas were mentioned as significant obstacles in implementing data- and evidence-based management practices in six out of seven cases (interviews I1, I3, I4, I5, I6, I7). In one case, it was also seen as a possible enabler to combine different information and data throughout different fields, although possibilities for it remain seldom. Five out of seven interviewed officials worked in other areas besides education, in one case, one interviewee worked alone in education, social work, youth work, and culture, also being a deputy mayor. Overall impression was that collegial help provided by managers in other areas was there if needed, but time is a major concern regarding DDDM practise.

The combination of existing knowledge, skills, and the vast amount of data can sometimes lead to confusion. It is not always clear which data and at what level are targeted to whom and what added value or knowledge existing open data could provide for local education management. This problem is well illustrated by the opinion: “School performance indicators are information primarily aimed at schools, not city-level decision-making (V1)”. Some interviewees were uncertain about the most efficient way to access certain data, and what specific information they could extract from Haridussilm or other sources. There were cases where specific situations were mentioned, stating that it is not possible to follow a trend in the existing dataset, while the Haridussilm allows it. Through the interviews, some small confusion was noticeable about what is available in EHIS internal view or the Haridussilm, and what role the portal minuomavalitsus.ee plays. This may indicate that officials do not have too frequent contact with databases.

Several points were mentioned repeatedly about people's movement and the perception of political directions at the level of education officials. One interviewee noted that "There is a lot of movement, some only stay for a short time... At the same time, some department heads may have been in the same position for ten years but don't make any changes, just sit there, and try to navigate through political turmoil" (V9).

It was evident in several interviews (I1, I4, I7) that different political coalitions can change directions of policy in a short period of time and there is some uncertainty, especially when it comes to strategic decisions. Although major school reorganisation decisions were rare, one interviewee noted that even while decision regarding one school had been made five years ago, along with evidence- based reasoning, the decision hasn't been adopted due to a change in the

coalition and apparently this topic will not be raised soon. Based on education committee protocols, two-thirds of the analysed municipalities had changed their education committee leaders within the year. One deputy mayor mentioned that he had already faced three motions of no confidence within 1.5 years.

5. CONCLUSION

In Estonia, the Government has created different possibilities to access educational data and information.

Local government officials rely on various national data sources in their work, including the population register, the Estonian Education Information Portal EHIS, in some cases also Haridussilm or satisfaction surveys. These data sources are used to make informed decisions mostly on school network planning e.g., with students with special educational needs, also monitoring teacher salaries and qualifications. Despite the availability of open data sources and their intentions for evidence-based planning, there is still room for improvement in the way local governments use these data sources in decision-making. The development plans reveal a need for more thorough analysis on the current situation and setting contextual education objectives that can be measured.

The empirical analysis shows that the general attitude about moving towards data- or evidence-based management, is predominantly positive. However, although state-level activities in developing databases for accessing education information and making data available were welcomed, their impact on this data in decision-making is still rather modest, fluctuating a lot.

Excessive workload, fragmentation between policy areas, and limited human resources hinder the implementation of data-driven management practices. Most interviewees acknowledged the need to develop their skills in data analysis, impact assessment, and data-driven decision-making. Additionally, in some cases frequent staff turnover and political fluctuations contribute to the challenges faced at the local government level.

Usability of available data was also questioned. Local government managers or any other school keepers (state or private) have not been considered as the specific target group when designing educational open data portals creating a somewhat missing link between existing databases and the perspective and needs of users. Portals like Haridussilm or EHIS, are not always meeting the engagement requirements or provide the easy opportunities related to data manipulation,

interaction with the government or sometimes also miss data quality (e.g., timeliness and credibility of raw data).

The thin management layer in many local governments impacts data-driven decision-making, and there could be a need for systemic changes to stimulate the use of data in decision-making processes. Even in bigger municipalities, limited training and sometimes general scepticism expressed regarding the data use contribute to this disparity. Despite this, local government officials recognize the need for improved data skills and practices, and some hope for better background analysis and measurable goals to be set for example in future development plans.

What this work adds to existing discussions is an example of how different contexts highlight the concrete enablers and barriers that play the most significant role in making data and evidence-based decisions happen. Such analyses facilitate the identification of the most significant challenges within given conditions, enabling a conscious effort to guide the decision-making process and rise the impact of open data.

It can be said that many of the barriers mentioned in the theoretical discussion were also discovered during the interviews. However, the following factors at Government, local government and personal (managerial) level can be highlighted by the author as following:

1. The state has not sufficiently considered the role and the needs of the stakeholder when making educational data available. Too few opportunities have been created for communication with the state, including substantive discussions why certain data or information is provided or how data could be purposefully used.
2. In many local governments, the school network is relatively small and officials' work time is divided across various areas. This makes it challenging to find the time for in-depth data or other evidence analysis.
3. Data-driven management is complex and requires high level skills that respondents point out as a shortcoming hindering the data usage.
4. If the broader organisational culture, including other departments and higher management, does not embrace a data-driven approach, it becomes difficult for an individual or a single area of responsibility to adopt such a practice, lining with (Coburn & Talbert, 2006; Provost & Fawcett, 2013) discussions of developing data analytical mindset in the organisation.

Rising awareness of these challenges is the first step in the direction to increase the influence of open data on decision-making processes both at strategic and everyday management level at Estonian local governments.

As a result, if there is a will to create a change in moving more towards data or evidence-based decision and policy making, e.g., have a larger impact of open government data in decision making, the author proposes to address following proposals:

1. Building up a cross-sectoral analysts positions to each local government.
2. Formation of a separate team of analysts who operate across local governments and support the contextualisation of data and information.
3. The structure of local government operations could be a topic of discussion, to offer a longer and stable perspective in education leadership.
4. Provide targeted data skill or evidence-based management training for education sector professionals together with other areas of representatives from the same local government or other local governments. Discussion and experience sharing platforms for data usage should be created.
5. Consider the specific needs of local governments when gathering and distributing educational data, and when establishing an open data perspective, also in regard of combining different datasets form different areas. This process should consider central legislative duties, assess local officials' data analysis capacity, and design databases and data collection methods accordingly. This would allow school owners to use data and information more effectively.

The author acknowledges that these suggestions may diverge from the lean governance model ideal. However, we still lack comprehensive, inclusive, and intelligent technological solutions capable of conducting sufficient research or analytical work for evidence-based decision-making without human expertise. While the future of technological capabilities remains uncertain, it will be some time before such solutions are widely understood, trusted, and used by officials. Ultimately, the application of such analytical work remains in human hands, at least for the foreseeable future.

5.1 Possible limitations and further research

When analysing the open government data impact in decision making, data-based decision-making may still be too narrow a concept in terms of education and in the context of municipalities. Considering the entire spectrum of different studies or observations supporting data or evidence-based management, this work certainly could not cover it all.

This study does not cover the overall ICT openness and does not go in depth to attitudes, capabilities, and skills in local government as an organisation. This requires a different approach to research, as interviewees were somewhat cautious about giving such feedback if those issues arose during the semi-structured interviews. It could be analysed to what extent the adoption of different other ICT solutions, such as procedural environments, intranets, reporting environments or document registers influence general organisational attitudes towards more evidence based and data driven decision making. Also, how big is the mayor's or the council's role in the context of shaping organisational attitudes. Having answers to those questions would help the Government even more nudge the impact of open data in decision making.

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Appendix 1. Interview plan with local municipality representatives

1. What is your job title, how long have you held this position? What was your previous working place (in case of working less than 10 years in your current position).
2. What are the other management or decision-making positions in your municipality in the field of education?
3. Do you have an analyst working with you? Have you received relevant training yourself?
4. In which activities or issues do you most often intervene in relation to education governance?
5. Please provide examples of when you used centrally available education data or any other information in the planning or evaluating these activities?
6. Looking solely at your municipality, which data is most meaningful to you? Which have you used most frequently?
7. Based on what you decide which data or publicly available information is meaningful for your work?
8. Is there any information or data about education that is collected by LG itself? For what purpose?
9. Please provide examples when the open access to education data changed anything in your management decisions or led you to make different decisions as anticipated at the beginning?
10. Which statement is more true in everyday practice: I seek evidence and information primarily to prove something?
    I explore information purely for the purpose of gaining new knowledge.
11. In case of using open data portals (like Haridussilm), is the information provided contextual and meeting the needs of LG? Please provide examples.
12. (if not mentioned before) Do you follow school-specific reports at Haridussilm? Do you follow individual schools' data outside that possibility?
13. Do you follow national performance indicators? Can you recall using them at decision making?
14. Have you used the information that reaches you through EHIS or Haridussilm, for
    - in feedback or any other discussions with school principals?

- in recruitment - to analyse the primary challenges a school principal will face in that school.
- planning changes in the school network? If the answer is the number of students, the question is followed by: have you looked at other indicators when making for example closure or opening decisions of schools or school levels?

15. Strategic view: At the LG development plan level - how much is education sector performance indicators or other nationally collected data used in development plan or its monitoring?

16. Do you compare your municipality's schools with others based on open data? (if examples needed: for salaries of teachers in your municipality or other teacher data?)

17. Do you monitor evidence-based approaches in your schools' development plans? How do you assess whether self - evaluation has been done well? How important is an evidence-based approach in this regard? Has open data provided new ideas in this sense?

18. How good do you consider your data usage skills?

19. Anything relevant to add regarding the data usage and its impact on decision making at local government level?

Appendix 2. Interview timetable

1. Municipality official, also acting as deputy mayor (I1;V1). Online interview, Microsoft Teams, 24.03.2023 at 11.00-11.36
2. Municipality officials: Analytic, head of department and education specialist (I2; V2-V4). Online interview, Microsoft Teams, 27.03.2023 at 13.00-13.46
3. Municipality official (I3; V5). Online interview, Microsoft Teams, 31.03.2023 at 14.00-14.25
4. Municipality official (I4; V6). Online interview, Microsoft Teams, 31.03.2023 at 16.00-16.32
5. Municipality official (I5; V7): Online interview, Microsoft Teams, 3.04.2023 at 15.00-15.35
6. Municipality official (I6; V8): 4.04.2023 at 10.00-10.40
7. Municipality official, acting deputy mayor (I7; V9): Online interview, Microsoft Teams, 12.04.2023 at 12.00-12.55

Representative of Ministry of Education and Research (M1): Online interview, Microsoft Teams, 5.04.2023 at 12.00-12.31

Appendix 3. Sampling the local governments

In 2023 there are 79 local governments in Estonia, which are divided into 15 cities and 64 municipalities (hereinafter also LG)[9]. Municipalities were grouped by the number of schools in each municipality (Tabel 1).

TABLE 1.

Number of schools per LG	1-4	5-9	10 -
Number of local governments in that category	43	30	6

Data in Table 1 is based on analysing the numbers from the year 2022/2023, source EHIS.ee, school network map.

As next, 7 municipalities were chosen to look more closely into (Tabel 2). From 7 municipalities, 3 were cities, and 4 were rural municipalities. 2 out of 9 interviewees were male and 4 were working less than 2 years on given position. In 5 cases out of 7, heads of departments were also responsible for other policy areas, having on average 1 partial education expert working together with them.

TABLE 2.

No of schools per LG	1-4	5-9	10 -
Number of municipalities chosen to participate	3	3	1

[9] Administrative Reform | Rahandusministeerium (fin.ee), last visited 10.05.2023

Appendix 4. Performance indicators

TABLE 3 Elementary and upper secondary school performance indicators

Elementary school	**Upper secondary school**
1) the proportion of 8th grade students who are satisfied with the school (a)	1) the results of the elementary school final exams of students who have entered the 10th grade of the gymnasium;
2) the proportion of 8th grade students who have not experienced bullying at school (a)	2) the proportion of 11th grade students who are satisfied with the school (a)
3) the proportion of students supported through support systems	3) the proportion of students participating in hobby activities;
4) frequency of using digital solutions in learning and educational activities (8th grade) (*data not available)	4) frequency of using digital solutions in learning and educational activities (11th grade) (a)
5) the proportion of 8th grade students who are absent without a reason (a);	5) results of state examinations;
6) the proportion of students participating in hobby activities;	6) consistency of state exams and school grades of corresponding subjects;
7) results of primary school final exams;	7) the high school's contribution to the progress of students (*data not available);
8) consistency of the final grades of the basic school and the corresponding academic subjects;	8) the proportion of graduates of upper secondary school with nominal time;
9) proportion of study dropouts in the III school level;	9) the percentage of 10th grade students who drop out;
10) proportion of among basic school graduates who continue with their studies;	10) share of continuing students among high school graduates;
11) the ratio of student and teacher positions;	11) the ratio of student and teacher positions;
12) the proportion of teachers who meet the qualification requirements;	12) the proportion of teachers who meet the qualification requirements;
13) primary school surface use index (m2 per student).	13) gymnasium surface use index (m2 per student)

Source: Minister of Education and Research (2016). Indicators are translated by the author.

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