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DEVELOPING INDICATORS TO SUPPORT THE IMPLEMENTATION OF EDUCATION POLICIES

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Acknowledgements

Abstract

Across OECD countries, the increasing demand for evidence-based policy making has further led governments to design policies jointly with clear measurable objectives, and to define relevant indicators to monitor their achievement. This paper discusses the importance of such indicators in supporting the implementation of education policies. Building on the OECD education policy implementation framework, the paper reviews the role of indicators along each of the dimensions of the framework, namely smart policy design, inclusive stakeholder engagement, and conducive environment. It draws some lessons to improve the contribution of indicators to the implementation of education policies, while taking into account some of their perennial challenges pertaining to the unintended effects of accountability. This paper aims to provide insights to policy makers and various education stakeholders, to initiate a discussion on the use and misuse of indicators in education, and to guide future actions towards a better contribution of indicators to education policy implementation.

Table of contents

Tables

Figures

Boxes

1. Introduction

The development of indicators in education dates back to the 1960s, when social scientists tried to emulate the success of economic indicators to guide policy making. They developed indicators to account for wider social welfare considerations, such as equity, qualitative aspects of life, and education. By the late 1970s, enthusiasm had faded. Among the reasons invoked were the high cost required to compute, sometimes already outdated, indicators, the ad hoc methodologies yielding unreliability issues, and the lack of policy relevance for many of the designed indicators (Carley, 1981[1]).

During the 1980s, many education systems faced shrinking budgets. In the meantime, under the influence of new public management, devolution reforms attributed new responsibilities to schools. These reinvigorated the interest in indicators, as an accurate and timely means to hold schools accountable and monitor change (OECD, 1994[2]). As summarised by Cheng (1997[3]), indicators help us i) assess the level of education quality, ii) identify the areas for improvement, and iii) understand the mechanisms and processes at work in education.

More recently, increasing demand for evidence-based policy making has further led governments to define policies jointly with clear measurable objectives, alongside associated indicators to monitor their achievement (OECD, 2020[4]; Schumann, 2016[5]). This came as a result of both internal and external pressure, with governments seeking to demonstrate the efficiency and effectiveness of public spending, and institutions willing to best allocate their resources to fulfil their mandate.

Given that education problems seldom have obvious solutions (Schildkamp, 2019[6]), acting quickly, but without evidence, has little chance to be effective. For instance, if large investments are made to distribute tablets to students and improve digital skills, but the cause of low digital literacy is rooted in teachers' limited digital capacity, the problem remains unsolved. The definition of indicators therefore lies at the heart of the policy-making exercise, as a source of evidence for accountability, development, and future evidence-based policy development (OECD, 2013[7]). It also serves as a tool to monitor policy implementation and identify remedy measures to support the achievement of its objectives (OECD, 2020[8]).

The overall consensus on the purpose of indicators does not extend to their definition. For some researchers, an indicator is a pure quantitative measurement, such as a statistical indicator, or a data element that represents information for a specified time, place, and other characteristics (Economic Commission for Europe of the United Nations (UNECE), 2000[9]). For others, it can include descriptive or evaluative statements. Such qualitative indicators can reflect reasons, personal views or attitudes. (European Commission, 2001[10]; European Commission, 2019[11]). In both cases, researchers agree that an indicator is an information vector, which excludes any analysis or discussion (OECD, 1994[2]). Yet, the choice of specific indicators and their underlying social theory, the selected measurement methodology, or the definition of "targets" and "benchmarks" may be viewed as political decisions (OECD, 1994[2]; Unterhalter, 2014[12]). When associated with a policy, indicators will influence how it is guided, perceived, and enacted (Gouëdard et al., 2020[13]; Viennet and Pont, 2017[14]).

In this paper, education indicators are considered as quantitative measures on the state of education systems, and can be used to understand policy efficiency and effectiveness in terms of resources invested and achieved objectives. This paper investigates how indicators

can support the implementation of education policies, and samples some international evidence while highlighting some of the perennial challenges associated with indicators' use. It is organised as follows: a first section maps the use of indicators against the OECD framework for education policy implementation. The following sections then review each of the three dimensions of the framework, and a final section details guidelines for developing indicators to support the implementation of education policies. This paper aims to provide insights to policy makers and various education stakeholders, to initiate a discussion on the use and misuse of indicators in education, and guide future actions towards a better contribution of indicators to education policy implementation.

2. The role of indicators in implementing an education policy

The OECD Implementing Education Policies framework (Figure 1) considers that three dimensions underpin a coherent implementation strategy, namely a smart policy design, an inclusive stakeholder engagement, and a conducive environment (OECD, 2020[8]). Along these dimensions, the allocation of responsibilities among stakeholders, their associated resources, and the timeline towards the realisation of objectives form the actionable part of the implementation strategy.

In this framework, indicators play a transversal role, as they contribute to each of the dimensions. As part of the policy design, indicators represent a tool that clarifies the vision and its objectives. They help outline the policy goals in specific terms and set priorities for development and implementation as they refine the abundance of available information to present key elements, either to support the policy rationale, or to act upon for policy effectiveness (Pintér, Swanson and Barr, 2006[15]; World Health Organization, 2002[16]).

Figure 1. OECD Implementing Education Policies framework
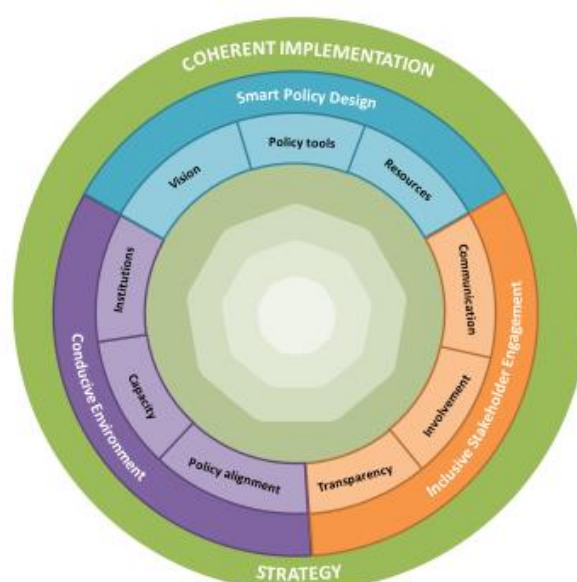
Source: OECD (2020[8]), "An implementation framework for effective change in schools", *OECD Education Policy Perspectives*, No. 9, https://dx.doi.org/10.1787/4fd4113f-en.

Indicators also contribute to stakeholder engagement, as they help monitor the use of resources, support stakeholders' accountability, and identify weak implementation areas that require further development. For instance, with recent research suggesting that data-based decision making can improve students' outcomes (McNaughton, Lai and Hsiao, 2012[17]; Poortman and Schildkamp, 2016[18]; van Geel et al., 2016[19]), some governments are expecting stakeholders to engage in a local data-driven approach to school improvement (e.g.: Denmark, Estonia, and the Netherlands). A simplified view of a complex array of information, indicators also play an important role in communication with the public and decision makers to describe the situation, or the progress made towards the achievement of the policy objectives. As such, indicators can raise awareness about specific challenges and garner public support in favour of a policy.

However, indicators' potential to support implementation by engaging stakeholders depends on the environment. The existence of a data culture and the capacity to use data strategically condition how much stakeholders make sense of indicators and their readiness to use them (OECD, 2019[20]). This is facilitated if there exists an integrated model of data use across levels of governance, if the indicator reporting strategy serves stakeholders' needs, and if the specific set of indicators has been defined in full alignment with the education policy it is meant to monitor progress on, rather than a convenient, or partisan, sample of cherry-picked available statistics. In other words, stakeholders are more likely to make sense of indicators if their strategy relies on a whole-of-system approach. Ideally, an indicator system details how individual indicators contribute to measuring an overall performance, according to an indicator framework that lays out the logical linkages between its various elements (International Institute for Education and Planning - UNESCO, 2021[21]; OECD, 1994[2]; OECD, 2020[22]).

In addition, the development of new technologies, automatising the collection and processing of large amounts of data, and the appeal of indicators, both as an efficient communication vector and a powerful policy tool, have favoured embedding indicators as a way of governance (Kauko and Varjo, 2008[23]). This has increasingly guided education policy, especially with the emergence of international initiatives to promote robust and internationally comparable indicators to steer efforts towards agreed priorities, such as the OECD Indicators of Education Systems (INES) programme initiated in 1988, the European Co-operation in Education and Training (ET 2020 framework) started in 2010, and the United Nations Sustainable Development Goals launched in 2015. As a consequence, the alignment of the education monitoring system, which includes a set of indicators to monitor a country's education strategy, and in particular of its education management information system, which produces and manages education data and information, with the objectives of the new policy and associated indicators, will influence which data are available to stakeholders and how they can engage with the implementation process.

Box 1. OECD programme "Implementing Policies: Supporting Change in Education"

The OECD's Implementing Education Policies (IEP) programme offers peer learning and tailored support for countries and jurisdictions to help them achieve success in the implementation of their education policies and reforms. It consists of three complementary strands of work that target countries' and jurisdictions' needs to introduce policy reforms and impactful changes:

- Policy assessments take stock of the selected policy and change strategy, analyse strengths and challenges and provide concrete recommendations for enhancing and ensuring effective implementation;

- Strategic advice is provided to education stakeholders and tailored to the needs of countries and jurisdictions. It can consist of reviewing policy documents (e.g. white papers or action plans), contributing to meetings, or facilitating the development of tools that support the implementation of specific policies;

- Implementation seminars can be organised to bring together education stakeholders involved in the reform or change process, for them to discuss, engage and shape the development of policies and implementation strategies.

Website: http://www.oecd.org/education/implementing-policies/
Brochure: http://www.oecd.org/education/implementing-education-policies-flyer.pdf

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3. Integrating indicators to the policy design

Indicators can represent the tangible part of a policy vision as they translate policy goals into measurable components that help track progress against its accomplishment. Defining a clear indicator system supports the monitoring of objectives' achievement and the identification of priorities for development. There exists a number of indicator frameworks that can help policy makers build an indicator strategy, but the selection of indicators must be well aligned to policy objectives to avoid "goal displacement".

3.1. Defining indicators associated with the policy vision

For effective policy implementation, Barber (2008[24]) highlights the need to set clear objectives, and associated targets, defined as objectives tied to figures. The definition of relevant indicators, aligned with the education targets or challenges to address, and the identification of key indicators help monitor the achievement of objectives and signal priorities for development.

As laid out in the Education at a Glance organising framework, indicators can be sorted into three categories: input, process, and output indicators (OECD, 2020[22]). In the next section, the OECD INES programme, the UN Agenda 2030 for Sustainable Development, and the European Co-operation in Education and Training (ET 2020 framework) from the European Commission are presented. These international indicator frameworks all offer a mix of the different sorts of indicators. They can guide or inspire policy makers when they define the indicators associated with the policy vision, according to their potential for contributing to policy implementation illustrated below.

On the one hand, input indicators relate to resources invested in the system, including financial, human (such as teachers and other school staff), or physical resources (such as buildings and infrastructure). They also account for policy choices, such as the instructional setting of classrooms, pedagogical content and delivery of the curriculum, and the organisation of schools and education systems, including governance arrangements and autonomy levels.

On the other hand, output, outcomes and impact indicators describe the production of the education system or the results of policies, initiatives, practices etc. Output indicators analyse the characteristics of those leaving the system. In the case of students, this may be their educational attainment or performance in national assessments. Outcome indicators describe the direct effects of the education outputs, such as the employment and earning benefits of pursuing higher education. Impact indicators analyse the long-term indirect effects of the outcomes, such as the contributions to economic growth, social cohesion, and aggregate well-being.

In between lie the process indicators. The process corresponds to what transforms the inputs into outputs. Process indicators measure the participation of actors in the process, and how inputs are used to produce outputs. These indicators include for instance the share of students accessing, enrolling in and completing different levels of education, or the participation of teachers in professional development and the pedagogical practices at the school level.

With the new public management paradigm, a shift has progressively occurred from input to output control, output indicators being at the core of indicators use. An initial allocation of resources is established according to an expected output, and the result must justify the

expense (OECD, 1994[2]; Tolofari, 2005[25]). However, the organising framework used in Education at a Glance (Figure 2) advocates that an indicator system should cover all components of the framework (input, process, output) for a holistic approach to a specific theme or policy. In particular, process indicators may inform how stakeholders adopt change according to a new policy. While input and output indicators shed light on the efficiency and the effectiveness of a policy, process indicators describe the performance of the processes that contribute to the achievement of outcomes. They help understand the effects, or the absence of effects, of a new policy, and provide insights on areas for making adjustments and improving the policy outcomes.

Applied to the OECD's policy implementation framework, these three categories of indicators can also support the deployment of a new policy, with input indicators signalling, for instance, available resources or policy levers, process indicators measuring stakeholders' engagement, and output indicators assessing effectiveness/success of the implementation strategy.

Education policy has been increasingly guided by what can be measured, namely indicators (Kauko and Varjo, 2008[23]), and the emphasis on output indicators has attracted some criticism as it may promote a narrower vision of education (OECD, 2013[7]). Foley et al. (2008[26]) reported that most of the education systems analysed in the United States focus on student-performance data, and neglect more process-oriented indicators of performance. They report that the most widely accepted and used indicators in education are standardised-test scores. Measured at the end of the year, these lagging indicators confirm trends, and arrive too late for taking remedy action (Box 2). Hattie (1990[27]) noted that performance indicators should not become more prominent than the desirable outcomes they aim to proxy, or they would divert attention and resources from what really matters. More precisely, opponents to performance indicators fear that using indicators to assess schools and teachers may distort practices within the school system, such as encouraging teaching to the test and focusing on a limited number of competencies that are measured by these tests (Burns and Köster, 2016[28]). In that sense, Hopfenbeck et al. (2017[29]) documented a nascent literature on the potential influence of the Programme for International Student Assessment (PISA) on national curricula and assessment methods.

There lies the perennial challenge of defining indicators. A summary of information, indicators only represent a truncated version of reality and, as such, risk to provide stakeholders and organisations with the wrong incentives, inducing undesired consequences. A balance must therefore be found to ensure indicators bring clarity about a complex array of information without producing perverse effects. To do so, the indicators associated with a policy should cover a mix of input, process, and output, while reflecting the breadth and depth of the policy objectives.

Box 2. Leading indicators for education

Indicators, such as national assessments administered at the end of the year, help depict the landscape of education at a specific point in time. They are called "lagging indicators" because they confirm trends, but do not inform in real time of the types of practices, people, strategies, materials, or technologies currently in use, and how to act upon them to improve education outcomes.

On the other hand, Foley et al (2008[26]) define "leading indicators" as conveying information that may predict future performance. Leading indicators are helpful to assess progress made towards goals, and make mid-course correction. For instance, in a

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context of a national programme of drop-out prevention, information on student attendance and teachers organising specific prevention modules helps school officials monitor early signs of student disengagement and adjust the strategy if required.

A leading indicator has three main characteristics:

- **Timely and actionable**: the indicator is reported early enough to allow for mid-course correction;

- **Benchmarked**: stakeholders understand the value of the indicator as it has already demonstrated impact on success;

- **Powerful**: the indicator shows progress, or the absence thereof, towards targets identified as necessary for the realisation of the outcome.

In a review of the practices of nine State Education Agencies (SEAs) in the United States, the Reform Support Network (2015[30]) analysed how SEAs collect and use leading indicators to drive school improvement. They find that states collect similar leading indicators to track progress and monitor the quality of intervention in schools, but have demonstrated various levels of rigour and consistency in establishing monitoring routines. In other words, selecting leading indicators is only one part of the puzzle. The SEAs that capitalised the most on leading indicators had also defined strong routines for data analysis, planning and accountability that feed into a continuous process of school improvement.

3.2. Existing international indicator frameworks

A number of international indicator systems and frameworks already exist and can guide or inspire policy makers when they define the indicators associated with the policy vision. They have been built co-operatively according to international interests and agreed priorities in education. The OECD proposes a full system of education indicators according to a well-defined organising framework, while the UNESCO and the European Commission only propose a list of indicators on specific topics.

At the OECD, the Indicators of Education Systems (INES) programme publishes yearly *Education at a Glance*, a rich, comparable and up-to-date array of indicators that reflect a consensus among professionals on how to measure the current state of education internationally. It allows comparison of education systems between countries, and across time. Indicators are sorted into four broad categories: i) output and outcomes of education, ii) access, participation and progress in education, iii) resources invested in education, and iv) teaching workforce and learning environment.

These categories correspond to a versatile framework (Figure 2) that can be used to understand the operation and functioning of any educational entity, from an education system as a whole to a specific level of education or programme. The framework uses an input-process-output model that recognises the various factors that influence a policy's outcome, identifies the actors responsible for each, and examines the contextual demographic, socio-economic and political factors that may influence the implementation of an education policy. For a given issue, it helps identify all related indicators at different institutional levels and the involved stakeholders.

Figure 2. OECD organising framework of indicators in Education at a Glance
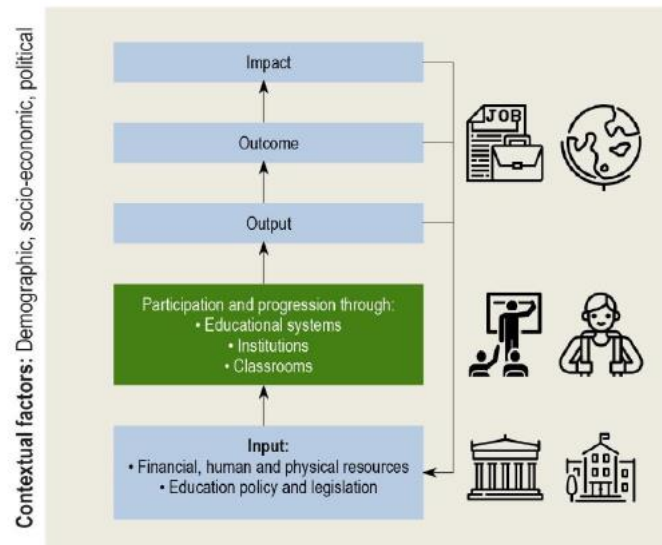
Source: OECD (2020[22]) *Education at a Glance 2020: OECD Indicators*, https://dx.doi.org/10.1787/69096873-en.

In its Agenda 2030 for Sustainable Development, the UN General Assembly has established 17 Strategic Development Goals (SDG) to stimulate and guide action in identified areas of critical importance for humanity and the planet (UN, 2015[31]). The SDG 4, "Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all", details ten targets to achieve the goal, each of them underpinned by a number of indicators that can be monitored. In total, around 200 indicators will encourage accountability and collaboration, identify areas requiring specific support, and provide information to sustain the reform agenda. For instance, to monitor the achievement of target 4.4, "By 2030, substantially increase the number of youth and adults who have relevant skills, including technical and vocational skills, for employment, decent jobs and entrepreneurship", three indicators have been selected:

- Percentage of youth and adults with information and communication technology skills;

- Percentage of youth and adults who have achieved at least a minimum level of proficiency in digital literacy skill;

- Youth and adults educational attainment rate (UNESCO, 2021[32]).

The European Co-operation in Education and Training (ET 2020 framework) is a forum for peer learning and best practice exchange among member states. It supports the achievement of common EU objectives including fostering lifelong learning, improving the quality and efficiency of education and training, promoting equity and social cohesion, and enhancing creativity and innovation. These objectives are pursued through the attainment of specific benchmarks at the European level such as:

- at least 95% of children should participate in early childhood education;

- fewer than 15% of 15-year-olds should be under-skilled in Reading, Mathematics and Science;

- the rate of early leavers from education and training aged 18-24 should be below 10% (European Commission, 2021[33]).

The yearly publication *Education and Training Monitor* reports on the achievement of objectives and benchmarks, and guides future resource allocation by feeding back into the EU long-term budget elaboration (European Commission, 2020[34]).

3.3. Measuring what matters

The definition of indicators to support the implementation of an education policy can be considered as a way to provide incentives to gear efforts towards the achievement of a specific objective. This is an attempt to solve the classic principal-agent problem, which occurs when an "agent" is able to take decisions on behalf of another agent, the "principal", while having diverging interests and different information. Various mechanisms exist to align the interests of the agent with those of the principal, such as performance management systems that aim to monitor the agent's efforts to work towards the principal's objective. However, researchers have documented how such systems may fall short of providing the right incentives. This happens when performance management systems fail to capture accurately the agent's contribution to all the objectives that are part of its mandate (Heinrich and Marschke, 2010[35]).

According to Lavertu (2015[36]), two reasons are usually invoked to explain this limitation of performance management systems. First, the difficulty to identify all the different contributions of the agent to the principal's objective may prevent the agent from engaging in desirable, but unrecognised, activities. This was discussed in the previous section ("Defining indicators associated with the policy vision"), with the need to adopt a well-balanced mix of indicators to reflect the richness of the policy vision. Second, the failure to measure performance adequately may lead to goal displacement, where the incentives are skewed towards the "visible", or measured, activities. The focus therefore shifts from the original objectives, to the goals for which there already exist data.

To avoid goal displacement, Schildkamp (2019[6]) has designed a model where "goal setting" precedes any "data collection". This follows what has been coined in the public debate as the popular idiom "Don't value what you measure, measure what you value". Existing indicators may be convenient, but they potentially capture what is easier to measure, or proxy a different outcome, which in turn may provide the wrong incentives to education stakeholders. The definition of new tailor-made indicators, following the SMART criteria for instance (Box 3), is sometimes required to ensure the selected indicators adequately serve the policy purpose.

Against this backdrop, the indicator frameworks listed in the previous section ("Defining indicators associated with the policy vision") must be considered carefully. In particular, they may not be detailed enough to inform precisely on the implementation of a policy, or only be loosely relevant to stakeholders expected to monitor and use them to inform decision making (section "Indicators to guide decision making"). Such high-level indicator frameworks constitute a starting point, but should not be substituted for indicators more tailored to the specific needs of a policy.

In addition, whether borrowing an indicator from an existing framework, or defining a new one, the input-process-output organising framework advocates for building a logical system, where different indicators contribute to producing an overall understanding of the different levers that may influence the achievement of desired outcomes. When defining the indicators associated with a new policy, it is therefore important to analyse how they are integrated into the existing indicator framework to ensure coherence.

Box 3. The SMART indicator criteria

A large literature has been dedicated to define the characteristics of a "good" indicator. Agencies and ministries generally use a checklist of criteria, such as the SMART criteria that has been accepted as one of the best practices in the field of monitoring and evaluation. SMART is an acronym that refers to the following desirable properties for an indicator:

- **Specific**: The indicator can be translated into specific terms associated with an intervention. For instance, it can provide information on the actors, the purpose, the location, and the modalities of a given intervention (the "who, what, where, and how"). The data collected is specific to the achievement of a particular objective;

- **Measurable**: The indicator can be observed, counted, analysed. The methodology to compute the indicator is transparent and can be challenged;

- **Attributable and Achievable**: The indicator is attributable to an intervention if it varies as a result of the intervention. It is achievable if the established performance target to achieve the outcome is realistic;

- **Relevant**: The indicator is relevant if there is evidence that it is linked to the desired result;

- **Time-Bound, Timely, Trackable, and Targeted**: For a set period, the indicator is tracked in a cost-effective manner at a frequency that allows to monitor progress, and targeting the stakeholder groups directly impacted by a given intervention.

Source: Bureau Of Educational And Cultural Affairs, US (2021[37]), *A good start with S.M.A.R.T. (indicators)*, https://eca.state.gov/files/bureau/a_good_start_with_smart.pdf [accessed on 17 September 2021].

3.4. Country case study: the Estonian indicator system to support the national education strategy

In 2014, Estonia published the Estonian Lifelong Learning Strategy 2020 (LLS), a guiding document for the development of education policy for the period 2014-20. The LLS is aligned to the National Reform Programme "Estonia 2020" and the Estonian national strategy for sustainable development ("Sustainable Estonia 21"). Five strategic goals were established in the LLS:

- Change in the approach to learning: Implementation of an approach to learning that supports each learner's individual and social development, the acquisition of learning skills, creativity and entrepreneurship at all levels and in all types of education;

- Competent and motivated teachers and school leadership: The compensation of teachers and school leaders including their salaries are consistent with the qualification requirements for the job and the work-related performance;

- Alignment of lifelong learning opportunities with the needs of the labour market: Lifelong learning opportunities and career services that are diverse, flexible and of good quality, resulting in an increase in the number of people with professional or

vocational qualifications in different age groups, and an increase in the overall participation in lifelong learning across Estonia;

- A digital focus in lifelong learning: Modern digital technology is used for learning and teaching effectively and efficiently. An improvement in the digital skills of the total population has been achieved and access to the new generation of digital infrastructure is ensured;

- Equal opportunities and increased participation in lifelong learning: All individuals are granted equal opportunities to participate in lifelong learning (Estonian Ministry of Education and Research, 2015[38]).

The Estonian LLS identifies a list of indicators to monitor the achievement of the five strategic goals by 2020 (Table 1). This methodology is similar to the one adopted by the European Commission for the Education and Training 2020 framework, where the achievement of the four common EU objectives (fostering lifelong learning, improving the quality and efficiency of education and training, promoting equity and social cohesion, and enhancing creativity and innovation) is supported by the monitoring of specific indicators.

The strategy was comprehensive and included indicators at all levels of education and across several different areas to account for the diversity of objectives. However, most of the indicators are markedly output or outcome oriented. While this provides information on the final performance of education systems, it says little about the conditions that have led to this result. This is for instance obvious in the first strategic goal 1 "Change in the approach to learning", which aims to gear Estonian education towards 21st century requirements by implementing the change introduced in the last curriculum revision. Proposed actions include change of assessment practices, the development of in-service education and training for heads of schools, or the promotion of co-operation among stakeholders. Yet, indicators for this strategic goal focus on the share of low achievers and drop-outs, leaving various inputs (e.g.: characteristics of the learning environment, provision of continuous professional development for teachers) and processes (e.g.: teacher's capacity to design new assessments, teacher's enrolment in professional development) undocumented.

With the LLS coming to an end, the Ministry of Education and Reserch (MoER) started preparing a new strategy towards 2035. Three broad-based expert groups (values and responsibility group, welfare and cohesion group, and competitiveness group) were tasked with developing a joint vision on issues that can be influenced by the MoER's four areas of responsibility: education, research, language and youth policy. The resulting vision is centred on the following targets for Estonian future development: happy learner, inclusive society of welfare and shared values, competitive and sustainably growing economy, and a viable and strong Estonian culture and language. To achieve this four-sided vision, three operational goals were formulated:

- Learning opportunities are diverse and accessible, and the education system enables smooth transitions between different levels and types of education;

- The approach to learning and teaching is learner-focused, forward-looking and helps learners to succeed in life;

- Learning options are responsive to labour market needs (Estonian Ministry of Education and Research, 2019[39]).

These strategic goals are supported by a set of indicators still currently under development. The OECD, as part of its Implementing Education Policies Programme, provided strategic advice on an earlier version of the set of indicators in 2020, according to an INES indicator

review framework (Box 4). The final version of the set of indicators supporting the Education 2035 Strategy, promoting school improvement and informing national and local decision making will be released at the end of 2021.

Box 4. OECD review framework for indicators

The OECD uses the following framework to assess the quality of indicators in education, which embeds the SMART indicator criteria (Box 3):

- **Description:** the indicator is described in a precise way, and does not need to be refined to be understandable;

- **Purpose/relation to strategic goals**: the indicator is well aligned to objectives and goal specific. It helps monitor progress towards the achievement of objectives;

- **Definitions and scope**: the terms used to define the indicators are clear and the scope of the indicator well-established to ensure the robustness of results;

- **Calculation methodology**: the calculation methodology is transparent and results are comparable and reliable;

- **Monitoring level (school/region/national):** the indicator is computed at a level coherent with its associated objectives;

- **Data availability and breakdown**: the data sources for computing the indicator are identified, and the opportunities for breakdowns (e.g.: gender, socio-economic background, immigration status) are explored;

- **Frequency and coverage**: the indicator can be updated at a frequency relevant for the achievement of its associated objectives (depends on the data publication cycle) and an adequate coverage of the targeted population is ensured;

- **Interpretations/limitations**: The interpretation of the indicator is straightforward, or there exist clear guidelines that highlight its limitations to minimise misinterpretation.

The purpose of this framework is to ensure indicators are designed properly, and depict a dynamic rather than static view of the education landscape and progress made towards objectives. Well-designed indicators constitute a solid basis for establishing claims about the effectiveness of policies and practices, and should result in more timely and actionable feedback for multiple stakeholders in education.

Source: OECD (Forthcoming[40]), "Enhancing data informed strategic governance in education in Estonia", OECD Education Policy Perspectives, OECD Publishing, Paris, https://doi.org/10.1787/5cc2d673-en

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Table 1. Education targets established by the Lifelong Learning Strategy 2020, Estonia

Indicator	Target level 2020 (%)	Starting level (2012) (%)
Key indicators		
Participation rate in lifelong learning among adults (percentage of 25-64 year-olds who stated that they received education or training in the four weeks preceding survey	20	12.9
Percentage of adults (25-64) with general education only (no professional or vocational education)	≤ 25	30.3
Early school leavers (percentage of the population aged 18-24 with at most lower-secondary education and not in education)	< 9	10.5
Top achievers in basic skills in: Reading	10	8.4
Mathematics	16	14.6
Science	14.4	12.8
Employment rate of recent graduates (20-34 year-old graduates; one to three years after leaving education)	At least 82	73.9
Digital competencies (individuals aged 16-74 with computer skills)	80	65
Comparative general education teachers' salaries (ratio of teachers' salaries to earnings for full-time, full-year workers with tertiary education aged 25-64)	≥ 1.0	0.84 (2011)
Stakeholders' satisfaction with lifelong learning	Satisfaction has increased	--
I – Change in the approach to learning		
Low achievers in basic skills in: Reading	7.5	9.1
Mathematics	8	10.5
Science	5	5.0
Drop-out rate from lower-secondary compulsory education	< 1	0.6
Drop-out rate from: Vocational schools	< 20	25.8
General upper-secondary education	< 0.8	1.1
Higher education institutions	< 15	21.3 (2011)
II – Competent and motivated teachers and school leadership		
Percentage share of teachers who are aged 30 or below	> 12.5	10.3
Competition for study places in teacher education	Competition has increased	--
Gender distribution of teachers in general education (female:male)	75:25	85.7:14.3
III – Alignment of lifelong learning opportunities with the needs of the labour market		
Share of tertiary graduates in Mathematics, Science and Technology as a percentage of all tertiary graduates	25	22
Share of basic education graduates who passed the career counselling	100	
Share of basic education graduates who continue their studies in vocational upper-secondary education	35	28.6
Percentage distribution of upper-secondary students by orientation – general:vocational	6040	6733
Student mobility	10	3.5
IV – Digital focus in lifelong learning		
Share of students (ISCED 1-6) who use computers, digital and mobile personal devices for studies every school day	100	
Share of Year 8 students at digitally supportive schools	100	33
Share of Year 8 students in schools with a virtual learning environment	100	54
Share of basic education graduates whose ICT basic skills are assessed and certified	100	
V – Equal opportunities and increased participation in lifelong learning		
Tertiary education attainment, age group 30-34	40	39.1
Participants in early education (aged between 4 and compulsory starting age)	95	89.1 (2011)
Share of Russian-language school graduates who master the Estonian language at B1 level	90	56.5
Share of labour costs of governmental education expenditures	60	55 (2011)
Share of teachers' labour costs of governmental expenditures on general education	50	38 (2011)
Optimisation of the use of space in educational institutions (m²)	3 million	3.5 million

Source: Estonian Ministry of Education and Research (2014[41]), *The Estonian Lifelong Learning Strategy 2020*.

4. Engaging stakeholders to use indicators

With new public management, indicator use has risen to strengthen accountability of education institutions towards student outcomes, and increase transparency to guide school choice and monitor education institutions. However, indicators also serve a developmental purpose, by guiding school-improvement processes and policy making.

In terms of policy implementation, the role of indicators is similar: it strengthens accountability through monitoring of target achievement, it increases transparency on the resources involved and accountability relationships, and more importantly, it provides adequate information to inform stakeholders' decision making and adjustments to the implementation process. The development of indicators, and the communication of their role and importance, is therefore a way to engage stakeholders towards specific objectives and support the implementation of a policy reform.

4.1. Indicators as a control mechanism: accountability, evaluation, and transparency

According to Osborne, (2006[42]), seven doctrines constitute new public management:

- a shift from bureaucratic administration to entrepreneurial management of public services;

- the assumption that private sector styles of management are superior;

- the disaggregation and decentralisation of public services;

- the promotion of competition in the provision of public services;

- an emphasis on output controls;

- the definition of explicit standards and measures of performance; and

- the promotion of discipline and parsimony in resource allocation.

In education, the new public management agenda was seen as a way to introduce incentives to challenge an inert and inefficient bureaucracy, and align the objectives of education professionals with delivering effective education. Partisans of the paradigm advocated for competition, choice, efficiency and accountability, which led policy makers to introduce reforms such as outcomes-based accountability, school choice, and merit pay schemes (Fusarelli and Johnson, 2004[43]).

This shift from administering to managing education is associated with a devolution of competence from central and local authorities to schools. By entrusting schools with planning, budgeting and resource allocation, policy makers undercut the traditional role of the administration, and expect that market forces and competition will sustain education quality. Various instruments such as school external evaluations and performance indicators would additionally contribute to hold school principals and teachers accountable for quality (Tolofari, 2005[25]).

Against this background, the development of indicators has risen in importance, with an emphasis on student outcomes as measured with national standardised assessments (OECD, 2013[7]), following the new public management logic of output control. For instance in Norway, a set of indicators contributes to identify the schools struggling to maintain education quality so they can be offered the support of an Advisory Team (Box 5).

Accrued concerns over resource limitations and public spending also led to the development of indicators to seek better value for money and systematically evaluate the impact of interventions, develop the accountability of education institutions towards student outcomes, and increase the transparency to guide school choice and monitoring of education institutions (Hazelkorn, 2018[44]; Kuh, 2007[45]). For instance, some research indicates that the Alberta Initiative for School Improvement (AISI), an approach to improving student learning with collaborative innovations within the school community, came to an end after roughly ten years due to the inability of the initiative to develop large-scale indicators monitoring student achievement and justifying public spending (Alberta Initiative for School Improvement, 2008[46]).

This development of indicators similarly serves the purpose of implementation. According to Barber (2008[24]) and the OECD (2020[8]), effective implementation requires a clear identification of relevant stakeholders, a precise distribution of responsibilities, and an agreed definition of accountability relationships. The development of indicators strengthens accountability among different actors, as it defines a metric allowing for comparison, and facilitates the monitoring of target achievement. In addition, the definition of indicators at different levels (classroom, school, local and central authorities etc.) following an organisation framework such as the one considered in Education at a Glance (Figure 2) can help communicate who will be held responsible, from the frontline to the ministerial level.

The emerging culture of public policy evaluation has supported the development of indicators and specific methodologies to identify and evaluate the impact of policy interventions, and the efficiency of public spending (OECD, 2013[7]). In the case of pilot studies, or phased-in implementation, such early-on impact evaluation can enrich the evidence base, contribute to justify a public intervention, and highlight potential shortcomings to elaborate compensatory strategies (OECD, 2020[8]).

Furthermore, indicators can contribute to transparency. On one hand, and along the lines of the aforementioned accountability dimension, indicators can help clarify task allocation for the policy implementation process. The definition of operational targets can guide implementation management as the reform unrolls on the ground, and enables the multiple stakeholders involved in the process to track their own and others' progress throughout the implementation period. On the other hand, indicators can inform on the resources dedicated to the policy and the on-going processes conditioning the implementation. Such input and process indicators shed light on the political commitment to a certain policy, and moderate accountability relationships, as outcomes are partly determined by inputs and processes.

Box 5. The follow-up scheme in Norway

In 2017, the Norwegian Directorate for Education and Training (the Directorate) launched a new competence development model to foster collaborative professionalism in schools and increase education quality. This model includes a "follow-up scheme", a safety net for municipalities reporting weak results, and a counterweight for decentralised professional development that can increase inequalities.

The Directorate has selected the different indicators that set the lower bound of quality in education and condition participation in the follow-up scheme. A set of 11 indicators defines a risk percentage to detect municipalities lagging behind in terms of education.

It considers three main areas:

- learning outcomes (one indicator): at the end of lower-secondary, students get a diploma with grades in specific fields – Norwegian, English, Maths etc. – that are averaged to give an overall indicator of learning outcomes;

- national testing (four indicators): the share of students at the lowest level in reading and numeracy in 5th and 8th Grade;

- learning environment (six indicators): the national Pupil Survey provides information on bullying, students' motivation, and perceived support from teachers in Grades 7 and 10.

The Directorate reviews these 11 indicators at the school level over the last three years, and aggregates them at the municipality level to calculate a municipality average. It then computes a municipality risk score by attributing one point if the municipality's indicator is below the national average, and three points if the municipality's indicator is below a specific threshold of quality. Municipalities with the highest risk score are offered support. Since 2020, the Directorate completes this assessment with a measure of dispersion: municipalities with the higher spread in risk scores between schools, and at least one school in the lowest risk score quartile, are also offered support.

Sources: OECD (2020[47]), "Improving school quality in Norway 2020 : Progress with the Competence Development Model", *OECD Education Policy Perspectives*, No. 8, https://dx.doi.org/10.1787/98600316-en.

OECD (2019[48]), *Improving School Quality in Norway: The New Competence Development Model*, Implementing Education Policies, https://dx.doi.org/10.1787/179d4ded-en.

4.2. Indicators to guide decision making

The recent transition from new public management to new public governance, as the latest form of public administration, may have shifted the role of indicators in public governance. While new public management is rooted in public choice theory and management studies, new public governance builds upon organisational sociology and network theory. It acknowledges the fragmentation of governing systems, and places trust and relational contracts at the heart of governance mechanisms (Osborne, 2006[42]).

In fragmented contexts, the development of indicators, particularly performance indicators according to the new public management paradigm, has contributed to steering the public system (Burns and Köster, 2016[28]). However, research has increasingly documented that data and indicators should not only be used for compliance and accountability, but inform continuous improvement (Mandinach, 2012[49]; OECD, 2013[7]). This shift in paradigm progressively gained traction in in the 1980s, when education monitoring systems started using data not only for compliance purposes only, but also as a performance tool (Richards, 1988[50]). Most countries have developed comprehensive indicator systems, presenting education indicators along with demographic, administrative and contextual data collected from individual schools (OECD, 2013[7]), which have increasingly guided future development of education systems by feeding into evidence-informed policy-making processes (OECD, 2020[4]).

In effect, beyond their role in accountability and transparency, indicators can guide the implementation process if they are delivered in a timely manner (Box 2). More frequent data might support a more formative use of indicators, and with indicators informing on progress made by different stakeholders, it is possible to identify the specific dimensions of the implementation process that may be lagging behind, and to follow-up with specific

groups of stakeholders. Depending on their frequency, indicators can therefore help monitor the implementation process, and provide continuous feedback to diagnose potential barriers to the achievement of implementation objectives and fine-tune the implementation strategy accordingly.

The role of indicators for guiding school development is at the heart of the data-based decision-making literature. According to Ikemoto and Marsh (2007, p. 108[51]), data-based decision making refers to "teachers, principals, and administrators systematically collecting and analysing data to guide a range of decisions to help improve the success of students and schools", and a growing corpus documents its role for improving students' outcomes (McNaughton, Lai and Hsiao, 2012[17]; Poortman and Schildkamp, 2016[18]; van Geel et al., 2016[19]). In other words, data-based decision making requires stakeholders to become actors, to overcome a passive relationship with indicators based on compliance and accountability.

Decisions based on data and indicator use are diverse. At the school level, it involves, among others, for teachers to analyse data to inform the setting of learning goals, to adapt instruction, and provide adequate feedback. In addition, school leaders can use data for optimising time allocation, budget arrangements, and staffing decisions according to the level of school autonomy (Lai and Schildkamp, 2012[52]). At the local and central levels, data-based decision making implies that boards of education, school owners, local and regional authorities etc., systematically use data to assess the effectiveness and efficiency of education policies, with a particular focus on student performance (Ikemoto and Marsh, 2007[51]).

The engagement of stakeholders during the implementation process will depend on their capacity to analyse data and indicators (section "Stakeholders' capacity to use indicators and to inform their practice"), but also on the relevance of the indicators proposed. Indicators can be developed at the school level, and hence directly fit local needs, but must also follow central guidelines as part of a monitoring strategy. For instance, if indicators are only defined to be monitored at national and regional level, little engagement from local actors is to be expected. On the other hand, if the monitoring strategy also includes indicators commonly used to monitor performance at school level, teachers, school leaders, and local authorities are more likely to engage, create meaning around national indicators from a school perspective, and ultimately take action according to the objectives of the strategy.

The definition of indicators relevant to stakeholders when developing a new policy therefore represents a further opportunity in terms of implementation. Such indicators may contribute to achieving the policy's objectives as they are more likely to be embedded in school practices and improvement processes. Several ways exist to ensure the relevance of indicators, such as organising stakeholders' consultation on the selection and prioritisation of indicators, channelling feedback to understand if existing data represents adequately the reality ("ground-truthing"), and co-shaping an indicator strategy with a diverse selection of indicators (UN ESCAP, 2018[53]; USAID, 2021[54]).

4.3. Indicators as a communication tool

Indicators play an important communication role with the public and decision makers. International indicator frameworks such as the United Nations SDG or the European Co-operation in Education and Training (ET 2020 framework) provide clear indicators and associated targets, to shape the global education agenda and gear efforts in the same direction. By definition, indicators simplify a complex array of information and describe succinctly the situation, which can help a wide range of stakeholders understand the scope

of a particular issue and the diversity of elements – such as inputs, processes, outputs, context and actors – involved.

As such, indicators can raise awareness about specific challenges and garner public support in favour of a policy. Developing an effective communication strategy prepares the ground for stakeholder engagement, and including indicators contributes to developing sense-making and ownership among stakeholders: it allows them to monitor the progress made towards the achievement of policy objectives, and potentially to adapt their actions accordingly (OECD, 2020[8]).

However, communicating effectively means tailoring the content of the communication strategy to the needs of various stakeholders, as the public disclosure of some education data may have undesirable effects. For instance, the controversial publication of raw school performance in "league tables" or "report cards" has generated an extensive academic literature. Critiques consider that these reports reduce a holistic developmental process to a technical accounting exercise, mislead people to believe performance is institutional while not reflecting on school external attributes such as students' social background, and damage durably lower-performing schools (Power and Frandji, 2010[55]). Some researchers have therefore called for the development of an ethical code for the publication of performance data (Karsten, Visscher and De Jong, 2001[56]; Karsten et al., 2010[57]), and some countries (such as the Netherlands) restrict the access of specific data on school portals, which can limit unwarranted competition between schools. In terms of implementation, it means that the communicated, or available, indicators to stakeholders should be considered carefully in order to curb the improper use of public information and the potential damage it entails for schools.

Communicating strategically about indicators is also a way to create short-term, and objective, wins. In fact, failure to create such short-term wins is deemed a common error in reform endeavour (Barber, 2008[24]). The definition of smart/achievable targets allows on one hand to capitalise on quick wins, and to build momentum for sustaining reform efforts among stakeholders. More ambitious targets may be established and communicated in the mid-term, once initial implementation processes have been developed. On the other hand, it helps adjust a strategy that is not working quickly rather than letting it continue into the future. In that sense, it can also help create trust in government that the situation is being monitored.

Not all indicators are relevant nor appropriate to disseminate. The selection of key indicators, a subset of the most important ones, facilitates communication around indicators and maximises impact by providing clear and tangible information on objectives. In its Lifelong Learning Strategy 2020, Estonia had defined a set of key indicators (Table 1) to focus attention on specific issues. However, these key indicators are only loosely connected to the overall strategy, and it is not clear how they contribute to the achievement of the five strategic goals, which limits their potential for driving change.

Therefore, the selection of key indicators should be based on the existing indicator framework associated with the policy, and not from a stand-alone set of indicators. The final set of key indicators is the result of a trade-off between selectivity, where only the most important indicators are selected to facilitate communication, and inclusivity, as indicators over-simplify complex issues and adding more indicators helps contextualise. Data quality, robustness, and ease of interpretation are also important criteria to consider (Box 4), especially when communicating to the broad public. Building on an input-process-output framework, key indicators should inform on critical elements necessary for the achievement of the policy, but also potential bottlenecks or weak points that require close monitoring (European Training Foundation, 2020[58]; National Research Council, 2012[59]; USAID, 2021[54]).

4.4. Country case studies: accessing information in Denmark and Portugal

4.4.1. How the Danish Data Warehouse facilitates the access to education indicators

Despite the abundance and diversity of available data, Denmark has not developed an indicator framework as comprehensive as Estonia to monitor the achievement of the goals stated in its Education Act. The governance-by-data in Denmark relies more on transparency at the local level, with a school system based on trust, local autonomy and horizontal accountability (Nusche et al., 2016[60]). Rather than central steering, data are used in Denmark according to soft accountability mechanisms. They do not involve harsh sanctions, but feed into a learning-oriented follow-up, where dare are largely used for a constructive dialogue (Ministry of Children and Education, Denmark, 2020[61]).

The three national goals for the development of the Folkeskole (public primary and lower-secondary education in Denmark) are operationalised through a limited number of clear, simple and measurable targets:

- At least 80% of students must achieve "good" results at Reading and Mathematics in the national assessments. The baseline is the share of students achieving "good" or higher in the national assessments in 2012;

- The number of high-performing students in Danish and Mathematics must increase from year to year. The baseline is the percentage of students achieving the top mark in the national assessments in 2012;

- The number of low-performing students in Reading and Mathematics, independent of social background, must decrease from year to year. This target should focus on the percentage of students with parents with only compulsory or unknown education performing poorly in the national assessments;

- The well-being of students as measured by a national survey must increase. A national obligatory and robust indicator for well-being has been developed by the Danish Ministry of Education. The instrument is based on a survey conducted among the students on their well-being.

The Danish Government manages education statistics through the Danish Data Warehouse (Data Varehuset). Launched in 2014, it aimed initially to manage the information linked to primary education, and make it available to schools and municipalities to monitor quality (Ministry of Children and Education, Denmark, 2020[62]). It has progressively become the primary statistical tool for the Ministry. In 2015, it was expanded to secondary and vocational education, and now it also includes early childhood education and care, preparatory basic education and training, and adult education and continuing training. In addition, the Data Warehouse publishes yearly a written status report with key indicators on public schools. It forms the basis for the on-going dialogue between the government, the municipalities, and other stakeholders involved in public schools' development.

The Data Warehouse gives institutions, regions, municipalities and the public access to a number of pre-defined reports, graphs and interactive maps with statistical information (Table 2). In particular, a quality report is developed at the municipal level as a new management information tool. It is expected to serve as a base for a dialogue between the municipal council and the municipal administration, between the municipal administration and the school principals about quality development, and between school principals and teachers about students' academic development. The quality report also forms part of the base for the school boards' supervision of the schools' activities.

The Data Warehouse is thus an open dynamic analytical tool, presenting data at national, relevant geography (region/municipality) and at institution/school levels. As part of the Openness Initiative in 2016, the Data Warehouse was also progressively geared towards helping parents choosing a school. The latest developments include, for instance, interactive dashboards and maps supporting and informing parental choice (Ratner and Gad, 2018[63]). It also allows comparisons between institutions, and monitoring of developments over time (Ministry of Children and Education, Denmark, 2020[64]). This initiative, which links data to the country's educational goals, is also designed for school leaders, to compare their school performance to similar schools, identify strength and weaknesses, and take appropriate measures to sustain school improvement (Ferguson et al., 2016[65]).

Table 2. Composition of the Data Warehouse, Denmark

Indicators
Indicators pertaining to early childhood education and care
Staff: Children per staff ratios and educational level of staff
Children: number of children per institution
Institution: opening hours and lunch statistics
Indicators pertaining to primary education
Scores: grades in elementary school and averages, and grades for the socio-economic reference[1]
National tests: results from the compulsory national tests in Danish and Mathematics
Application and transition to secondary education: applications for 10th grade and secondary education, figures for educational readiness assessments, as well as transition rates for 10th grade and secondary education
Number of pupils: number of pupils in compulsory school, among others by type of school, grade level and municipality
Well-being: student well-being and general school well-being
Absenteeism: students' school absenteeism, due to absence of permission, illness, or illegal absenteeism
Teaching: scheduled teaching hours, proportion of teaching covered by teachers with the adequate teaching skills in the subjects
Staff and finance: number of employees, students-teacher ratio, proportion of staff working hours spent with students, and the cost of primary school per student
Indicators pertaining to secondary education
Scores: students' grades, and grades for the socio-economic reference
Application to upper-secondary education: enrolment in secondary education after 9th and 10th grade
Number of pupils: how many students start, finish, interrupt and complete upper-secondary education
Well-being: student well-being and general school well-being[2]
Students' fields of study and subjects: which subjects and levels do the students in the upper-secondary education programmes choose?
Staff: statistics on teaching hours such as the proportion of teachers' working hours spent in pupil interaction with a direct learning purpose
Indicators pertaining to vocational education
Application for vocational training: enrolment in secondary education after 9th and 10th grade
Internship statistics: information on the development of agreements, school internships and internships in total
Well-being: student well-being and general school well-being
Number of pupils: how many students start, finish, interrupt and complete vocational education
Business satisfaction: satisfaction of customer companies (i.e. the companies that have students in internship)
Turnover and transition statistics: data on completion, drop-out and socio-economic background in vocational education programmes at both national and institutional level
Time: data on average hours for the teacher-directed teaching on the basic courses of vocational education
Staff: statistics on teaching hours, such as the proportion of teachers' working hours spent on learning-related student interaction in vocational education
Employment rates: employment rates for vocational education graduates
Indicators pertaining to preparatory basic education and training
Absenteeism: student absenteeism due to general absence
Well-being: student well-being and general school well-being
Number of pupils: number of students per institution
Indicators pertaining to adult education and continuing training
Activity: general activity in adult vocational training programmes
Results: results of adult vocational training programmes
Course satisfaction: participant satisfaction scores with adult vocational training programmes
Announced and completed courses: course statistics for adult vocational training programmes
Staff: share of staff hours spent with students
Activity: general activity on further adult education and continuing training

Source: Ministry of Children and Education, Denmark (2020[64]), *Datavarehuset og databanken [Data Warehouse and Data Bank].*

4.4.2. *How the Portuguese web platform engages stakeholders to build trust*

As of 2016, Portugal replaced its previous education web portal by the InfoEscolas Portal (OECD, 2019[66]). This new public website offered by the Portuguese Ministry of Education shows statistical data about the students enrolled in public and private schools in continental Portugal. Besides aggregated data at the national level, InfoEscolas shows statistics for each individual district, municipality and school in a graphic interface for the general public, and in excel spreadsheets for specialists.

The InfoEscolas system is part of the Portuguese Ministry of Education's endeavour to integrate a previously fragmented education data infrastructure into a new centralised information system. By integrating all administrative information related to students (e.g. personal background, enrolment and transfers, attendance, assessments) on the same platform, InfoEscolas centralises student management operations, from pre-school to upper-secondary education, supporting the entire processes of enrolment, renewals and transfers of students and automating tasks such as certificate issuing. It strengthens the ability of the ministry to produce improved indicators and address policy questions by providing a complete view of student educational paths in a more granular and timely manner, building on the individual student and teacher identifiers of the national e-enrolment system introduced in 2010 (OECD, 2019[67]).

Besides increasing transparency, InfoEscolas aims to improve the technical quality of the statistical indicators released to the public, schools and decision makers. It completes the traditional school rankings released by the media based on simple averages of examination results, by displaying academic results taking into account the socio-economic background of the school, measuring students' relative progress between entering and leaving the school, or measuring the dispersion of results within the school among others (Baptista, 2020[68]).

In addition, the system seeks to improve the exchange of information from administrative bodies and schools to students and families. On one hand, the Ministry of Education receives data from all the schools and aims to provide statistical analysis and useful feedback to schools from a global perspective. For instance, this can allow schools to compare their performance with national and regional averages, or with schools with a similar socio-economic profile. On the other hand, the Ministry expects that engaging with schools in a data dialogue, supporting them in harnessing the power of data, and making part of the school statistics publicly available, will provide incentives for schools to invest in the data reporting process, and improve the overall data quality (Baptista, 2020[68]).

Prior to InfoEscolas, data collected and stored in the longitudinal database "Information System of the Ministry of Education" (MISI thereafter) did not inform school management. The earlier MISI information system collected data from independent school management systems and fed a separate database per school year. Despite containing very rich data at the individual and school levels, these data were hardly used to inform school decisions. Also, the system did not enable longitudinal linkages and suffered from poorly defined

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[1] The socio-economic reference is a statistically calculated expression on the basis of the school's student base. The calculation includes factors at the individual level such as gender, ethnic origin and parents' education and income - thus factors that the school does not directly influence. By comparing the socio-economic reference with the actual grades of the school, one can get a picture of whether the school's pupils have passed the final exams better, worse or on a par with pupils at national level with the same socio-economic background.

[2] The aggregate well-being indicators includes four different sub-indicators: "social well-being", "professional well-being", "support and inspiration" and "peace and order".

standards. Although data on teacher resources, student results and student enrolment was available, it was not currently possible for schools to compare their own data with indicators aggregated at the municipal, regional, or national level, or with schools presenting a similar socio-economic profile (OECD, 2019[67]).

InfoEscolas aims to overcome these limitations and encourage the use of data by a number of various stakeholders at all levels. It provides a platform, which hosts a wealth of data, for schools to benchmark each other, and allows teachers, parents and students to access comprehensive school-specific data. By increasing transparency, InfoEscolas also aims to build public trust among stakeholders and in the system, and to strengthen data-informed decision making (Baptista, 2020[68]).

5. Enabling the environment for the use of indicators

How indicators support implementation is conditioned by contextual factors. The alignment of the Education Monitoring System, in particular of its Education Management Information System, with the objectives of the policy and associated indicators, will influence which data are available to stakeholders and how they can engage with the implementation process. In addition, the drive for stakeholders to use indicators relies on the data culture, in other words how indicators are perceived/trusted/integrated into work routines, and on stakeholders' capacity to develop, interact with, and make sense of, data.

5.1. The Education Monitoring System and the importance of the Education Management Information System

According to an OECD framework for education system monitoring, indicators play a central role in system planning and performance monitoring (Figure 3). An Education Monitoring System (EMS) is a structured framework with four different components. First, setting educational "goals" implies to define an overarching framework for the selection of data and indicators. Second, an "indicator monitoring plan" details a comprehensive list of indicators to measure progress in achieving the goals, including the definitions and data needs. It also provides an assessment of the availability and quality of possible data sources, which will influence the selection, definitions, and methodology relative to the indicators. Third, the "tools" that can be included to support the EMS consist in national assessments that monitor performance regularly, and the Education Management Information System (EMIS), which is the data or IT related component of the EMS. Finally, the last component to consider is the purpose of the EMS, how it contributes to evidence-based policy making and public accountability (OECD, 2013[7]).

A key challenge in monitoring education systems is to develop indicators that permit a good understanding of how well an education system is achieving its objectives. While national goals are typically comprehensive and broad, monitoring systems may be rather limited in the information they can offer, as defining relevant indicators to the national education vision and objectives is a challenging exercise (section "Integrating indicators to the policy design"). In addition, the way this information is made available and relevant to a variety of stakeholders conditions their ability to act upon it and influence their engagement. In this sense, the EMIS plays a pivotal role not only for monitoring an education system, but also for supporting the implementation of an education policy.

The EMIS consists of "an institutional service unit producing, managing and disseminating educational data and information, usually within a national ministry or department of education", whose functions include "collecting, storing, integrating, processing, organising, outputting, and marketing educational data and statistics in a timely and reliable fashion". The EMIS builds on a set of operational processes and co-operative agreements to ensure that data and information are regularly shared, analysed, and disseminated to guide decision making at various administrative levels. It also requires an institutional culture that continuously advocates for data and information use, which is conditioned by organisational arrangements (Hua and Herstein, 2003, pp. 4-5[69]). By providing timely and reliable data for education planning and management, EMIS have been increasingly considered as a means to improve accountability and meet more stringent requirements in terms of transparency (Powell, 2006[70]).

Figure 3. OECD framework for system monitoring
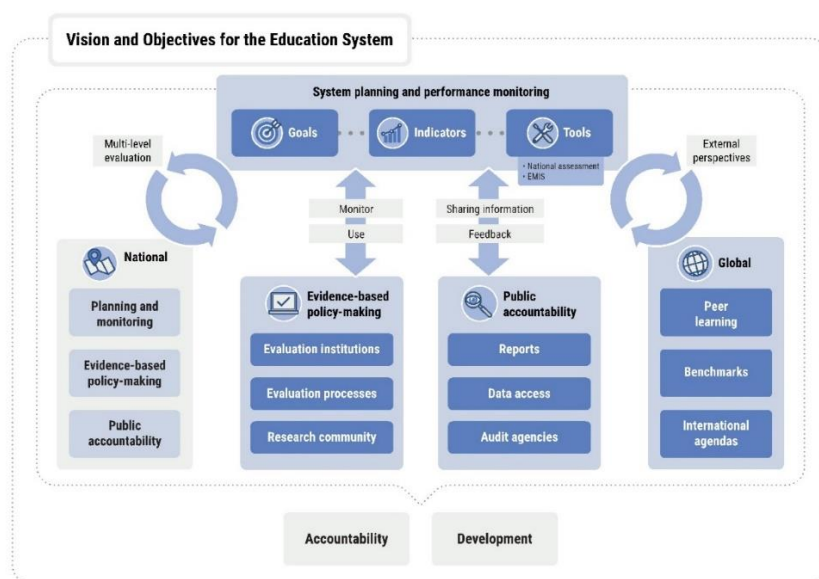
Source: OECD (2019[71]) *OECD Reviews of Evaluation and Assessment in Education: North Macedonia*, OECD Reviews of Evaluation and Assessment in Education, https://doi.org/10.1787/079fe34c-en.

As such, an EMIS represents a suitable tool to support the implementation of an education policy. On one hand, as information flows multi-laterally between central and local levels, and across administrative units, an EMIS has the potential not only to improve decision making, but also to engage stakeholders both as data producers and users (UNICEF and UIS, 2016[72]). On the other hand, EMISs have been initially developed in many countries at the sub-national level, to evaluate local school systems (OECD, 2013[7]). They allow to monitor progress with policy indicators, which help assess and fine-tune the implementation strategy based on statistical evidence.

Yet, to harness the power of data and drive system-wide innovations requires significant investments. In a systematic review of its EMIS-related portfolio of activities between 1998 and 2014, the World Bank concluded that the operational performance of EMISs fell short of expectations. Potential reasons included unrealistic EMIS goals, unclear definition and understanding of the EMIS, and over-reliance on central development of the EMIS (Abdul-Hamid, Saraogi and Mintz, 2017[73]). The review calls for evaluating EMISs' potential according to the four core policy areas identified in the System Assessment and Benchmarking for Education Results (SABER) EMIS framework, namely enabling environment, system soundness, quality data, and utilisation for decision making (Abdul-Hamid, 2014[74]; Porta and Arcia, 2011[75]).

Therefore, the contribution of an EMIS to policy implementation requires adjustments. For instance, the UNESCO-UIS has produced a handbook to use EMIS to track progress towards the achievement of the SDG 4 (UNESCO-UIS, 2020[76]). More precisely, the UNICEF and UIS propose an eight-step monitoring framework that aligns an EMIS to the objectives of a given policy and ensures it supports fully the realisation of its objectives:

1. Establish indicators, definitions and benchmarks;

2. Prevent, detect and resolve data inaccuracies;

3. Update EMIS to incorporate new indicators and methodologies;

4. Close gaps in vertical information flows between local and national level;

5. Close gaps in horizontal information flows through cross-sector collaboration;

6. Create an early warning system;

7. Create automated reporting and analysis routines;

8. Develop and establish evidence-informed policies and interventions (UNICEF and UIS, 2016, p. 14[72]).

5.2. Stakeholders' capacity to use indicators and to inform their practice

The literature on data-based decision making in education analyses how the use of data by stakeholders may steer school improvement. According to Ikemoto and Marsh (2007, p. 108[51]), it refers to "teachers, principals, and administrators systematically collecting and analysing data to guide a range of decisions to help improve the success of students and schools". In complex education systems, multiple actors are engaged in education (Figure 4), and their capacity to understand data and indicators will condition how much they engage with various sources of data. In terms of policy reform, the use of indicators for monitoring and piloting policy implementation hinges on "stakeholders' data literacy".

Figure 4. OECD review of potential stakeholders in education
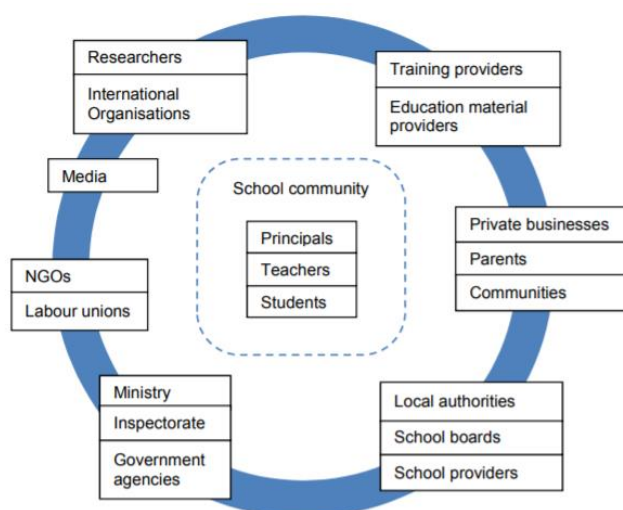
Source: Burns and Köster (2016[28]), *Governing Education in a Complex World*, Educational Research and Innovation, https://dx.doi.org/10.1787/9789264255364-en.

From the perspective of data-based decision making, the capacity of policy makers to interpret and integrate data in the policy-making process has become critical. Yet, there is little evidence on how data and research evidence is used by education policy makers (Schildkamp, 2019[6]). In the analysis of a tripartite initiative in Canada involving the Ontario Ministry of Education, two Canadian Universities and 44 research projects, Campbell et al. (2017[77]) consider that building capacity in knowledge mobilisation is an important next step to strengthen data-based decision making. They suggest that consumers of research evidence, such as policy makers, also need the capacity to provide feedback on the research agenda. After conducting interviews in a State education department in Australia of 25 policy makers actively involved in the development of three specific education policies, Rickinson et al (2017[78]) advocated for sustained capacity building to

use evidence more effectively within educational practices. In the United States, a study conducted in four educational districts concluded that one of the biggest challenges district administrators face consisted in turning their data analysis into action (Foley et al., 2008[26]).

Similarly, at the school level, the use of data and research evidence to inform instruction is challenging. Specific pedagogical knowledge is required, otherwise teachers may fail to interpret data and apply drawn insights to instruction (Coburn and Turner, 2011[79]). In the aforementioned US study, teachers reported their recurring struggle to turn data into instructional action (Foley et al., 2008[26]). This stems from the need for teachers to know how to navigate a complex stream of information, to select and shape data in a coherent and meaningful way, and to apply it to planning instruction (Datnow and Hubbard, 2015[80]; Means et al., 2011[81]).

This is why effective data-informed decision making requires not only specific knowledge and capacity, but also integrated support from the school management, either through the planning of collective reflection on data use or by growing leadership to model its use (Means et al., 2009[82]). In that sense, the school leader is a crucial stakeholder in the data use process. School leaders are expected to demonstrate data literacy skills, encourage the use of data, allocate dedicated resources, grow the school capacity, scaffold and model data use (Datnow and Hubbard, 2015[80]; Hoogland et al., 2016[83]).

Against this backdrop, data and indicators may support the implementation of a policy if i) they are relevant to stakeholders, and ii) stakeholders have sufficient capacity in data use. Relevant indicators means they are actionable for stakeholders: those using the indicator have the power to act on the results to produce the desired change, and the results are produced in such a way that calls to action. For instance, national statistics are only loosely connected to school performance, and more local, disaggregated, indicators may better account for specific contexts and better guide schools in their improvement process. As mentioned in a previous section ("Indicators to guide decision making"), one way to increase indicators' relevance is to include stakeholders in the co-shaping of the indicator strategy.

Stakeholders' capacity for data use, on the other hand, will not only influence the use of indicators, but also their production. Stakeholders are an important component of an EMIS for instance, as they guide the collection of data and its transformation into indicators to inform decision making (Abdul-Hamid, 2014[74]). In many education systems, either teachers or school leaders are expected to feed information into the EMIS (section Country case studies: the importance of the EMIS in Estonia and the Netherlands"), and their data literacy, along with their motivation to interact with data (section "The existing data culture") will condition the quality of the data collected.

The use of data and indicators to support implementation questions more broadly the country evidence-based decision-making model. How do teachers, school leaders, policy makers and other stakeholders collaborate, explore educational issues and collectively develop solutions? In other words, is there "joint practice development" to support the use of evidence among education professionals (Rickinson et al., 2017[78])? In a case study of a US elementary school, Farley-Ripple and Buttram (2015[84]) consider that capacity building efforts for data use focused on individual and organisational levels, missing the social dimension of interactions in capacity building.

Hence the need to develop an integrated model of data use to support evidence-based decision making, and strengthen capacity building at every governance level. For instance, the "evidence production-to-use system" developed by Gough et al. (2011[85]) encompasses evidence production, mediation and use, stakeholder engagement, and research on the

processes and outcomes of evidence-informed policy. Best and Holmes (2010[86]) propose to go beyond simplistic linear models in what they call "system models", where the interaction of stakeholders across all levels of the system allows the co-creation of evidence, and the promotion of research and practice knowledge for informing decision making. As a consequence, developing a model of data use will support stakeholders' use of indicators for piloting and monitoring policy implementation, since such models strengthen data literacy and integrate data use in the regular workflow of stakeholders.

Box 6. Required skills for teachers to master data use to improve instruction

As part of the Study of Education Data Systems and Decision Making in the United States, an exploratory sub-study analysed teachers' thinking about data to inform teacher preparation. During the 2007/08 school year, a research team collected data across 13 school districts located in 12 different states. In total, the research team gathered information from 52 teachers and 70 small groups of school staff from 21 elementary schools and 14 middle schools.

That study confirmed previous research results, namely that teachers are more likely to use data in decision making if they feel confident about their knowledge and skills in data analysis and data interpretation. The research team identified five skills areas necessary for teachers to master data use to improve instruction:

- Data location: Ability to find relevant information in the data system;

- Data comprehension: Ability to understand the data, their representation, and the underlying statistical concepts;

- Data interpretation: Ability to infer relevant insights from the data, and to understand the limitation of statistical measurements;

- Instructional decision making: Ability to select an instructional approach to address any potential issue identified through the data analysis;

- Question posing: Ability to formulate instruction-related questions that can be explored through the data in the system.

In addition, the research team established, in line with the existing literature, that data-related work tends to increase collaboration among teachers. This result suggests that data use and collaboration on instruction may mutually reinforce each other, and initiate a virtuous cycle of school improvement.

Source: Means et al. (2011[81]), *Teachers' ability to use data to inform instruction: Challenges and supports*, US Department of Education, Office of Planning, Evaluation, and Policy Development, Washington, DC, https://files.eric.ed.gov/fulltext/ED516494.pdf [accessed on 17 September 2021].

5.3. The existing data culture

As discussed in the previous section ("Stakeholders' capacity to use indicators and to inform their practice"), the use of indicators for monitoring and piloting policy implementation depends on the capacity, or data literacy, of various stakeholders. It also depends on the data culture of a specific context, in other words, how indicators are perceived and trusted. In fact, the dual role of indicators, as an accountability mechanism and an input for decision making, creates a tension between using data for school improvement, and using data for holding school accountable (Schildkamp, 2019[6]).

Research literature has largely documented the potential detrimental effects of accountability on school development. Such side effects include: i) intended strategic behaviours referred to as "gaming the system" and leading to a misrepresentation of the school, ii) unintended strategic behaviours such as a fixation on indicators and leading to "teaching to the test/inspection" and an over-reliance on short-term solutions at the expense of long-term development, and iii) heightened stress of school staff or relaxed attitude following a positive evaluation (Ehren and Swanborn, 2012[87]; de Wolf and Janssens, 2007[88]; OECD, 2013[7]). This is why the use of indicators for supporting implementation should be decoupled from external accountability, to build trust among stakeholders and emphasise the role of indicators for school improvement (Datnow and Hubbard, 2015[80]).

In particular, framing data use as a continuous school improvement process, and not solely as compliance to accountability demands, is important to build a data use culture (Datnow and Hubbard, 2015[80]; Hoogland et al., 2016[83]; Park, Daly and Guerra, 2012[89]). In addition, the design of an integrated model of data use across levels of governance, such as the "evidence production-to-use system" (Gough et al., 2011[85]) and the "system model" (Best and Holmes, 2010[86]) discussed in the previous section ("Stakeholders' capacity to use indicators and to inform their practice"), not only support capacity building, but also promote this data use culture.

The use of indicators by stakeholders requires a specific set of beliefs that is often unaddressed in educational reform efforts and capacity building programmes (Datnow and Hubbard, 2015[80]). When stakeholders are facing indicators, they bring with them a pre-existing set of beliefs that can prevent them from seeing the interest of using indicators, or lead them to distrust indicators. In that sense, the role of leaders, whether at school, or at the district level, is pivotal to set an example and establish supportive management. For instance, Long et al. (2008[90]) found that only a minority of teachers would explore data when the school leader is unsupportive. Leaders shape practices, and provide guidance on how data use informs decision making to drive school improvement (Datnow and Park, 2014[91]). The establishment of an effective data-oriented culture therefore requires to build capacity while attending to stakeholders' beliefs, attitudes, and perceptions about data use (Datnow and Hubbard, 2015[80]).

To manage this cultural change, the dialogue between central and local institutions, and schools is pivotal. One way to drive engagement with data is to embed data use in already existing processes, for example in school evaluation or policy decision making. However, for the change to be effective, stakeholders must perceive its added value. In that sense, the Portugal case study ("How the Portuguese web platform engages stakeholders to build trust") presents valuable insights.

A country's reporting strategy plays a significant role in the data culture. First, central institutions can get engagement from schools if they provide interesting data that the school would not have had otherwise. For instance, the Portuguese InfoEscolas Portal offers schools to compare their performance with their "peers", schools considered similar in terms of student demographics and school characteristics. This information is only available thanks to a national monitoring strategy and a central platform that disseminates the information in a meaningful way to schools. Second, the transition from static reporting with yearly reports, to updated data on-demand is also likely to initiate school engagement. Teachers and school leaders will perceive the value of accessing and using real-time data as it helps them manage the school more effectively and improve instruction.

Central institutions should therefore tailor their reporting strategies to the needs of schools and local institutions. On one hand, as it engages schools in data-related activities, and on the other hand, as data flow from schools to central institutions, according to a bottom-up process. The more schools perceive the value of data, the more they are likely to invest

time and resources in the reporting process to central institutions, which is critical to ensure data quality. As discussed in the Portuguese case study, the establishment of a transparent education portal displaying robust indicators contributes to building trust in the system (Baptista, 2020[68]). Central institutions therefore play an important role in fostering an effective data-oriented culture in initiating a virtuous circle between data relevance and accessibility to schools, schools' engagement with the data process, and data quality.

5.4. Country case studies: the importance of the EMIS in Estonia and the Netherlands

5.4.1. How the Estonian EMIS contributes to transparency in a future-oriented society

In 2004, the Estonian MoER piloted the official "Estonian Education Management Information System" (EHIS[3]) to collect information for organising and purposefully administering the education system. The EHIS embodies the concept of e-Estonia and transparency, as it provides an extensive set of data, and many services associated to the X-Road infrastructure[4].

EHIS combines data that comes directly from all schools in Estonia. These include all institutions that provide education that follows a curriculum. In total, about 2 000 institutions enter data into EHIS. By law, all schools are required to enter the data and keep it up-to-date, and school principals required to nominate at least two employees who are responsible for EHIS data (OECD, 2020[92]).

EHIS consists of five sub-registers:

1. the sub-register of documents certifying education: records are kept of the issuing of graduation documents certifying basic, general secondary, vocational secondary and higher education, and of reports proving the completion of residency;

2. the sub-register of teachers: contains information on teachers and head teachers, including their qualifications, and the subjects/level/school they taught during their career;

3. the sub-register of pupils, university students and resident physicians: records are kept of pupils, students, external students and resident physicians acquiring pre-primary, basic, general secondary, vocational secondary, and higher education;

4. the sub-register of educational institutions: records are kept of educational institutions enabling the acquisition of pre-primary, basic, general secondary, vocational secondary, higher and hobby education, and of general data and the inventory required for education and schooling in these institutions;

5. the sub-register of curricula and education licenses: contains information on the curricula, programmes and education licenses of educational institutions enabling

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[3] The Estonian Education Management Information System is accessible at this address: www.ehis.ee.

[4] The X-Road is a data exchange layer that was launched in 2001. It is a technical and organisational environment, which enables secure Internet-based data exchange between the state's information systems. For instance, a student fills a study allowance request in the EHIS. The EHIS will update the Population Database, which will update in-turn the Tax Board Database, which takes a final decision and communicates it to the EHIS. The EHIS then directly transfers, or not, the allowance to the bank account of the student.

the acquisition of pre-primary, basic, general secondary, vocational secondary, higher and hobby education or in-service training.

In addition to the aforementioned information system, several other registers are also kept; the following of them are related to education:

- the register of research and development institutions[5];

- the results of state examinations (not a public register but all examinees can find out their examination results here);

- the register of professions[6]: lists all the existing professional councils.

EHIS provides everyone with an opportunity to review the performance indicators of educational institutions. Data established by the minister's regulation are available for each educational institution on a dedicated website[3], and is used in particular for:

- making policy and financing decisions in education and other tasks arising from law;

- developing state and international educational statistics;

- monitoring the progress of the Lifelong Learning Strategy through selected indicators;

- other analysis and studies of developments in education, including background data and samples for research;

- X-Road based services;

- quality assurance in higher and vocational education: background data for internal evaluation reports;

- transparency: educational institutions and school owners have access to all of their data and data concerning their students and teachers.

The MoER has developed a more user friendly tool, the Education Eye, for the public to access the information, at an aggregate level, stored in the EHIS. The Education Eye allows visual representation of the different datasets related to the education system. It presents characteristics pertaining to students, teachers, teachers' salary analysis, education expenditures, teaching staff, research, performance indicators and school profiles.

5.4.2. How the Netherlands has built a school-based EMIS system to steer local improvement

Schools in the Netherlands have among the highest levels of autonomy in OECD countries (Figure 5), which is balanced with a strong accountability for results (OECD, 2016[93]). In fact, system monitoring in the Netherlands is mainly driven by student achievement in standardised testing (a national monitoring sample survey JPON[7], results reported by schools from their EMIS, and the results from the secondary school leaving examinations) that allows the Inspectorate to identify low-performing schools.

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[5] The register of research and development institutions is accessible at this address: www.etis.ee.

[6] The register of professions is accessible at this address: www.kutsekoda.ee.

[7] *Jaarlijks Peilingsonderzoek van het Onderwijsniveau* (Annual Survey of Educational Levels).

DUO[8], the unit dedicated to information management for the Dutch Ministry of Education, Science and Culture, collects student-performance data and complements it with a wide range of demographic, administrative and contextual information. For instance, the education databases developed by DUO are enriched with databases from the National Bureau of Statistics (CBS) who collects information on parents (e.g. labour market, population registry), and school finances.

Since 2014, primary schools in the Netherlands are required to implement an EMIS that consist in a longitudinal student monitoring system gathering formative standardised assessments. Schools have to use these systems to quantitatively assess the progress of their students towards the reference levels. There are three comprehensive student monitoring systems available to schools for this purpose: LVS[9], ParnasSys, and ESIS[10]. A legacy of the time when the Central Institute for Test Development (Cito) had the monopoly for the end-of-primary test (Cito test), virtually all primary schools participate in the LVS developed by Cito, and schools are requested to periodically send their data in a standardised format to DUO.

For instance, the LVS is a longitudinal student monitoring system and offered for Years 1-8 (4-12 year-olds). The tests are taken once or twice a year and are completed by hand or, for some subjects, by using computer-based modes. Tests in ordering, language and orientation in space and time are given in Years 1 and 2 only. For Years 3-5, tests are given in several aspects of Dutch language, Arithmetic/Mathematics, and social and emotional development. These tests are also given in Years 6-8, along with world orientation (Geography, History, Biology), Science and Technology, and English (Years 7 and 8 only). The formative/diagnostic function is accomplished through provision of interpretive materials, as well as suggestions for relevant pedagogical strategies.

Following the implementation of the unique student identifier, student progress can be analysed since results in LVS tests, end-of-primary and school leavers tests, and national examinations are registered for each student. In particular, scores in LVS tests are vertically equated, which allows the calculation of student growth trajectories[11] in primary education. While there are no intentions to use the LVS results for accountability, the student number can facilitate the longitudinal analysis of student assessment results.

The different databases are connected and made publicly available through an online information system called Windows for Accountability (Vensters voor Verantwoording). This online information system was created at the initiative of the Primary and Secondary Education Councils (the national associations of school boards) to provide information about individual schools. It is subsidised by the Ministry of Education, Culture and Science and managed by the Foundation SchoolInfo (Stiching SchoolInfo). Windows for Accountability brings together central administrative data from DUO, public accountability information and school-based information. It edits and creates visual representations of the data, and a dashboard of twenty indicators supports individual schools in developing quality education and monitoring progress (Foundation SchoolInfo, 2020[94]).

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[8] *Dienst Uitvoering Onderwijs* (Implementation of Education Service).

[9] *Leerling Volg Systeem* (Student Monitoring System).

[10] *Elektronisch School Informatie Systeem* (Electronic School Information System).

[11] Growth models involve estimating students' test score trajectories, usually drawing on longitudinal data obtained from annual examinations. Typically, these trajectories are estimated for homogeneous groups of students and enable informative comparisons among groups that are useful for both school self-study and national policy planning.

Figure 5. School autonomy in the Netherlands, TALIS 2018
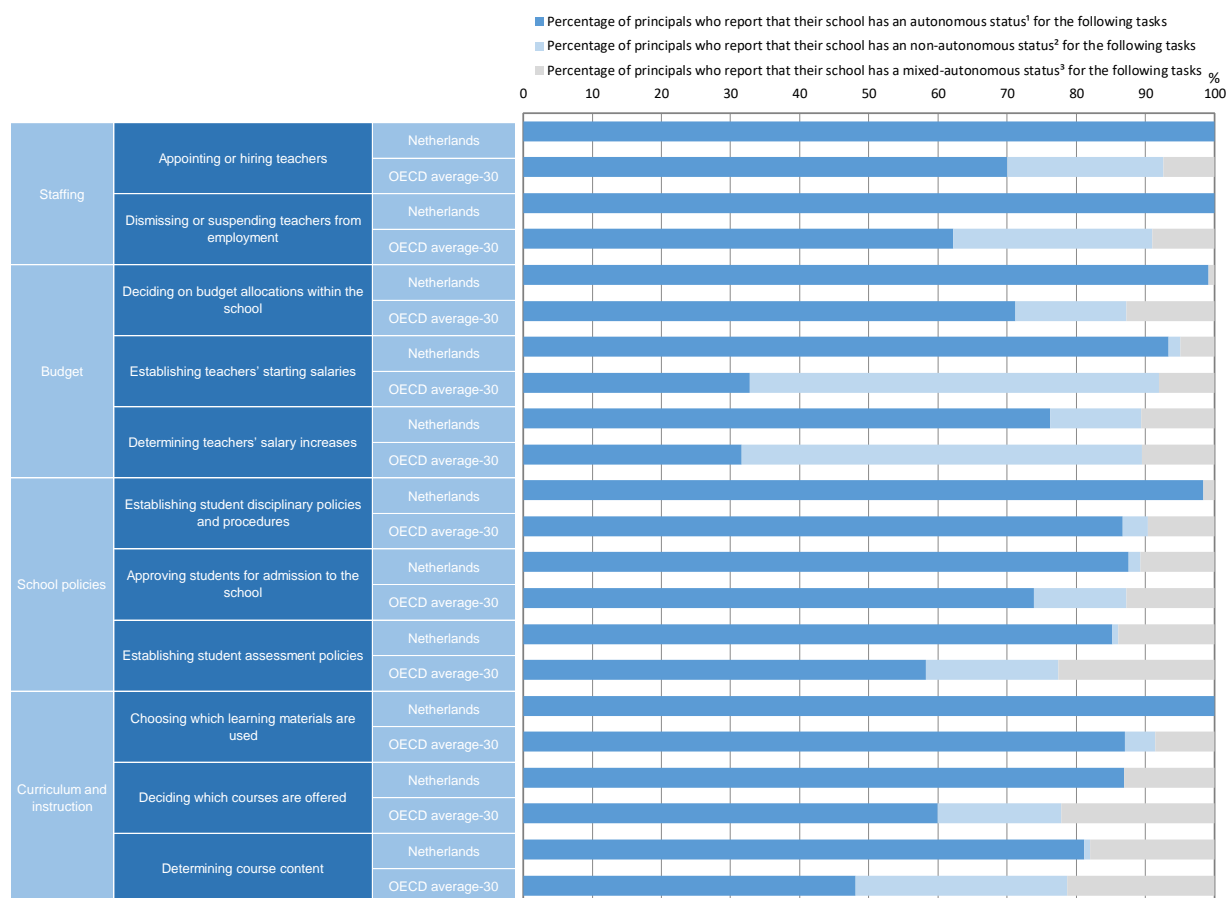
Note: 1. "Autonomous status" occurs when significant responsibility is taken solely by at least one of the following entities: principal, other members of the school management team, teachers who are not part of the school management team or the school governing board.

2. "Non-autonomous status" occurs when significant responsibility is taken solely by a local/regional/state/national/federal authority.

3. "Mixed-autonomous status" occurs when significant responsibility is taken by a local/regional/state/national/federal authority and by at least one of the following entities: principal, other members of the school management team, teachers who are not part of the school management team or the school governing board.

Source: OECD (2020[95]) *TALIS 2018 Results (Volume II): Teachers and School Leaders as Valued Professionals*, TALIS, https://doi.org/10.1787/19cf08df-en.

6. Conclusions on developing indicators to support the implementation of education policies

The shift from administering to managing education, spurred by new public management principles, the increasing demand for evidence-based policy making, and the development of new technologies, automatising the collection and processing of large amount of data, are among the reasons for the more prevalent role of indicators in informing decision making in education. A simplified view of a complex array of information, indicators serve three main purposes: accountability of schools and administrations, transparency of the resource allocation to demonstrate the efficiency and effectiveness of spending, and identification of strengths and weaknesses of the education system to initiate specific remedy measures.

However, an over-reliance on indicators to manage education systems has attracted some criticism, more precisely in relation with the side effects of accountability on schools and education staff. The research literature mentions, among others, that indicators may provide incentives to "game the system" by "window dressing" the school, to narrow the learning experience by "teaching to the test/inspection", to favour short-term solutions at the expense of long-term development of children, and may also result in heightened stress for education staff.

Building on the OECD education policy implementation framework, this paper has reviewed how indicators can support the implementation of education policies, while taking into account some of these perennial challenges pertaining to the unintended effects of accountability. The role of indicators is discussed along each of the dimensions of the framework, namely smart policy design, inclusive stakeholder engagement, and conducive environment, and some lessons are drawn to improve the contribution of indicators to the implementation of education policies.

As part of the policy design, indicators represent a tool that brings clarity about the vision and its assorted objectives. It outlines the policy goals in specific terms and sets priorities for development. The definition of an indicator system, or the integration of the new policy indicators to an existing one to ensure coherence, details how individual indicators contribute to producing an overall effect, according to an indicator framework that lays out the logical linkages between its various elements. A number of indicator frameworks (e.g.: the OECD Indicators of Education Systems, the UN Agenda 2030 for Sustainable Development, and the European Co-operation Education and Training (ET 2020) framework) already exist and can guide policy makers in building their indicator strategy. However; such high-level indicator frameworks constitute a starting point, but should not be substituted for indicators more tailored to the specific needs of a policy, as they may not be detailed enough to inform precisely on the implementation process, or only be loosely relevant to stakeholders expected to monitor and use them to inform decision making.

To reflect the breadth and depth of the policy objectives, and to track where they may fail in terms of implementation, the selected indicators should cover a mix of input, process, and output. Existing indicators may be convenient, but they potentially capture what is easier to measure, or proxy a different outcome, which can create wrong incentives and lead to "goal displacement". The definition of new tailor-made indicators is sometimes necessary to ensure a holistic approach to monitoring policy implementation and its impact. To that effect, the input/process/ouput model helps ensure the right coverage and scope of indicators, and the SMART framework helps refine the definition of the indicators.

When developing a new policy, the definition of indicators represents an opportunity to engage stakeholders, in particular to ensure their relevance, but also to drive adoption which is critical for change management and the supply of quality data. Several ways exist such as organising consultation on the selection and prioritisation of indicators, channelling feedback to understand if existing data represents adequately the reality ("ground-truthing"), and co-shaping the set of indicators associated to the policy. Such indicators may contribute to achieving the policy's objectives as they are more likely to be embedded in school practices and improvement processes.

In addition, designing a communication strategy that includes indicators contributes to developing sense-making and ownership among stakeholders on the purpose and potential of indicators. For instance, the selection of key indicators can inform stakeholders on critical elements necessary for the achievement of the policy, but also potential bottlenecks or weak points that require close monitoring. It prepares the ground for stakeholders to monitor their progress towards the achievement of policy objectives, and potentially to adapt their actions accordingly.

Indicators also serve a traditional accountability role among different actors, as they define a metric allowing for comparison, and facilitate the monitoring of target achievement. The definition of indicators at different levels (classroom, school, local and central authorities etc.) can help to communicate who will be held responsible, from the frontline to the ministerial level, and ensure that every stakeholder is involved in the implementation process.

Ultimately, how indicators support implementation is conditioned by contextual factors. The alignment of the Education Monitoring System, in particular of its Education Management Information System, with the objectives of the new policy and associated indicators, will influence which data and indicators are available to stakeholders and how they can engage with the implementation process. By providing timely and reliable data for education planning and management, EMIS have been increasingly considered as a means to improve accountability and meet more stringent requirements in terms of transparency.

However, the drive for stakeholders to use indicators relies on the country indicator culture, in other words, how indicators are perceived and trusted, and the set of beliefs stakeholders hold towards them. Framing data use as a continuous school improvement process and not solely as compliance to accountability demands is an important step to build a data use culture. Integrated models of data use, such as the "evidence production-to-use system", support evidence-based decision making at every governance level as they integrate data use in the regular workflow of stakeholders.

In addition, effective data-informed decision making requires specific capacity. At the school level, specific pedagogical knowledge and data literacy are required to navigate a complex stream of information, select and shape data in a coherent and meaningful way, and apply it to planning instruction. For instance, school leaders are expected to demonstrate data literacy skills, encourage the use of data, allocate dedicated resources, grow the school capacity, scaffold and model data use. At the central level, district leaders and policy makers are expected to provide feedback on the research agenda, integrate research evidence into their practice, and turn data analysis into action. This is why effective indicator-informed decision making requires not only specific knowledge and capacity, but also integrated support from the management, either through the planning of collective reflection on indicator use or by growing leadership to model its use.

To conclude, indicators can be effective tools to support the implementation of education policies: they improve the policy design by making objectives concrete and allowing to

gauge progress towards their achievement, and stimulate stakeholders' engagement around data use. These depend however on how relevant indicators are to stakeholders, and on contextual elements, such as the data culture and the data-related technology. As a consequence, indicators contribute significantly to the actionable part of the implementation strategy, along the allocation of responsibilities and resources among stakeholders, and the timeline towards the realisation of objectives. A carefully crafted set of indicators associated with a policy therefore represents an opportunity in terms of implementation when it takes into account stakeholders' beliefs, attitudes, and perceptions about data use.

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