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A study on smart, effective, and inclusive investment in education infrastructure

Final report

Education, Youth, Sport and Culture

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Contact: Antonio Garcia Gomez

E-mail: Antonio.GARCIA-GOMEZ@ec.europa.eu

European Commission
B-1049 Brussels

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Abstract

The need for smart, effective and inclusive investment in education infrastructure has been put high in the EU political agenda but has not been thoroughly analysed in EU27 countries. The goal of the study is to review recent trends and provide policy recommendations on smart, effective and inclusive investment in education infrastructure. As part of this study, comprehensive desk research, scoping interviews, national (regional) mapping exercise and analysis of good practice examples were carried out. The mapping exercise was at the core of this study and involved comprehensive analysis of EU27 current situation regarding investment in education infrastructure. The report provides the final findings of the research, including conclusions and recommendations and the good practice framework, that were validated during the expert validation workshop. The mapping revealed that although many EU27 countries mostly invest their regional and national funds in education infrastructure and carry out at least some form of investment needs assessments, forecasts and infrastructure monitoring, the efforts made to collect data on education infrastructure are usually not systematic and investment planning is not always based on current needs. The report offers 12 recommendations for all countries to implement to achieve smart, effective and inclusive investment in education infrastructure.

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Introduction

This document is the **Final Report of the project 'A study on smart, effective, and inclusive investment in education infrastructure'**. The overall purpose of research was to review recent trends and provide policy recommendations on **smart, effective, and inclusive investment** in education infrastructure in the EU27.

Within the frames of this study, education infrastructure is understood as **all the material elements that support education**. These include land, buildings, furniture, software, and equipment, which, together, provide physical, blended, and virtual spaces where teaching and learning take place. Besides its educational value, school infrastructure has often a symbolic value, as being in many cases a very relevant building in a community. Not being smart, effective, or inclusive in educational infrastructure investments is not just a waste of precious resources, but more importantly a missed educational and cultural opportunity.

At the core of the study is a detailed and comprehensive **mapping** of both the trends in education infrastructure investment and its governance. Furthermore, the analysis of good practices in EU27 provides not only an overview of best approaches to infrastructure and investment management and planning but led to creation of good practice framework that will allow all Member States to take inspiration and provides clear idea of how investments in education infrastructure should be made and monitored.

The study covers **all levels of education and training** by ISCED 2011, including early childhood, primary, secondary, post-secondary non-tertiary, and tertiary education. The focus is on 27 Member States of the EU, with the mapping carried out in each country with assistance of national experts. In countries where the governance of education infrastructure is decentralised (Austria, Belgium, Germany, Italy and Spain), regions are subject to analysis too.

The aim of this report is to present study results and, based on them, main conclusions and recommendations aimed at policy makers and stakeholders at all levels, from local or regional, to national, to European or international. The report features:

- A description of the **study methodology** (Chapter 2)
- **Findings on trends**, including research results on the context, needs, priorities, objectives, scope, and source of investment, and investment gap in education infrastructure; findings build on desk research, scoping interviews and national (regional) mapping results (Chapter 3)
- **Findings on governance**, including approaches adopted to needs assessment and forecast, planning, project prioritisation, approval and funding, supervision of infrastructure investment, collection and disclosure of data, funding arrangements, delivery modes and coordination between actors involved; findings build on desk research, scoping interviews and national (regional) mapping results (Chapter 4)
- **Principles of good practice and illustrative case studies** (Chapter 5)
- **Conclusions and recommendations** (Chapter 6)

Methodology

This chapter presents the study's overall methodological approach. We begin by introducing the data collection methods, followed by the approach for data analysis. Finally, we present the approach to arriving at final study conclusions and recommendations.

Data collection

Desk research

We carried out desk research to support different steps of the study. In particular, we:

- Explored existing literature on investment in education infrastructure to fine tune the research methodologies, which helped to ensure that the study builds on what is known and provides added value;
- Examined a wide range of reports from European Commission, European Investment Bank, OECD, World Bank, other international, European, and national policy actors, as well as academia, to prepare for scoping interviews and the national (regional mapping);
- Analysed earlier cross-country studies and datasets on investment in education infrastructure to support trend analysis.
- The full list of references used is included at the end of the report.

Scoping interviews

In February-March 2021, we carried out a programme of scoping interviews. The purpose of it was two-fold:

- To fine tune the definitions of key terms, intervention logic, study questions, research design, and develop the main research tools;
- To gain insights on trends in investment in education infrastructure and approaches to the governance of such investment in the EU27 and beyond.

We conducted **16 semi-structured video interviews**[1] with representatives of the European Commission, OECD, World Bank, European Investment Bank and Council of Europe Development Bank. A breakdown by stakeholder group is provided in the table below.

[1] A semi-structured interview employs a blend of closed- and open-ended questions, often accompanied by follow-up why or how questions. It allows the interviewer to change the order of questions, and probe different directions as new information emerges. A semi-structured interview includes only a few predetermined questions and builds on a checklist of topics to be covered instead.

Table 1. Scoping interviews

Stakeholder group	Interviews conducted
European Commission (DG EAC, DG REGIO and DG EMPL)	6
OECD	1
World Bank	3
European Investment Bank	5
Council of Europe Development Bank	1
TOTAL	16

National (regional) level mapping

In April-June 2021, we carried out a mapping of governance and recent trends of education infrastructure investments across 27 EU Member States[2]. The mapping was at the core of the study and aimed at gathering comparable data on:

- **National (regional) approaches** to the governance of education infrastructure and investment in it, in each EU Member State and where relevant at regional level;
- **Trends** in investment in education infrastructure over the last 10 years in each EU Member State.

We approached the mapping of governance and trends in phases. **First**, we revised the mapping framework and developed guidelines for national experts and a mapping reporting template. We then proceeded to carry out a pilot in three Member States – France, Ireland, and Lithuania. This helped to assess what data it is feasible to collect, and to validate mapping methodologies.

Second, we explored a wide range of cross-country studies, reports and international databases that offered relevant information on different countries. The original plan was to employ a semi-automated approach and prefill the reporting template by combining traditional modes of desk research with automated ones. Such plan built on the assumption that key documents featuring infrastructure investments in education can be easily accessed via a couple of main webpages of public authority websites in each Member State. However, this is not the case. In many cases key information is not published and in some others the data is already old or not relevant. Policies, standards, and trends are for the most part absent of official websites. Data on investment in education infrastructure is scattered, and some of it (for instance, studies, evaluations, and comparable education statistics) is not available on the websites of public authorities. Moreover, the data that exists has to be accessed via multiple webpages. Such a wide spread of relevant information across different

[2] Within the frames of this study, the 'mapping' refers to the process of data collection via desk research and interviews at the national and, where applicable, regional level in the Member States of the EU27.

sources made the automated search and downloading counterproductive. Thus, we examined key sources and linked them with topics covered in the reporting template manually.

Third, we set up a system of collaboration with national experts in all EU27 Member States. Experts were selected based on their experience in the field and specialisation (prior projects and publications). For some countries (like Spain and Latvia) multiple experts were selected for various reasons (experts wanted to collaborate being from the same expert network or organisation, one expert replacing another, etc.). Each expert was duly informed of the task, provided with guidelines, reporting template, relevant international literature, and background information about the study. The experts then proceeded with their tasks related to national (regional) level mapping:

- **Desk research** in a local language and, where relevant, English. The experts explored a wide range of legal, policy, programming, administrative, technical, and procedural documents, national and international studies, and (for quantitative indicators) Eurostat and national statistical databases. This comprised the core of the national (regional) level mapping.
- **Semi-structured interviews** with high-level officials and infrastructure, finance, administrative, research and/or education specialists. The experts secured the collaboration of a wide range of stakeholders, including ministries, agencies, and other public authorities at the national, regional, and local level, also experts outside the public sector and representatives of the education community. A total of **175 interviews** were conducted – on average, 6 interviews per country. They helped to fill in knowledge gaps remaining after desk research and validate research results. A breakdown by country and organisation is provided in the table below. It reveals that the target of at least 5-7 interviews was achieved in all countries, except for Austria, Croatia, Cyprus, Malta, and the Netherlands. The national experts report that falling behind the target had no impact on the quality of the findings in Austria, Malta, and the Netherlands; however, it meant some gaps in data in Croatia and Cyprus (for example, complete expenditure on education infrastructure, in-depth information about value for money processes in the country and inventorisation of education infrastructure, etc.).

In many cases, desk research and interviews at the national (regional) level were followed by written inquiries to and correspondence with various local, regional, and national authorities. DG EAC provided support by identifying key stakeholders in countries where they were difficult to contact and encouraged national authorities to collaborate with the national experts. Once all data was collected, the national experts reported their findings to the core research team. The mapping results were then peer reviewed to ensure that the information provided comes from reliable sources, helps answer research questions, and is sufficiently detailed and clear. The core team of the study provided national experts with comments so that they can elaborate, clarify, and update the findings as required. Such process of quality control helped to ensure that the mapping results are robust and allow for a cross-country comparison in every case where comparison was possible.

Table 2. Mapping interviews

Member states		Organisations involved and number of people interviewed by organisation	Total number of people interviewed
Austria	AT	Statistics Austria – 1 Federal Ministry of Education, Science and Research – 2 Federal Institute for Quality Assurance in the Austrian School System – 1	4
Belgium (Flanders)	BE	Ministry of Budget of the Wallonia-Brussels Federation – 1 General Service for School Infrastructures of Wallonia-Brussels Education – 1 Wallonia-Brussels Federation, main coordinator of the reform on school infrastructure – 1 General Service for Subsidized School Infrastructure – 1 Wallonia-Brussels Federation, Advisor of the minister on School Infrastructures – 1 Administrator for the Catholic schools – 1	6
Belgium (Wallonia)	BE	Flemish Government, Agency for School infrastructure (AGION) – 1 Flemish Government, Department of Education and Training – 1 Flemish Government, GO! education network (public education) – 1 City of Antwerp, Cabinet of the Alderman for Education & Youth – 1 Flemish Government, Ministry of Education – 1	5
Bulgaria	BG	Ministry of Education and Science – 1 National Inspectorate of Education – 1 Humanitarian Activities Department, Yambol Municipality – 1 Primary School Sv. Ivan Rilski, village of Kosharitsa, Nessebar municipality – 1 105 Secondary School Atanas Dalchev, Sofia – 1 Veselushko Kindergarten, Smolyan – 1	6
Croatia	HR	Ministry of Science and Education of Croatia, service for capital investments and bookkeeping – 1 Ministry of Science and Education of Croatia, Service for programs and EU projects – 1 Ministry of Science and Education of Croatia, Sector for improvement of system of upbringing and education – 1 Agency for science and High Education of Croatia – 1	4
Cyprus	CY	Pelendri Primary School – 1 Ministry of Education – 1 Ministry of Education, National School Technical Services – 1 Directorate General for European Programmes - 1	4
Czechia	CZ	Ministry of Education, Youth and Sports - 3 Ministry of Regional Development - 2 Department of Education of the Pardubice Region – 1 Department of Conception and Development of Education of the Central Bohemian Region – 1 Department of Education, Youth and Sport of the Zlín Region – 1	12

		Department of Education, Youth and Sport of the Pilsen Region – 1 Department of Education and Youth of the Olomouc Region – 1 Department of Education and Sport, City Council of Ostrava – 1 Department of Education, Youth and Sport of the Capital City Municipality Prague - 1	
Denmark	DK	Municipalities in Denmark – 1 University of Aarhus – 1 The Blu Highschool – 1 Thisted Municipality – 1 Business Academies Denmark – 1 University Colleges Denmark – 1 Ministry of Higher Education and Science – 1	7
Estonia	EE	Estonian Ministry of Education and Research, School Net – 1 Tallinn City Municipality, Education Department, Early childhood education – 1 Tallinn City Municipality, Education Department, general education – 1 Kolga-Jaani Basic School, Viljandi municipality – 1 Tartu International School (private school), Tartu municipality – 1	5
Finland	FI	Finnish National Agency for Education – 1 Finnish National Agency for Education – 1 City of Jyväskylä – 1 Regional Council of Central Finland – 1 ISKU (Furniture solution provider) – 1 Finpeda (school building designer) – 1	6
France	FR	Ministry of National Education, Youth and Sports, Building School Unit – 1 Ministry of Higher Education, Research and Innovation, Building Stock Strategy Department – 2 ARTIES (Association of persons responsible for higher education building stock techniques) – 1 Caisse des dépôts et des consignations (Banque des Territoires), Investment Department, Education Sub-Department – 1 Caisse des dépôts et des consignations (Banque des Territoires), Regional Office of Pays de la Loire – 1	6
Germany	DE	Berlin-Brandenburg State Institute for Schools and Media – 1 Federal Ministry of Education and Research – 1 Federal Ministry of Education and Research Germany, EU Office, DLR Project Management Agency – 1 Office for education Hamburg – 1 Federal Statistical Office – 1	5
Greece	EL	Ministry of education, consultant to the Minister of Education – 1 Ministry of education, Unit A of the NSRF Executive Structure – 1 Ministry of education, Communications office – 1 Ministry of education, Directorate General of Higher Education – 1 Ministry of education, Directorate General of Strategic Planning, Programming and e-Government – 1 Hellenic Investment Bank – 1	15

		Administration and e-Government of Western Greece, Technical Works Division, and Infrastructure and Construction – 3 Development Planning and Infrastructure – 1 University of Patras – 1 University of Patras, Directorate of the Financial Service – 1 University of Patras, Design & Project Implementation directorate – 1 University of Patras, Studies Department – 1 University of Patras, Public Relations & External Relations directorate – 1	
Hungary	HU	Klebelsberg Center of Education district in Heves County, Primary and Secondary School Principal – 1 Klebelsberg Center of Education district in Gyor County, Primary School Principal – 1 Ministry of Human Resources, Deputy Secretary of State for Public Education – 1 Education Office in charge of Public Education Development, Department of Digital Pedagogy, Deputy Head of Department, - 1 Ministry of Innovation and Technology – 1 written answer	5
Ireland	IE	Ministry of Education – 3 Regional Planning Officer Southern Regional Assembly – 2 Economist for Ireland's three Regional Assemblies – 1	6
Italy	IT	University of Rome, Professor – 1 Fondazione Agnelli – 1 Pica Ciamarra Associati, Architect – 1 Open Plan Consulting, Architect – 1 National Institute of Documentation, Innovation and Educational Research – 2	6
Latvia	LV	Ministry of Education and Science, Structural Funds Department – 1 Ādaži Municipality Council – 1 State Education Development Agency, Education Infrastructure Projects Department – 1 Ministry of Education and Science, Department of Vocational and Adult Education – 1 Ministry of Culture, Department of Cultural Policy – 1 Union of Local Governments of Latvia, Adviser on education and culture – 1	6
Lithuania	LT	Ministry of Education, Science and Sports – 4 Lithuanian Association of Municipalities – 1 Vilnius University – 1 National Education Agency, Education Data Division – 1	7
Luxembourg	LU	Ministry of National Education, Children and Youth, Infrastructure Department – 1 Union of Luxembourg Cities and Communes – 1 University of Luxembourg, Infrastructure Department and Administration – 2 Ministry of Higher Education and Research, First adviser to the Government – 1	6

		Administration of the commune of Dudelange – 1	
Malta	MT	Ministry for Education – 1 Foundation for Tomorrow's Schools – 2 National Students Support Service – 1	4
Netherlands	NL	Association of Dutch Municipalities – 1 Ruimte-Ok – 1 Association of Dutch Universities – 1	3
Poland	PL	City of Chełm – 1 Nidzica County, Deputy Marshall (Starost) – 1 Ministry of Education and Science, Department of Curriculum and Textbooks – 1 Capital City of Warsaw Municipal Office, Education Department – 1 European Fund for the Development of Polish Villages Foundation, Board – 1 Office of the Marshal of the Mazowieckie Voivodeship in Warsaw, Department of Regional Development and European Funds, Office of Management of the Implementation of the European Social Fund – 1 Office of the Marshal of the Mazowieckie Voivodeship in Warsaw, Department of Regional Development and European Funds, Office of Management of the European Regional Development Fund - 1	7
Portugal	PT	Lisbon City Council, Education Department, School Network Division – 1 National Association of Portuguese Municipalities, Legal office, Head and Financial office – 2 Directorate General for Schools – 1 Parque Escolar EPE – 1 AD&C – 1	6
Romania	RO	Iasi Town Hall, Education Commission – 1 Alexandru Ioan Cuza University of Iasi, Administration – 1 Costache Negruzzi National College, School principal – 1 Romanian Ministry of Education, General Directorate for Infrastructure* - 1 Romanian Ministry of Education, Project Management Unit for the Modernization of the School and University Network - 1	5
Slovakia	SK	Ministry of Education, Department of Financing of Regional Education (pre-primary- secondary education) – 1 Bratislava Self-Governing Region, Education Department – 1 Ružinov City District (Mestská časť Bratislava-Ružinov), Department of Education, Culture and Sport – 1 Association of Towns and Communities of Slovakia (Združenie miest a obcí Slovenska - ZMOS), Expert in the field of education and culture, ZMOS Office – 1 Slovak Centre of Scientific and Technical Information, Department of Methodology and Creation of Education Information – 1	5
Slovenia	SI	Ministry of Education, Science and Sports – 5 Parliament of Slovenia, Member of Parliament – 1 Faculty of Information Studies (public higher education institution) – 1 ERUDIO Group (private secondary, post-secondary non-university,	10

		and tertiary education) – 1 Municipality of Nova Gorica, Department for Social Affairs – 2	
Spain	ES	Institutional Government of Catalonia, Department of Education, General Direction of Public Centers – 2 Basque Country, Direction of Infrastructure, Resources and Technology – 1 Junta de Andalucía, Ministry of Education and Sports, General Direction of Planning and Centers – 1 Rey Juan Carlos University, Vice chancellor of Quality, Ethics and Good Government – 1 Provincial Deputation of Barcelona, Area of Education, Sports and Youth, Manager of Educational Services – 1 Government of Navarra, Department of Education, General Direction of Educational Resources, Service of Education Infrastructure – 1 Former General Manager at the University of Barcelona. PhD in Economics, specialized in the economics of education – 1	8
Sweden	SE	National Statistics Sweden – 1 Lund municipality – 1 Linköping municipality, Joint administration department, Education office – 1 Linköping University – 2 Akademiska Hus – 1	6

Data analysis

Analysis of trends

Having concluded the mapping activities, we explored trends in investment in education infrastructure. By **trends**, we refer to key contexts, needs, priorities, objectives, scope, and source of investment, as well as investment gap. To guide and structure research efforts, we focused on operational questions presented in the table below.

We carried out trends analysis based on results of the scoping interviews, desk research, and mapping exercise. To the extent that existing data allows, we explored various aspects by level of education and training and Member State but paid special attention to trends that can be observed at the level of the EU. Findings of trend analysis are presented in Chapter 3.

Some variables touched upon in the questions are more meaningful to explore at the national level. These include 1) change in enrolment of minorities (size, background, and needs of such groups vary across countries), and 2) patterns of domestic migration (location references are country-specific). These variables are not subject to cross-country analysis and, where relevant, they will be discussed in the country fiches instead.

Table 3. Research questions on trends in investment in education infrastructure

Sub-topic	Questions
At the level of the European Union	
General trends	How has the scope of investment in education infrastructure evolved over the last decade? How have the priorities and objectives of investment in education infrastructure evolved over the last decade? What contextual factors have influenced or contributed to such dynamics in the scope, priorities and objectives of investment in education infrastructure?
By Member State and, where applicable, region	
Investment context	How has the enrolment in education and training changed in the last decade? What is expected for the next ten years? To the extent possible, by level of education and training, location (rural vs urban) and other relevant variables (people with disabilities and special needs, the poverty-struck, minorities, etc.) Can any geographical patterns or population shifts be observed? Examples include migration from rural to urban, from downtown to suburb areas, which may influence the demand for education and training in certain locations. How has the scope and condition of the existing education infrastructure changed in the last decade? This may include the number of school buildings, facilities age, etc. To the extent possible, by level of education and training and location (urban vs rural) Have there been any other key factors that influenced the need for and investment in education infrastructure, for example, COVID-19? What? To the extent possible, by level of education and training In what contexts have the investments in education infrastructure been made? How have these evolved in the last ten years? Examples include optimisation of the school network, modernisation of learning environments to fit new pedagogies and student needs, addressing environmental concerns, gaps in enrolment, health and safety of education and training, and the use of ICT
Investment priorities and objectives	What have been the main priorities for and/or objectives in investment in education infrastructure in the last decade? Examples include focus on ICT, greening, energy savings, optimal and fit-for-purpose design To what extent do tensions between investment priorities and/or objectives exist? Have they been acknowledged? How have they been resolved? Have the investment priorities and/or objectives changed over the last decade? What can be expected in the next ten years? To what extent do differences in investment priorities and/or objectives exist by source of funding (public vs private vs co-financing)?
Scope and source of investment, and investment gaps	How much has been spent on education infrastructure over the last decade? To the extent possible, by level of education and training and year and source of funding Have there been any significant fluctuations in spending over the last decade? Why? To what extent have the needs for investment been met? What are the gaps, if any?

Analysis of approaches to governance

Having concluded trends analysis, we analysed the approaches to governance of investment in education infrastructure. By **governance** we refer to key principles, standards, processes, and procedures used to assess and forecast needs for investment, plan it, prioritise, approve, fund, and supervise projects, and ensure investment performance. Inventories of infrastructure, sources of funding, delivery modes, and actors involved were subject to the analysis too.

We explored the approaches to governance based on results of desk research, scoping interviews, and national (regional) mapping. To guide and structure research efforts, we focused on operational questions presented in the table below.

To the extent that existing data allows, we explored each of the aspects by level of education and training but focused on differences and similarities by Member State. In particular, we aimed to provide an overall picture on how investment is managed in the EU27, what are the standard (if any) or most divergent approaches adopted as well as good practice examples to use. The research on governance is explorative and qualitative. Findings of it are presented in Chapter 4, whereas good practice elements are covered in Chapter 5.

Table 4. Research questions on governance of investment in education infrastructure

Sub-topic	Questions
At the level of the European Union	
Models of governance	Do Member States have a strategic approach to the governance of education infrastructure and investment in it? Which ones? What are the types of approaches Member States adopt to govern education infrastructure and investment in it? Are some approaches more common than others? Which ones?
Good governance	Which aspects of the governance of investment (including principles, standards, processes, and procedures) are particularly helpful in ensuring that investment in education infrastructure is smart, effective, and inclusive? How can investment in education infrastructure (and good governance of it) help improve learning environments and (effectively) outcomes?
By Member State and, where applicable, region	
Strategic vision	To what extent does a strategic vision for education infrastructure and investment in it exist?
Making investment decisions	How are the needs for investment in education infrastructure assessed? What objective standards of measurement and sources of data are used? How often are such assessments conducted? What is the process/key steps taken? What are the methodologies used for planning investment in education infrastructure? To what extent is such planning based on the assessment of needs? What other factors are considered? How are the priorities settled and objectives set?
Gap analysis and forecast	What are the methodologies and data sources used to analyse gaps in investment in education infrastructure? What are the methodologies and data sources used to forecast

	the needs for investment in education infrastructure? To what extent are the long-term dynamics in demographics, environmental, health, geopolitical and other relevant risk factors considered?
Making delivery arrangements	What are the criteria and procedures for project prioritisation, approval, and funding? For example, do any standard design models or building specifications have to be used? Do certain requirements for furniture and equipment have to be met? Is potential energy consumption considered and/or sustainability assessed? What are the processes to ensure value for money and competitive tendering?
Execution and monitoring	How is the implementation of education infrastructure projects supervised? This may include construction supervision, budget and schedule control, etc. What are the methodologies used to measure and evaluate investment performance and take corrective actions, if needed? Are there any procedures used to measure the links between investments in education infrastructure and quality of education and training? What are the specific measures adopted to assess the results and impacts of investment? What are the methodologies used for ensuring asset performance throughout its lifecycle? These may include preventive maintenance and systematic replacement programmes as well as renovation initiatives. Is the information on investments in education infrastructure accessible to the public? How? To what extent are specific measures to increase transparency and ensure accountability employed? What are the methodologies used for generating, analysing, and disclosing data on facilities used for education and training? Is education infrastructure inventoried? How?
Funding sources and delivery modes	What are the key sources of funding employed? Examples include public (EU, national, regional, and local) and private funds. To what extent is funding centralised and comes from one source? To what extent is funding contingent on tax collection or any special campaigns? To what extent are bulk purchases made to make use of scale economy? What other solutions are employed to reduce costs? What are the key delivery modes and how are they chosen? Examples include direct public provision, public procurement, and PPPs.
Actors involved, their coordination, and consultation process	To what extent is the governance of investment in education infrastructure centralised at the national level? What are the actors involved in the governance of investment in education infrastructure? Public, private or both? What are their roles and responsibilities in different stages of governance? How do these actors coordinate across levels of government and levels of education and training? What stakeholders are consulted and how?

Good practice analysis

Selection of good practice examples for an in-depth review

We explored exemplary cases of organising infrastructure and improving learning environments. In particular, we focused on illustrative examples of smart, effective, and inclusive investment in education infrastructure which has contributed or is expected to contribute to improved learning outcomes. In consultation with DG EAC, eight good practice examples were selected for an in-depth review out of 39 suggested by national experts across all countries. These include:

- Use of enrolment projections and GIS for planning investment in educational infrastructure (Ireland)
- National Registry of School Buildings (Sistema Nazionale dell'Anagrafe dell' Edilizia Scolastica) (Italy)
- 'My school, a quality space. A guide for basic education' (Mon école, un espace de qualité. Guide pour l'enseignement fundamental) (Belgium)
- 'Parque Escolar' Secondary School Modernisation Programme (Portugal)
- 6Aika: Smart Learning Environments of the Future (Finland)
- Construction of the Life Sciences Centre (Vilnius University) (Lithuania)
- Holistic Building Programme of BIG (Austria)
- Schools of the Future (Bulgaria)

One should not consider that any one case completely encapsulates the good practice of investment in education infrastructure. The aim of the good practice case studies is to highlight positive examples of particular aspects, so that taken together they provide a comprehensive array of possible action areas. As such, a diverse spread of cases were chosen to cover variation in:

- The level of the initiative, from national, to regional, to local/specific projects
- The focus of the initiative on the governance of the process and/or the practical implementation
- The scale of the initiative, from new buildings to maintaining and equipping existing learning environments
- The geographical location of the initiative, a Member State or a region
- The stage of education and training, from pre-school to university

To provide coherence to these focused "inspirations", a holistic model of an idealised investment process for educational infrastructure was developed, and then refined in an iterative analysis process. The final version of it is presented together with the results of cross-case analysis in Chapter 5, as well as in the conclusions and recommendations of the study.

Data collection and assessment of good practice cases

We collected additional data on the good practice examples through desk research and interviews. Although it would have been beneficial to conduct study visits instead, given the travel restrictions imposed by the COVID-19 pandemic and time constraints,

we are convinced coupling interviews with desk research was the second best and the only feasible option.

Exploring each case, we considered a group of connected aspects, together with its observed impact(s) on the related parts of the idealised investment model. This helped us understand and illustrate the dynamics of the link between governance and the creation of improved learning environments.

We assessed the selected practices by applying a realist approach and structured analysis around key components of the context-mechanism-outcome (CMO) model (see the box below). Such an approach helped to reveal the potential of investments into education infrastructure and make recommendations with reference to necessary framework conditions.

Box 1. Realist evaluation and the main features of the CMO model

Developed by Ray Pawson and Nick Tilley, realist evaluation is a form of theory-driven evaluations. Back in the 1990s, Pawson and Tilley argued that to be useful for decision-makers, evaluations need to identify 'what works, for whom, how and in what circumstances' rather than merely 'what works'. Key research tasks for a realist are to hypothesise the key mechanisms, the key contexts and to explain the outcome pattern. Accordingly, applying a realist logic, one aims to reveal context-mechanisms-outcomes configurations (CMOCs), where:

- Contexts are external conditions that guide the selection of policy measures, favour or hinder the mechanisms in place, and influence the scope of policy impacts.
- Mechanisms are ways in which the policy measure's components, or a set of these components brings about change through subjects' reasoning and reactions.
- Outcomes are practical effects produced by causal mechanisms, which are triggered by policy measures within given contexts.

Above all, CMOCs show how changes in regularity (outcomes) are produced by policy measures introduced to modify the context and balance of mechanisms triggered.

Source: Adapted by the authors from De Souza (2013), 'Elaborating the context-mechanism-outcome configuration (CMOc) in realist evaluation: A critical realist perspective', Evaluation, Vol. 19, No. 2, pp. 141–154.; Pawson, R. and Tilley, N. (1997), Realist evaluation, Sage Publications Ltd.

Overall, such an approach allowed us to explore some examples under which circumstances and what kind of investments may produce the expected outcomes. This was especially important considering the transferability of the good practices, as through this analysis we were able to discover what works under what conditions and how. As a result, policymakers and practitioners in other countries will be able to "abstract" the principles in play from the original context and re-apply them appropriately into their own situation as described by Lillrank[3] in his power supply model of effective technology transfer.

[3] See Lillrank P. (1995). "The Transfer of Management Innovations from Japan." Organisational Studies, 16(6), p. 971-989.

Use of good practice examples selected for an in-depth review

It is intended that the good practice case studies serve several roles in the Final Report:

- act as a stimulus to action for individual stakeholders across the EU as they recognise common ground with the actors described and the challenges that they face
- evidence that such actions are feasible in the real world and reveal the type of impacts that can be achieved
- illustrate and substantiate the practical utility of the final version of the idealised investment process for educational infrastructure

Above all, good practice analysis highlights essential dynamic connections between the different parts and levels of the proposed investment process, stressing the importance of continuous improvement through effective feedback mechanisms and capture.

Development of conclusions and recommendations

Building on answers to research questions, we drew key conclusions with regards to investment in education infrastructure:

- **Trends:** key contexts, needs, priorities, objectives, scope, and source of investment, as well as investment gap
- **Approaches to governance:** key principles, standards, processes, and procedures used to assess and forecast needs for investment, plan it, prioritise, approve, fund, and supervise projects, and ensure investment performance, also inventories of infrastructure, sources of funding, delivery modes, and actors involved
- **Principles of good practice:** lessons learned and the way forward at different levels

Each conclusion is accompanied by a brief description of evidence that supports it.

Developing recommendations, we followed the utilisation-focused approach, which builds on the idea that studies should be judged by their utility and actual use[4]. We employed the results of the comparative cross-country analysis, good practice analysis and complementary desk research, and developed recommendations for both the European Commission and Member States. These recommendations focus on governance and indicate ways to ensure that investment in education infrastructure is smart, effective, and inclusive.

To validate the draft conclusions, we organised an expert workshop.

[4] Patton, M. Q. (1997). Utilization-focused evaluation: the new century text. SAGE Publications, 3rd edition.

We prepared a short (9 pages) document, summarising the emerging study conclusions and recommendations. The document was disseminated to the workshop participants before the event. We invited 48 participants to the workshop, focusing on key stakeholders in the areas of relevance to this study, including investment financing models, greening, digital aspects. National experts were also invited to participate and extended the invitation to the people that they have interviewed during the mapping stage. The categories of stakeholders who participated in the workshop are presented in the table below.

Table 5. Stakeholders who participated in the workshop

Stakeholder type	**Specific organisations/participants**
European Commission	DG EAC
International organisations and financial institutions	The World Bank European Investment Bank The Social Development Bank for Europe
National experts	National experts from: ▪ Spain ▪ Bulgaria ▪ Romania ▪ Czechia ▪ Portugal ▪ Belgium
National stakeholders	High level official(s) in the Ministry of Education from: ▪ Lithuania ▪ Malta ▪ Ireland Representative of Association of Local Authorities in Lithuania Representative from University of Barcelona in Spain

The workshop was held online on Teams platform. The workshop lasted 2.5 hours and included interactive breakout rooms. We prepared an internal document, summarising the results of the workshop and accordingly refined our study conclusions and recommendations. Validated and final conclusions and recommendations are featured in this report.

An accompanying communication strategy was prepared to disseminate the final study results to the education stakeholder community.

To make sure the deliverables reach their target audiences, we prepared the communication strategy. It details the communication objectives, key target audiences, main messages, and communication activities. The implementation of the strategy builds on the principles of co-ownership of the communication actions and the development and execution of the work plan.

Trends in investment in education infrastructure

Context of investment

The demand for investment in infrastructure is driven by changes in the population, economy, technology, society, education policy, and environment as well as policy developments. In education, the needs for infrastructure investment are directly shaped by the following:

- Dynamics in demographics, including geographical patterns and population shifts;
- Scope and condition of the existing infrastructure.

Moreover, the national (including regional) mapping revealed a number of other factors of influence. The effects of all these in the last decade in the EU27 are discussed in the sections below.

Dynamics in demographics

One of the key factors defining the needs for infrastructure investment in education is the change in the number of students enrolled. The higher the growth of enrolments, the more pressure to invest in the building stock, be it expanding the existing capacity (to absorb the change in demand) or constructing new facilities. This goes hand in hand with the increased demand for the furniture, machinery and equipment, ICT and other types of fixed assets, depending on the level of education in question. A downward trend in enrolments can also imply the need for investment in education infrastructure, even if the pressure is lower. Such need is often linked to the optimisation of the school network and repurposing buildings for future use, and even closing some buildings as needed.

The number of enrolments in early childhood, primary and lower secondary education is typically influenced by these key factors:

- **Birth rates:** From the 1960s until the mid-1990s, the average number of childbirths per woman in Europe decreased[5]. It recovered somewhat in the 2000s and then roughly stabilised in the decade that followed. In 2018, the figure stood at 1.55 children per woman, which is 0.12 lower than in 2001 and well beyond the value of 2.1, which is considered to be the level required to keep the population size constant in the absence of migration. Out of 1169 NUTS-3 regions in the EU27, only four had the fertility rate above such level. This illustrates well that, in the absence of migration, the number of enrolments in early childhood and compulsory (primary and lower secondary) education would decrease in all Member

[5] European Commission. (2020). European Commission Report on the Impact of Demographic Change. Available at: https://ec.europa.eu/info/files/report-impact-demographic-change-reader-friendly-version-0_en

States, reducing the scale of infrastructure required and slowing down the acquisition of new buildings.

- **Net migration:** In the last 35 years, Europe has been a continent of net immigration[6]. In 2018 alone, 2.4 million people immigrated into the EU27, while 1.1 million people emigrated to a non EU27 country. In the same year, 1.4 million people (including third country nationals living in Europe) moved to another Member State. Although this had no significant effect on the size of the overall EU population, it did have an impact at the national level. Overall, positive net migration has the potential to mitigate the negative effects of the low birth rate on enrolments at early childhood, primary and lower secondary levels, and to put pressure on maintaining existing and/or acquiring new building stock. In contrast, negative net migration intensifies the effect of low birth rates on enrolments at aforementioned levels of education, and typically leads to efforts to optimise the network in the longer term.
- **Absorption rates:** This is especially important in upper secondary and tertiary education. As upper secondary and tertiary education in not compulsory in most countries (in some EU27 countries upper secondary education is considered compulsory as all residents must attend school until they are 18 years old), the demand for education infrastructure may increase in case upper secondary and tertiary education becomes more attractive to students.

In contrast to early childhood and compulsory education, in upper secondary, post-secondary non-tertiary, and tertiary education demographics have little influence on enrolments. At these levels, the number of students enrolled is influenced by other factors, such as: education requirements, school drop-out rate, variety and popularity of existing post-secondary pathways, and quality of higher education services in the country. The national (regional) mapping revealed that if these evolve, the needs for investment in education often do too.

The cumulative effect of the factors discussed can be observed in a time-series of enrolments (see the table below). The positive difference between the number of students enrolled at all levels in 2019 and 2009 is the highest in France, Spain, and Sweden, whereas this trend is the most negative in Poland, Romania, and Portugal. In terms of overall trends in enrolments observed in 2009-2019, Member States can be clustered into three groups (please note that full data was available for 22 countries):

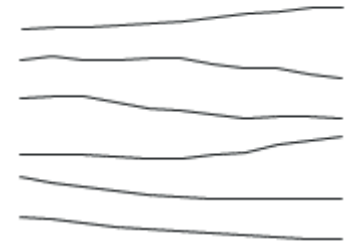
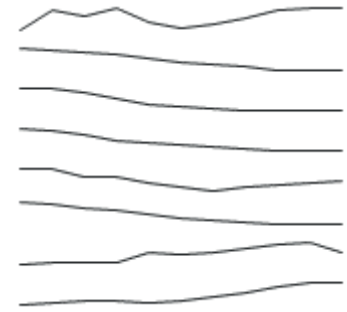
- **Upward change:** Belgium, Denmark, Ireland, France, Cyprus, Finland, and Sweden
- **Downward change:** Bulgaria, Czechia, Croatia, Italy, Latvia, Lithuania, Hungary, Poland, Portugal, Romania, and Slovakia
- **Fluctuations:** Germany, Malta, Austria, and Slovenia

While the table below does not allow to make insights by level, it does reveal the evolution of needs for infrastructure investment in education in general. In countries

[6] Ibid.

where the number of students enrolled has increased, investment in new building stock is required. Meanwhile, a decrease of total enrolments calls for network optimisation and repurposing of existing building stock, which also requires investment.

Table 6. Students enrolled at all ISCED levels in 2009-2019 in the EU (22 countries)

	Difference between the number of students enrolled in 2019 and 2009	Change in the number of students enrolled in 2009-2019
Belgium	182 442	
Bulgaria	-136 019	
Czechia	-60 922	
Denmark	61 544	
Germany	3 098	
Estonia	*Not available*	*Not available*
Ireland	321 667	
Greece	*Not available*	*Not available*
Spain	405 573	*Not available*
France	844 943	
Croatia	-42 577	
Italy	-301 569	
Cyprus	15 955	
Latvia	-82 255	
Lithuania	-235 287	
Luxembourg	20 819	*Not available*
Hungary	-319 937	
Malta	206	
Netherlands	*Not available*	*Not available*
Austria	29 570	
Poland	-1 209 622	
Portugal	-448 875	
Romania	-1 006 653	
Slovenia	-12 068	
Slovakia	-181 827	
Finland	28 866	
Sweden	326 253	

Source: Compiled by the authors based on Eurostat, Pupils and students enrolled by education level, sex, type of institution and intensity of participation (EDUC_UOE_ENRA01) (for 2013-2019) and Students by ISCED level, age and sex (EDUC_ENRL1TL) (for 2009-2012).
Note 1: ISCED levels changed in 2011. Although aggregate numbers including all levels are reflected in the table above, the set and content of these levels for 2009-2012 (based on ISCED 1997 classification) and 2013-2019 differs (based on ISCED 2011).

Note 2: Eurostat does not provide data on students enrolled in Estonia in 2017, 2018 and 2019, in the Netherlands in 2013, 2014 and 2019, and in Greece in 2009, 2013 and 2014. This is why neither the difference between the number of students enrolled in 2019 and 2009 can be calculated nor change in time illustrated for these countries. Data on Luxembourg is not available for 2013 and 2014, and that on Spain for 2013, hence the change in the number of students enrolled in 2009-2019 cannot be illustrated for these countries either.

At the level of the EU27, the population has grown consistently since 1960, which implies gradual increase in enrolments and needs for new building stock. Such a trend is set to continue, but not for long. Projections of the European Commission suggest that Europe's population will remain rather stable for the next two decades and then start declining and reach a 5% reduction in 50 years[7]. The demographic indicator taken alone (without considering the ageing of the buildings and the inadequacy of existing facilities) implies that the needs for the acquisition of new building stock will decrease, sparing resources for investment in other assets and triggering a shift in educational investment objectives and priorities towards a focus on optimisation and quality.

Trends in enrolment by level of education differ and may not be in line with the overall change in enrolments. Based on the national (regional) mapping, developments vary across the countries, but a common challenge for many countries is the increasing demand for early childhood and primary education, hence the infrastructure investment in it.

Within each Member State, the needs for investment in infrastructure depend on location. Between 2014 and 2019, in rural regions of the EU27, the population dropped by 0.8 million, whereas the population in urban regions grew by 3.8 million over the same period[8]. This suggests an overall trend of urbanisation, which increases demand for education infrastructure in urban locations and leads to the closure of some education institutions in rural areas. Some differences across countries and regions exist, though. For instance, there are Member States where demand in rural regions did grow. Nevertheless, the overall trend is that regions close to cities tend to grow, whereas more remote ones tend to lose their population. This has significant impacts on the needs for education infrastructure by location.

Level of economic development of a region and economic wellbeing of its population may influence the investment in education infrastructure as well. Research reveals that education institutions (for example, schools) receive additional support if they are located in an area that has a high concentration of poverty[9]. Regardless, the mapping

[7] Ibid.

[8] Ibid.

[9] Verelst, S., Bakelants, H., Vandevoort, L., Nicaise, I. (2020). The governance of equity funding schemes for disadvantaged schools: lessons from national case studies. NESET report, Luxembourg: Publications Office of the European Union. Available at:

did not reveal the share of the poverty-struck in the population or level of economic development of a region to be key factors driving infrastructure investment in education in most Member States. Nevertheless, it did capture examples where decision makers took inequalities by location into account, for instance:

- In **Portugal**, schools differ in terms of the socioeconomic background of students that attend them, therefore TEIP[10] 3 Programme was launched. The programme is designed exclusively for schools in underprivileged areas with high dropout rates. As of 2021, this represents 136 school clusters, and around 16% of Portuguese schools. The programme is expected to promote learning and academic success, improve the efficiency of resource management, and increase the effectiveness of school efforts in terms of results achieved. TEIP schools are prioritised when it comes to interventions in terms of both infrastructural and pedagogical support.

Needs for investment in infrastructure are shaped by not only overall trends in enrolment but changes in the composition of the enrolled population too. This is especially true for people with special educational needs and disabilities. The recognition of these has improved to the point where more students are diagnosed with special educational needs and disabilities. Consequently, the share of enrolments this sub-population comprises has increased in some countries:

- **Finland**: According to mapping results, the number of students with special needs has increased, however, the number of special needs schools has decreased as a result of the effort to integrate special needs students into mainstream schools, provided that the necessary adaptations are made [11].
- **Hungary**: The number of students with a disability has been steadily increasing, but only a very small share (around 6%) receive early childhood development services at the institutional level.
- **Lithuania**: The share of students with special needs and disabilities has increased in pre-primary, primary and secondary education, with the majority of such students attending joint classes.
- **Belgium (Wallonia)**: Over the last 10 years, the share of special education in each level has been increasing, and there is a clear political

https://nesetweb.eu/wp-content/uploads/2020/02/NESET_analytical_report_3-2019.pdf.

[10] Programa Territórios Educativos de Intervenção Prioritária https://www.dge.mec.pt/teip. This is the third edition of TEIP programme.

[11] https://www.hel.fi/helsinki/fi/kaupunki-ja-hallinto/strategia-ja-talous/kaupunkistrategia/kiinteistostrategia/; https://tilastokeskus.fi/til/erop/2019/erop_2019_2020-06-05_tie_001_fi.html; https://www.finlex.fi/fi/laki/alkup/2010/20100642

will to progressively advance the inclusion of students with special needs in mainstream education.

The national (regional) mapping captured the increase in enrolment of students with special needs and disabilities in the following countries as well: Austria, Denmark, France, Ireland, Romania, and Italy. This was triggered mainly by improved recognition and encouraged efforts towards inclusive learning spaces and accessible infrastructure.

Scope and condition of existing infrastructure

In most Member States of the EU27, systematic monitoring of the existing infrastructure conditions at all levels of education does not exist. However, some countries make efforts to monitor the scope and condition of infrastructure in education at least at one or a few levels:

- **Italy**: For school buildings in Italy, a web portal and database were launched in 2019. Each school building has a unique code that is used to identify it in the school building registry. The database includes ownership documentation, building drawings, number of educational spaces, their dimensions, information on the age of the building, condition of it, investments made, etc. 158 different data indicators are covered.
- **Belgium (Flemish education administration)**: For primary and secondary education, every five years Flemish Government, Agency for School infrastructure AGION[12] prepares a school building monitoring report. It describes the quality, use and management of the educational buildings in Flanders and Dutch education in the Brussels-Capital region (except for higher education). The last edition was published in 2019. Also, GO! (a public school network) completed a thorough inventory of its infrastructure, and now has a digital database of its assets.
- **Belgium (Francophone education administration)**: A meta-inventory was officially started during the spring of 2021 to collect data on the age and physical condition of buildings. This effort is part of a large review of the policy and management of infrastructure that was launched in 2020 and aims to adapt school infrastructure to the Pact for Excellency Education (reform process began in 2015) and to the carbon neutrality objectives set by the Walloon and Brussels regions.
- **Romania**: Educational infrastructure is monitored via the Integrated Information System of Education in Romania (SIIIR). It records data on the following categories of material resources: buildings (year of construction, property type, built area, video and/or audio surveillance equipment available, technical status, number of rooms, utilities, amenities, seismic risk class etc.), classrooms (type, area, floor number, facilities, beneficiaries), transport vehicles, and land (data on land belonging to educational institutions: area, land type, fencing, roads

[12] AGION – Flemish Government, Agency for School infrastructure

access). The data is entered by each school, every year. The GIS application includes data at county, commune, and school levels.

The national (regional) mapping captured efforts to monitor the scope and condition of infrastructure in education in the following countries as well: Croatia, France, Greece, Lithuania, Ireland, Malta, Hungary, Luxembourg, Portugal, Bulgaria, Estonia, and Spain. However, efforts made in these Member States are not systematic either. Information collected covers only some levels of education and/or asset types; often, it is incomplete and/or inaccurate due to irregular inspections.

Evidence that exists, even if qualitative or anecdotal, suggests that a large share of the building stock in the EU27 is old (above 40 years) and may require major renovation, refurbishment, or replacement. Health and safety is a concern in many Member States as is low energy efficiency, which fuels high operating costs. Some countries, like Portugal and Italy, are solving specific problems of old buildings by investing in removing asbestos from school buildings, including with the support of EU funds (the case in Portugal). Since comparable data on the condition of educational infrastructure is lacking, differences across Member States and levels of education cannot be explored.

Other factors

The national (regional) mapping revealed that the nature and scale of investment in education infrastructure is influenced not only by dynamics in demographics and condition of the existing infrastructure, but an array of other factors too, for example:

- Climate goals and environmental targets
  - **Luxembourg**: Led by environmental targets, such as those set by the 2015 Paris Agreement and Directive 2012/27/EU of the European Parliament and of the Council of 25 October 2012 on energy efficiency, the Government of Luxembourg has decided to maintain the building energy efficiency renovation rate set by the aforementioned Directive for buildings owned and occupied by the Government after 2020.
  - **France**: Legislation has set ambitious environmental targets in the last decade. Recent examples include the 2015 law on energy transition for green growth, the 2019 law on energy and climate and the 2018 law called ELAN (housing, territorial planning and digital evolution). For instance, the latter (article 175) sets targets for reducing the energy consumption of tertiary sector buildings (including those used for education and training) of more than 1 000 square meters.
- Education policy and reforms
  - **Croatia**: The country strives to increase the number of hours per day primary students spend in their schools and do so by moving to a one-shift teaching system[13]. Almost 60% of all pupils in

[13] One-shift teaching system would mean that classes begin in the morning and end in afternoon or evening for all students going to the same school. Currently, there are

primary education are in schools that currently operate in two shifts, while 3% of all pupils attend classes in schools that operate in as many as three shifts. The key precondition for a transition to one-shift teaching at primary schools is improving school infrastructure and its capacities.

- Early school leaving
  - **Malta**: A noticeable reduction in secondary school absenteeism was achieved thanks to infrastructure investments and policy changes in Malta. There are initiatives in place that aim to reduce early school leaving. For instance, "My Journey" introduced vocational subjects in secondary schools, and so fuelled the need for infrastructure investment (especially in terms of equipment) in these VET schools.
- Horizontal policies such as inclusion of people with special needs and disabilities
  - **France**: Measures were implemented to foster enrolment of people with disabilities, for example, a 2005 law on the obligation to make public facilities accessible to people with physical and mental disabilities or a 2013 law which introduced a multiannual disability master plan for higher education institutions.
- COVID-19 pandemic
  - **Cyprus**: The pandemic has strengthened the need to update ICT at schools as well as the quality and sufficiency of digital technologies available to educators. The existing infrastructure in some cases is still very basic, with some primary and secondary schools using old equipment (computers as old as 12 years) and suffering from connectivity issues. Similar importance of ICT equipment in schools was noted in other countries, like Lithuania, Poland, Portugal and Slovenia.
  - **Estonia**: Due to the pandemic, importance of ventilation systems in schools was highlighted. Every school now must monitor CO2 levels in classrooms and guarantee natural ventilation as well as ensure proper ventilation systems.
- Terrorist threats
  - **France**: Several terrorist attacks have taken place in France in the last decade. After several months at the maximum risk level, the Vigipirate plan, a national tool of vigilance, prevention, and protection against the terrorist threat, is currently set at the "enhanced security - risk of attacks" level. The terrorist threat triggers investment in education infrastructure to secure buildings and enhance the safety level of learners and staff.
- Risk of earthquakes and other natural disasters
  - **Italy**: The country proceeds with improvement and adaptation of school buildings in seismic areas 1 and 2. It makes use of

two (and in some instances – three) shifts in schools, meaning that for some students classes begin in the morning, while for others – in the afternoon.

seismic activity and improves energy efficiency of buildings to achieve a decrease of energy consumption by 50%.
    - **Greece**: A country that is predominantly earthquake-prone, has constant and diachronical problems with school buildings caused by earthquakes. For example, an earthquake in Thessaly completely destroyed two school buildings, that dated back to the 1930s.
    - **Spain**: Maintenance of older universities requires a large investment, which is not being carried out, and which can generate safety problems, such as fires or floods[14]. To deal with these problems there are specific projects in place. For example, Smart UIB programme in the University of Balearic Islands improved the condition of Ca ses Llúcies Innovation Centre, that has been the subject of a construction and energy rehabilitation, financed with European funds[15].
- Climate change and heatwaves
    - **France**: Increased frequency and intensity of heatwaves have consequences on health. In its guide on improving the thermal comfort of buildings used for education during heatwaves, the French Government suggests investing in outdoor solar protection blinds, improving the insulation of buildings and using fixed or removable structures to provide shaded areas for learners.
- Historical heritage
    - Some buildings used for education and training are treated as historical heritage. This is especially true in higher education. The maintenance of such buildings is often costly, whereas renovation requires following certain standards, which often increases the scope of investment required. For instance, in **Spain**, the Community of Navarra reports that the state of the educational infrastructure is not optimal in terms of maintenance costs. Both the Basque Country and Catalonia report that their infrastructure in education is very heterogeneous due to the historical character of certain areas and their urban centres.
- Digitalisation
    - **Portugal**: The programme for school digitalisation, among other objectives, aims at improving the ICT infrastructure at schools. The focus is on equipment, internet access and teachers' digital skills, as well as the development of digital educational content (supported by distance teaching and learning platforms and teleworking), the digitalisation of didactic and pedagogical resources, digitalisation of national tests and exams and the supply of computers for individual use by schools. These are all aligned with the EU Recovery and Resilience facility.

[14] Findings from interviews with national stakeholders.

[15] https://smart.uib.eu/Activitats/Projectes/Ca-ses-Llucies/

Investment needs, priorities, and objectives

Although trends in enrolment, hence also the investment in new building stock, differ across the EU27, many challenges Member States face are the same. Based on the national (regional) mapping, in 2012-2020 some of the most common priorities and objectives were:

- School network optimisation to address overcrowding or, in contrast, low occupancy rates, and to reduce the transit from home to school
- Health and safety (to tackle front-line challenges such as asbestos, fire hazards, leaking roofs, poor indoor quality, non-sanitary bathrooms, poor ventilation especially in COVID-19 situation etc.)
- Energy efficiency and sustainability to reduce the number of buildings with high energy consumption.
- Accessibility of facilities (to boost the inclusion of people with disabilities and special needs)
- Investment in ICT infrastructure (to improve internet access, and stock of computer hardware and software)
- Investment in equipment and modern laboratories (to support STEM education)
- Adapting to modern pedagogy and improving the quality of the buildings in general (to provide schools with spaces that provide multiple opportunities for learning that fit current pedagogy needs (such as mobile walls, open classrooms, etc.) and improve learning environments in general)

As evidenced by the table below, in 2012-2020 most Member States of the EU27 aimed at investing in ICT infrastructure. Some were keen on providing education institutions with fast internet connection (for example, Croatia, Slovenia and Ireland), and others focused on offering institutions computers and other devices (for example, Poland, Germany, the Netherlands, Portugal and Spain). This is hardly surprising as technology-assisted learning and teaching have been evolving fast and providing new opportunities. Energy efficiency and sustainability were also among the most common priorities. The focus was on both making the buildings more energy efficient as well as managing CO2 emissions. For example:

- **Austria** set an objective to reduce the use of fossil fuels to 0 by 2025, have at least 20ha of roof surfaces that are photovoltaic before 2023, and increase the use of ecological building materials as of 2020, meaning that investment will be focused not only on making the buildings energy efficient, but also managing CO2 emissions while doing so.
- Similar near-zero emission targets were set in other countries such as the **Netherlands** and **Sweden**; the use of renewable sources to reduce energy consumption was also prioritised, for example, in **Spain**.
- Some interesting initiatives that concern sustainability include efforts in **Finland** to build schools from wood, and those in **Austria** to do so from ecological building materials.
- The movement towards sustainability and energy efficiency is in line with priorities set at the level of the EU and in some countries is driven by these. This illustrates well how developments in EU policy influence

the priorities and objectives set in the Member States, especially those that rely more heavily on the EU funds (for example, **Lithuania, Latvia, Hungary, Poland, Slovakia** and others).

Table 7. Most common priorities and objectives in investment in education infrastructure in EU27, by Member State

Country	Network optimisation	Health and safety	Energy efficiency / sustainability	Accessibility	ICT	Equipment / laboratories	Modern pedagogy / quality buildings
Austria			+		+	+	+
Belgium (Dutch)	+		+				+
Belgium (French)	+	+	+	+			+
Bulgaria	+	+	+	+	+	+	+
Croatia	+				+		+
Cyprus	+	+	+	+	+		
Czechia							
Denmark	+		+	+	+		
Estonia	+		+	+	+		
Finland		+	+		+		+
France	+	+	+	+	+		
Germany		+		+	+		+
Greece			+		+		+
Hungary	+		+		+		
Ireland	+		+		+	+	
Italy		+	+	+	+		+
Latvia			+	+	+		+
Lithuania	+	+	+	+	+	+	+
Luxembourg		+	+		+		
Malta		+	+	+	+		+
Netherlands		+	+		+	+	
Poland		+		+	+		
Portugal	+	+	+	+	+	+	+
Romania	+	+		+			+
Slovakia	+		+	+	+		+
Slovenia					+		
Spain	+	+	+	+	+	+	+
Sweden	+		+		+		

Source: Compiled by the authors based on the national (regional) mapping results.

Health and safety were also high priorities among the countries. This is especially evident in the Member States that have older buildings, which often are not up to health and safety standards. Investment in equipment and modern laboratories for STEM turned out to be a key only for several countries. For example, **Lithuania** aims to equip general schools (primary, lower secondary and upper secondary levels of education) with modern laboratories in the hopes to improve the quality of teaching and learning. Similar developments have been taking place in **Ireland**.

Also, a number of Member States expressed the need to invest in infrastructure for the purpose of accommodating modern pedagogy. For example:

- **Austria** wants to introduce the idea of a living space into schools. This relates to not only good architecture, but also ensuring that the environment created optimally supports the pedagogy practiced in it.
- **Germany** plans to apply pedagogical and educational concepts while investing in ICT infrastructure.
- **Italy** has a program call "Scuola Bella" ('Beautiful School') supported by government and private institutions, which intends to make school buildings more attractive.

The recognition of needs to adapt learning spaces to new teaching approaches does not depend on the quality or complexity of a country's education system. Instead, it is driven by the overarching desire to provide learners with well-equipped and student-centred learning environments. While many focus on classrooms and other indoor spaces, some countries also set the objectives regarding green areas and outdoor environment (examples include Bulgaria, Portugal and Sweden).

The national (regional) mapping revealed no significant tensions or competition between investment priorities and objectives, although this does not deny the existence of challenges related to the allocation of funds, for example:

- In **Wallonia (Belgium)**, tensions arise when deciding on the allocation of finance between the organised official education network (with buildings in the ownership of the FWB), the subsidised official education network (with buildings in the ownership of communes and provinces), and the subsidised free education network (with privately owned buildings). Similar tensions can be observed in Denmark, Sweden, and other countries.
- In **Croatia**, tensions in terms of resource allocation and management between the need to reform the primary education network and expand secondary education network arise. These also compete with the need to invest in ICT in higher education.
- In **Malta**, ICT needs to be improved at all levels of education, hence the challenge of the most efficient resource allocation among education institutions.

Based on the scoping interviews and national (regional) mapping, a decade is too short for meaningful shifts in priorities and objectives of investment in education infrastructure to emerge. In many cases, there is a span of 3 to 5 years between detection of the need for a new building and such building being constructed and fully operational, Such investment is typically based on long-term plans that set the direction at least five years forward, thus within a decade some plans for investment may not even materialise to the full, let alone priorities or objectives change. Such stability spanning a few political cycles has the potential to boost the efficiency of investment. Nevertheless, major disruptions have the potential to strengthen the focus on some rather than other priorities and objectives or introduce new ones in the short-term. This is well illustrated by the COVID-19 pandemic. It pushed Member States of the EU27 to rapidly invest in ICT infrastructure and introduced a new focus on ensuring proper ventilation and indoor air quality.

With regards to the future, trends observed in the last decade are likely to continue. In line with the horizontal policies and objectives that go beyond education, some

trends, for instance, investment in energy efficiency and ICT infrastructure are set to become more pronounced. Considering the shift towards the improvement of learning spaces to fit modern pedagogy, in the short-term significant changes are more likely in countries which have little challenges in relation to the accessibility, safety and health of their education buildings.

No meaningful differences between investment priorities and objectives by source are observed. The national (regional) mapping suggests that countries treat EU and national funds as complementary and use both to reach pre-defined policy goals. There are some countries, for example, **Lithuania** and **Slovakia**, that invest in education infrastructure using mainly EU funds, whereas others, such as **Malta, Germany**, and the **Netherlands**, employ mainly national funds. Nevertheless, no meaningful differences in terms of priorities and objectives between the two groups are observed. Most countries share the priorities and objectives regardless of the main source of funds that they use. This happened despite the notion that EU funding is usually targeted at innovation or at tackling challenges and shortcomings aligned with EU policies and recommendations.

Scope and source of investment

Data on national or regional infrastructure investment amounts, let alone its sources of finance, are not readily available[16]. Infrastructure investment falls under different economic activities, hence it is not classified as a separate item in national accounts[17]. This explains why neither Eurostat nor other international data providers, including the European Commission, European Investment Bank, OECD, and World Bank, offer direct measurements of total infrastructure investment in education by country. While these organisations provide national accounts aggregates and government finance statistics (e.g., total expenditure on education), investment in education infrastructure is not measured directly. The difficulty of accessing comprehensive and comparable data on investment in education infrastructure was confirmed by the national (regional) mapping as well.

In the absence of a standard indicator, the most common approach is to employ gross fixed capital formation (GFCF) in the activity sectors of interest[18]. This applies to all sectors of economic activity commonly labelled as 'infrastructure', including education. According to Eurostat, GFCF, also known as investment, consists of resident producers' acquisitions, less disposals, of fixed tangible and intangible assets during a

[16] European Investment Bank. (2010). Public and private financing of infrastructure: Evolution and economics of private infrastructure finance. EIB Papers, 15(1), 17-39.

[17] Zachariadis, I. (2018). Investment in infrastructure in the EU: Gaps, challenges, and opportunities. European Parliamentary Research Service.

[18] European Investment Bank. (2010). Public and private financing of infrastructure: Evolution and economics of private infrastructure finance. EIB Papers, 15(1), 17-39.

given period plus certain additions to the value of non-produced assets[19]. Examples include machinery and equipment, vehicles, computer software, buildings and structures, literary or artistic originals and major improvements to land. These assets are intended for use in the production of other goods and services; within the frames of this study, the focus is on education.

GFCF is the only ready-to-use indicator of infrastructure investment and allows for cross-country comparison. This is why it is widely used by the European Investment Bank[20] and has been adopted for this report. Nevertheless, the indicator is not ideal. The main pitfall of using GFCF is that it may overestimate true infrastructure investment; it reflects the investment in all types of fixed assets, some of which may not be infrastructure-related[21]. Given this, the analysis of the scope of investment in education infrastructure based on GFCF in education shall be treated with caution. That being said, the overestimation effect does not deny trends described in this section. GFCF is well fit to illustrate changes in time and differences across countries, which are of primary interest to this study in contrast to knowing the very exact scope of investment at any time.

Some suggest that, on average, infrastructure investment accounts for 8-10% of the total expenditure on education with wide variations out of the range depending if a country in on an expanding or contracting mode. However, using a fixed percentage is not fit for trends analysis as it prevents one from exploring changes in time and differences across countries. Both – historical and geographical – dimensions will prove essential to describing trends in this section, hence GFCF is used as the best from available measures of infrastructure investment in education.

Taking GFCF as a measure, after a period of growth marked with a peak in 2010, investment in education infrastructure plummeted to hit decade low in 2012. The recovery from the effects of the financial and economic crisis started in 2013. In 2013-2018 the scope of investment in education infrastructure steadily increased, except for 2016, when it dropped and briefly paused the upward recovery trend (see 'Total fixed assets in education' in the figure below).

Examining three types of assets[22] closest to infrastructure and most relevant in education – other buildings and structures, machinery and equipment, and computer

[19] Eurostat. (n.d.). Gross fixed capital formation, volumes. Retrieved 19 May 2021, from https://ec.europa.eu/eurostat/web/products-datasets/-/teina041

[20] See, for example, Investment Report 2018/2019: retooling Europe's economy, Investment Report 2019/2020: accelerating Europe's transformation, and Investment Report 2020/2021: building a smart and green Europe in the COVID-19 era, all available at https://www.eib.org/en/publications/.

[21] European Investment Bank. (2010). Public and private financing of infrastructure: Evolution and economics of private infrastructure finance. EIB Papers, 15(1), 17-39.

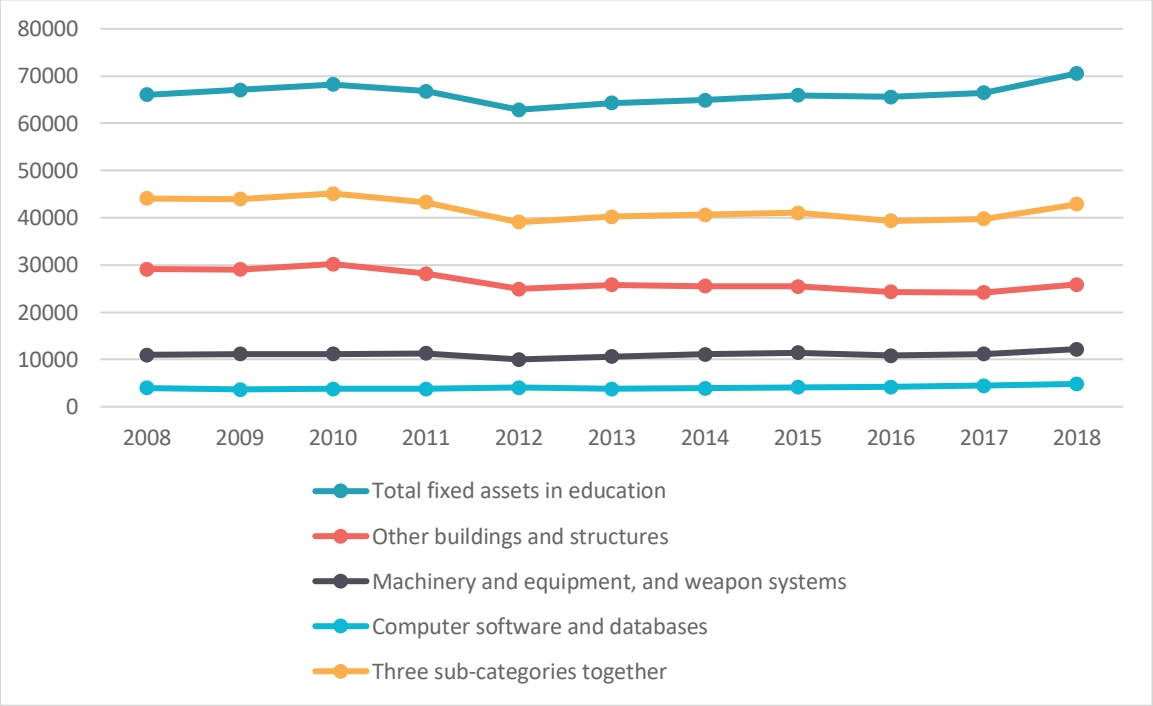
[22] Eurostat classifies assets into the following categories: **dwellings, other buildings and structures** (buildings other than dwellings and other structures), **machinery**

software and databases taken together – the trends in 2008-2018 were similar. Investment peaked in 2010, plummeted to reach its lowest in 2012, and started recovering after with a short pause in 2016-2017 (see 'Three sub-categories together' in the figure below). However, the total GFCF for the three sub-categories is significantly lower than the total fixed assets in education. This illustrates the overestimation effect of using GFCF as an indicator of infrastructure investment mentioned above. Investment in buildings and structures, machinery and equipment, and computer software and databases in 2008-2018 fluctuated between 39 and 45 billion euro, whereas investment in total fixed assets in education – between 63 and 71 billion euro. Such differences in absolute numbers do not change the conclusions on trends but shall be considered interpreting findings on general government GFCF in education, for which data by asset type is not available.

That being noted, the trends in infrastructure investment in education observed in 2008-2018 were driven mainly by changing investment in buildings and structures. Spending on computer software and databases, and machinery and equipment had not fluctuated that much. This explains why in 2018 investment in assets of these two types was slightly higher than in 2008, whereas investment in buildings and structures had not reached the levels before the economic and financial crisis which started in 2007-2008.

and equipment (transport equipment, ICT equipment, computer hardware and telecommunications equipment), **weapon systems**, **cultivated biological resources**, and **intellectual property products** (research and development, mineral exploration and evaluation, computer software and databases, entertainment, literary or artistic originals, and other intellectual property products).

Figure 1. Gross fixed capital formation in education (chain linked volumes) in 2008-2018 in EU27



*Source: Compiled by the authors based on Eurostat, Gross capital formation by industry (up to NACE A*64) (NAMA_10_A64_P5) and (to fill in gaps and for computer software and databases) Cross-classification of gross fixed capital formation by industry and by asset (flows) (NAMA_10_NFA_FL).*
Note: Eurostat offers the indicator of GFCF in different measures such as current prices, chain linked volumes, previous year prices, and price index. To adjust for inflation or deflation and obtain the most accurate data, above we use chain linked volumes with 2010 as a reference year. Data on Cyprus and Croatia are not available, hence they are excluded. Data on computer software and databases is not available for not only Cyprus but Denmark (2016-2018), Ireland, Greece, Poland, and Portugal too, thus the figures for this sub-category are underestimated.

In 2008-2018, more than 751 574.7 million euro was invested in education infrastructure in the EU27. Data by year is presented in the table below. **The most** was allocated in **Germany** (217 493.0 million euro), **France** (116 590.0 million euro) and **Spain** (84 360.0 million euro), whereas **the least** in **Malta** (523.9 million euro), **Bulgaria** (1 145.1 million euro) and **Latvia** (1 378.8 million euro)[23]. Such differences can be explained mainly by the size and economic capacity of the countries.

[23] Data on Cyprus and Croatia are not available, hence they are excluded.

Table 8. Gross fixed capital formation in education (current prices) in 2008-2018 in EU27

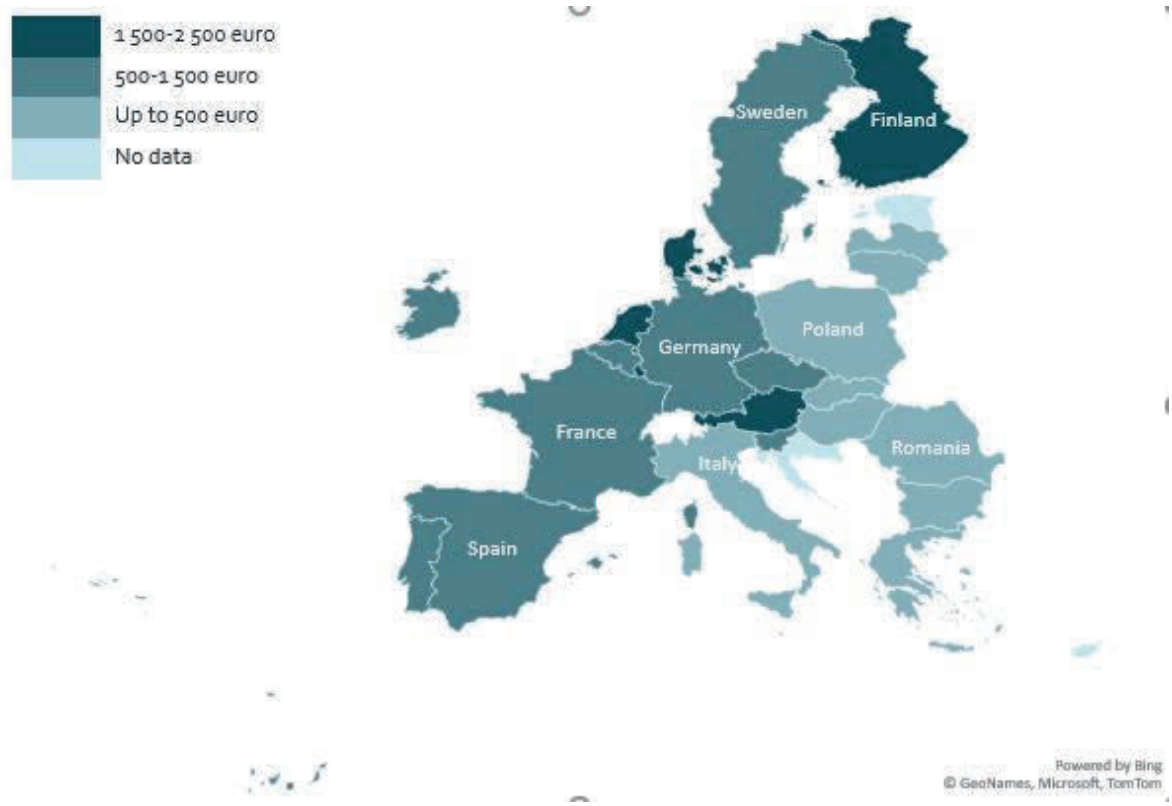
2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
65 363.7	65 953.7	68 227.1	68 029.1	65 017.2	66 950.6	67 822.3	69 251.3	69 512.1	71 655.5	77 336.1

*Source: Compiled by the authors based on Eurostat, Gross capital formation by industry (up to NACE A*64) (NAMA_10_A64_P5).*

Note: Eurostat offers the indicator of GFCF in different measures such as current prices, chain linked volumes, previous year prices, and price index. To be able to aggregate data from multiple years, GFCF is measured by current prices, million euro. Data on Cyprus is not available, hence it is excluded; Croatia joined the EU in 2018, thus it is not featured in the table above either. Data for Denmark in 2018 are from Eurostat, Cross-classification of gross fixed capital formation by industry and by asset (flows) (NAMA_10_NFA_FL).

In terms of infrastructure investment per student, in 2018 it was the highest in **Denmark** (2381 euro), **Luxembourg** (2012 euro) and **Austria** (1944 euro), and the lowest in **Bulgaria** (64 euro), **Italy** (147 euro) and **Romania** (179 euro). Same year, differences between regions were observed with Northern, Western and Southwestern countries investing more than Eastern and Southeastern ones (see the map below).

Figure 2. Gross fixed capital formation in education (current prices) per students in 2018 in EU27



*Source: Compiled by the authors based on Eurostat, Gross capital formation by industry (up to NACE A*64) (NAMA_10_A64_P5) and Pupils and students enrolled by education level, sex, type of institution and intensity of participation (EDUC_UOE_ENRA01).*
Note: Data on Cyprus, Croatia and Estonia is unavailable.

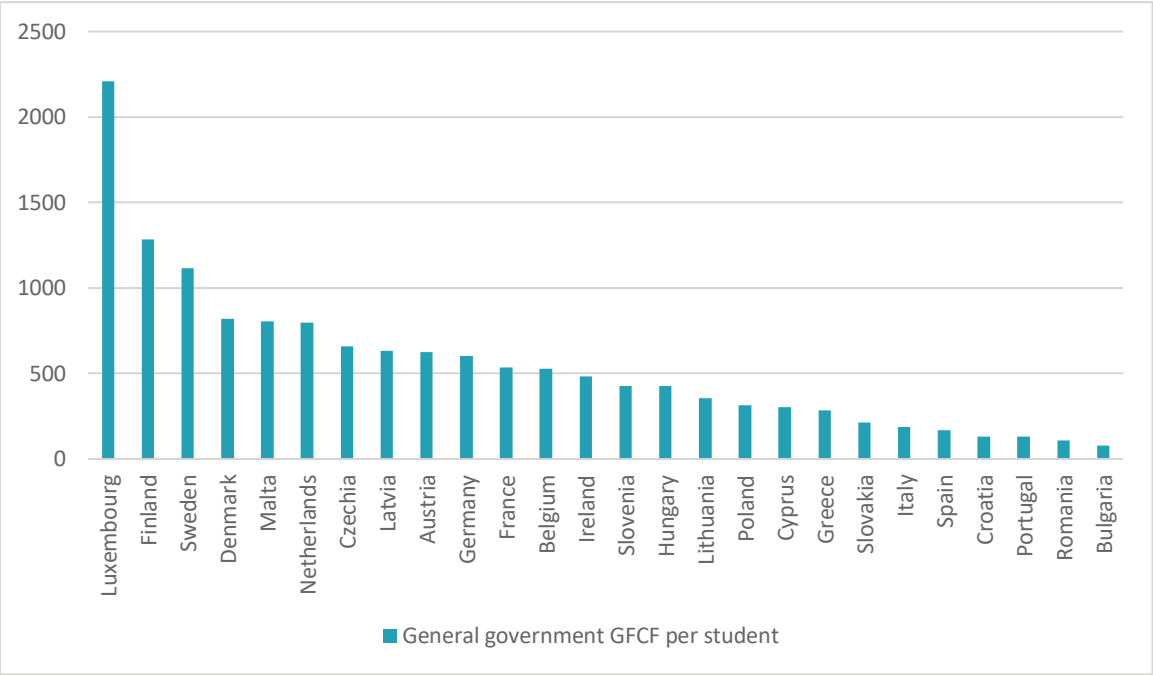
General government GFCF in education comprised more than a half (58%) of the total investment in education infrastructure between 2008 and 2018[24] and stabilised at around 0.3% of gross domestic product in 2017 in EU27[25]. During this period, total public expenditure on education infrastructure was the highest in Germany, France, and the Netherlands, and the lowest in Malta, Cyprus, and Croatia. In terms of general government GFCF in education per student, in 2018 Luxembourg spent the most, whereas Bulgaria – the least (see the figure below). This illustrates the overall trend

[24] Calculated without Cyprus and Croatia, and Denmark for 2018 to allow for a comparison with total GFCE for the same period. Based on Eurostat, General government expenditure by function (COFOG) (GOV_10A_EXP).

[25] Calculated based on Eurostat, General government expenditure by function (COFOG) (GOV_10A_EXP).

that Member States located in the Northern and Western Europe invest in education infrastructure notably more than their Southern and Eastern counterparts. It should be noted that high expenditure per student does not necessarily mean high efficiency in investing or strong educational outcomes. For example, a country could allocate less funds than previously and achieve the same results via rationalisation of school network, using smart solutions like use of public facilities for education purposes (like public libraries, sport halls, etc.) or providing remote education that requires little physical resources.

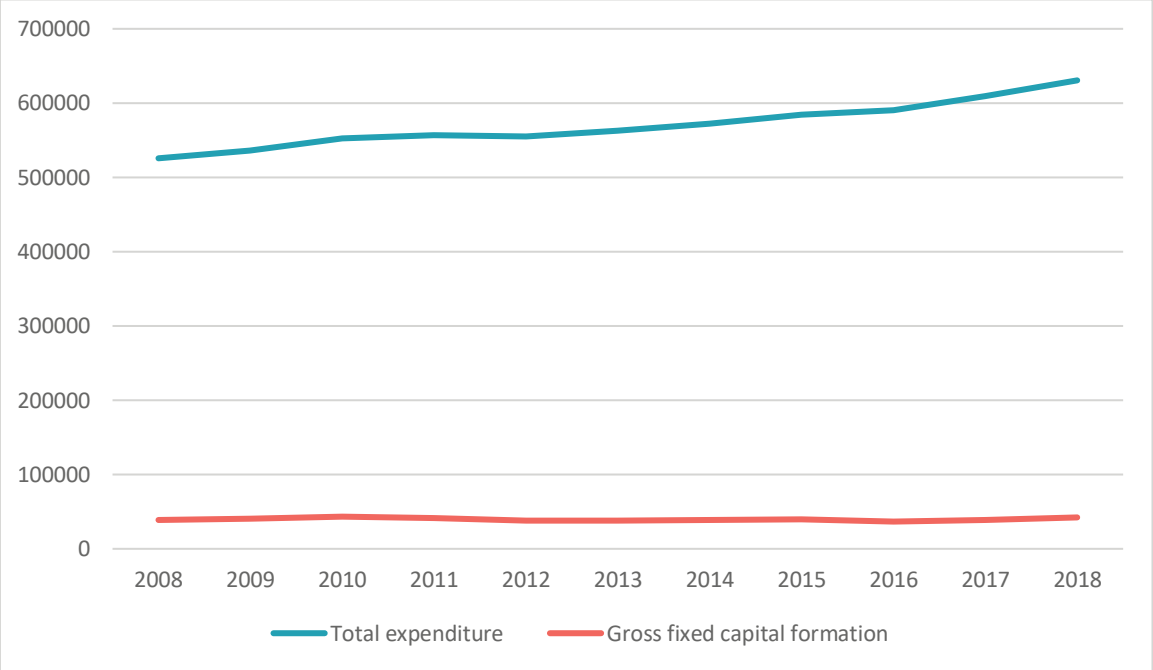
Figure 3. General government gross fixed capital formation in education per student in 2018 in EU27



Source: Compiled by the authors based on Eurostat, General government expenditure by function (COFOG) (GOV_10A_EXP) and Pupils and students enrolled by education level, sex, type of institution and intensity of participation (EDUC_UOE_ENRA01).
Note: Data on Estonia is unavailable.

The share of infrastructure investment of the general government compared to its total expenditure on education varies in time. At the level of the EU27, the share was 7.4% in 2008, and 0.7 percentage point lower in 2018. This can be explained by comparing the change in total expenditure on education with that of GFCF in 2008-2018 (see the figure below). The difference in total expenditure is notably higher than in GFCF, hence the lower share of infrastructure investment of the general government in 2018 compared to 2008.

Figure 4. General government expenditure on education, total and gross fixed capital formation in EU 27 in 2008-2018

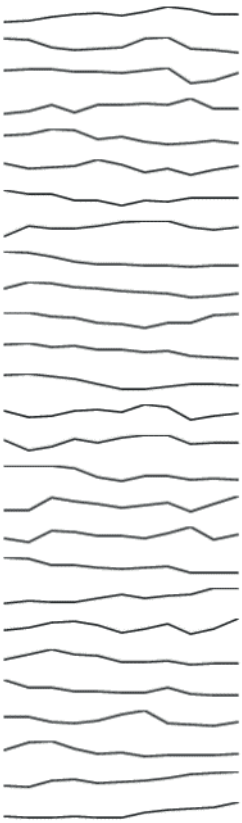


Source: Compiled by the authors based on Eurostat, General government expenditure by function (COFOG) (GOV_10A_EXP).
Note: Eurostat does not provide data on general government expenditure measured by chain linked volumes or any other unit that is better fit to assess trends in time than million euro. This does not deny trends described in the text but means the figure should not be used to make conclusions on whether expenditure increased or decreased since these would require accounting for inflation.

The share of infrastructure investment of the general government compared to its total expenditure on education varies by country as well. The highest share (24.3%) was invested by the government of Romania in 2008, whereas the lowest (2.5%) by that of Portugal in 2016. The annual average in 2008-2018 by country is provided in the table below. Based on the scope of infrastructure investment as a share of the total government expenditure on education, three groups of Member States can be differentiated:

- Investing **below 5%**: Spain, Croatia, Italy, and Austria.
- Investing **between 5% and 10%**: Belgium, Denmark, Germany, Ireland, Greece, France, Cyprus, Hungary, Malta, Netherlands, Poland, Portugal, Slovenia, Slovakia, and Sweden. This group is the largest.
- Investing **above 10%**: Bulgaria, Czechia, Estonia, Latvia, Lithuania, Luxembourg, Romania, and Finland.

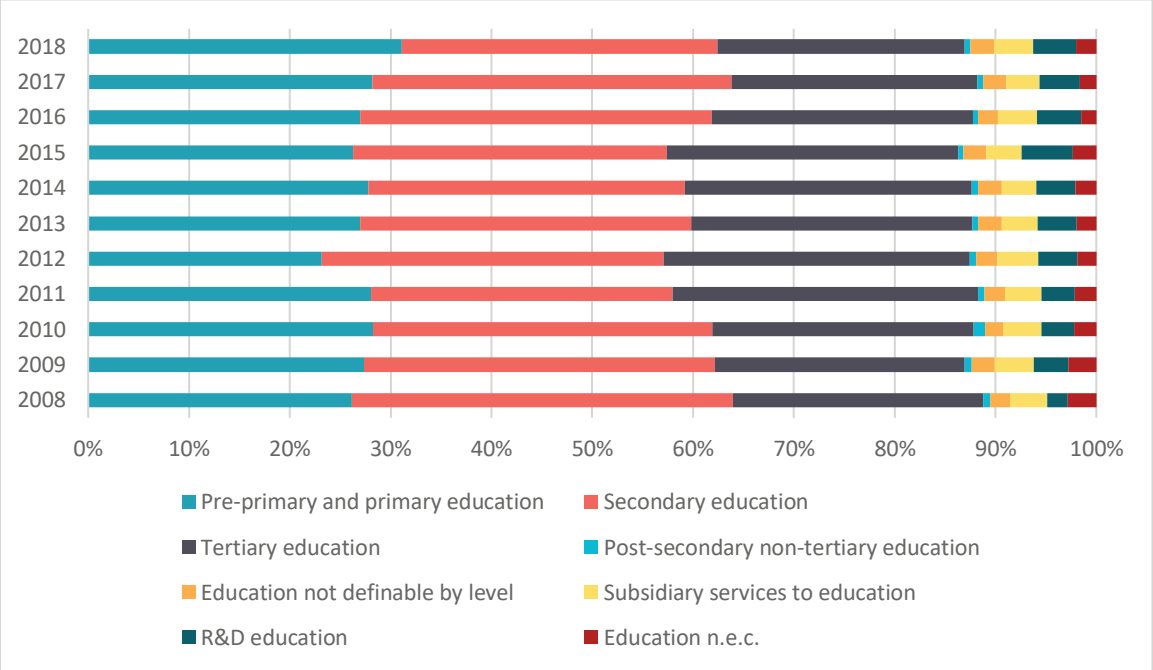
Table 9. General government gross fixed capital formation as a share of total government expenditure on education in EU27, annual average and change in 2008-2018

COUNTRY	GG GFCF AS A % OF TOTAL EXPENDITURE ON EDUCATION, ANNUAL AVERAGE IN 2008-2018		CHANGE IN GG GFCF AS A % OF TOTAL EXPENDITURE ON EDUCATION IN 2008-2018
Belgium	5.5	Between 5% and 10%	
Bulgaria	10.4	Above 10%	
Czechia	14.4	Above 10%	
Denmark	6.7	Between 5% and 10%	
Germany	7.6	Between 5% and 10%	
Estonia	13.7	Above 10%	
Ireland	6.4	Between 5% and 10%	
Greece	9.0	Between 5% and 10%	
Spain	4.5	Below 5%	
France	7.1	Between 5% and 10%	
Croatia	4.0	Below 5%	
Italy	3.9	Below 5%	
Cyprus	6.3	Between 5% and 10%	
Latvia	15.5	Above 10%	
Lithuania	10.8	Above 10%	
Luxembourg	11.2	Above 10%	
Hungary	7.6	Between 5% and 10%	
Malta	10.0	Between 5% and 10%	
Netherlands	9.7	Between 5% and 10%	
Austria	4.6	Below 5%	
Poland	8.1	Between 5% and 10%	
Portugal	5.5	Between 5% and 10%	
Romania	11.3	Above 10%	
Slovenia	7.7	Between 5% and 10%	
Slovakia	7.7	Between 5% and 10%	
Finland	12.0	Above 10%	
Sweden	6.4	Between 5% and 10%	

Source: Compiled by the authors based on Eurostat, General government expenditure by function (COFOG) (GOV_10A_EXP).

Each year between 2008 and 2018 almost 90% of the total investment in education infrastructure were made at four levels – pre-primary, primary, secondary and tertiary (see the figure below). Pre-primary and primary taken together, around 30% of the total go to each of the three annually.

Figure 5. Share of general government gross fixed capital formation in education by level in 2008-2018 in EU27



Source: Compiled by the authors based on Eurostat, General government expenditure by function (COFOG) (GOV_10A_EXP).
Note: Measured by million euro.

Priorities by level of education differ across countries. Excluding subsidiary services to education, R&D education and education not elsewhere classified, in 2008-2018 ten Member States invested in infrastructure the most at the tertiary level, nine did so at pre-primary and primary levels, seven at the secondary level, and one in education not definable by level. This can be explained mainly by a cumulative effect of the trends in enrolment at different levels (influenced by demographic shifts), and policy priorities. Nevertheless, pre-primary and primary, secondary, and tertiary levels were top three priorities for investment in education infrastructure in all countries, except for Belgium. Details by country are provided in the table below.

Table 10. General government gross fixed capital formation in education by level in EU27, total for 2008-2018 by country

	Pre-primary and primary	Secondary	Post-secondary non-tertiary	Tertiary	Education not definable by level	Subsidiary services to education	R&D education	Education n.e.c.
Belgium	2526	1448	41	3429	4862	1959	0	859
Bulgaria	473	586	0	410	2	33	15	278
Czechia	1889	5800	17	2464	172	645	764	122
Denmark	5694	4820	0	1948	63	2	663	39
Germany	24847	33107	1265	37473	813	2403	1195	648

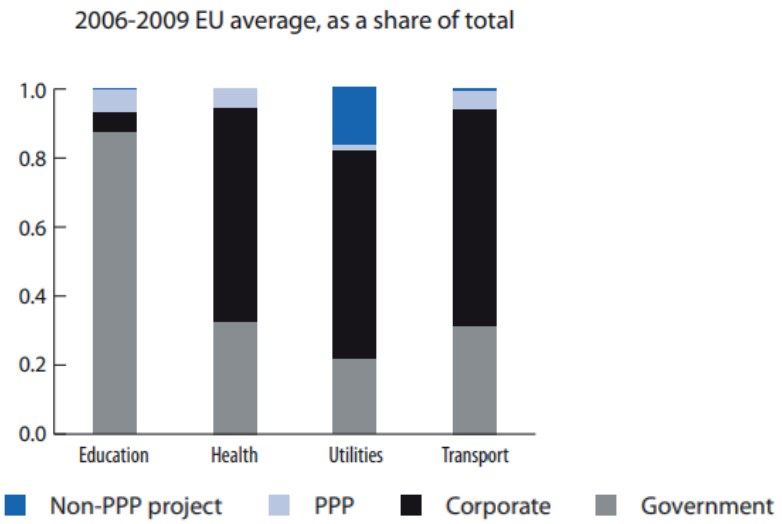
Estonia	558	444	84	514	62	7	70	36
Ireland	3762	2042	44	417	8	0	0	5
Greece	23	0	0	1064	0	2	5787	983
Spain	8115	4395	15	6107	204	289	2813	1194
France	24005	39644	794	18115	1353	7203	97	1
Croatia	400	47	0	287	21	51	37	127
Italy	4553	17076	707	3056	252	2168	907	154
Cyprus	202	86	1	320	12	71	0	100
Latvia	665	601	1	697	112	27	17	258
Lithuania	125	356	9	515	47	3	480	669
Luxembourg	1092	1068	2	353	62	117	64	18
Hungary	1700	536	0	1829	79	28	170	430
Malta	31	161	0	109	1	0	191	10
Netherlands	11596	16271	0	8708	0	439	540	492
Austria	3094	1848	7	2328	228	105	739	19
Poland	5777	3128	118	8112	379	35	1479	33
Portugal	894	2494	22	1359	132	145	224	889
Romania	906	1575	11	2461	123	225	1	1049
Slovenia	787	662	0	479	24	6	0	20
Slovakia	831	291	0	1102	33	119	8	204
Finland	3551	5456	0	7617	69	0	1	45
Sweden	*11028*	*2429*	*22*	*5693*	*211*	*12*	*81*	*294*

Source: Compiled by the authors based on Eurostat, General government expenditure by function (COFOG) (GOV_10A_EXP).
Note 1: Education not definable by level typically refers to educational programmes that do not require any specific educational prerequisite for entrance and cannot be fitted into any of the other categories[26]. The subject-matter content of such programmes is organised and presented in a non-theoretical 'general interest' manner, with minimal reference to scientific principal or historical perspective. Most programmes are part-time and voluntary; they vary greatly in length. A wide range of organisations provide them, including government departments, educational institutions, and non-governmental organisations. General government GFCF encompasses investment in administration, inspection, operation, and support of these. Nevertheless, please note that the category is residual, hence sometimes encompass all cases that are difficult to classify by ISCED levels due to differences between the international and national or regional classifications.
Note 2: Measured by million euro. Top three areas of investment are marked in blue, yellow and red in decreasing order by the size of the total investment during the period of 2008-2018. Subsidiary services to education, R&D education and education not classified elsewhere are excluded.

[26] UNESCO. (1976). International Standard Classification of Education (ISCED). Division of Statistics on Education, Office of Statistics, Paris.

Given the lack of comparable data at the national level, let alone a time series by investment source, the mapping did not reveal any trends in private investment. However, it could be judged from the national experts' reports that, in general (aggregated at EU level), the share of private investment in education infrastructure is relatively small. This is in line with conclusions the European Investment Bank made a decade ago. It then argued that the public funding is by far the most important source of infrastructure investment in education[27]. In 2006-2009, on average, it accounted for more than 85% of infrastructure investment in education compared to one fifth to one third in health, utilities, and transport (see the figure below). Private investment in education comprised merely 12.9% and included corporate (5.7%), PPP (6.7%) and non-PPP (0.5%) finance.

Figure 6. Composition of infrastructure finance in the EU across sources in 2006-2009, by sector and activity



Source: European Investment Bank. (2010). Public and private financing of infrastructure – Evolution and economics of private infrastructure finance. EIB Papers, 15(1), p. 25.

Investment gap

In broad terms, the gap of investment in infrastructure can be defined as the difference between investment needs and current investment levels. First attempts at quantifying long-term needs for infrastructure investment and gaps in it were made only a few years ago[28]. These early examples reveal that investment in social

[27] European Investment Bank. (2010). Public and private financing of infrastructure – Evolution and economics of private infrastructure finance. EIB Papers, 15(1), 17-39.

[28] Inderst, G. (2020). Social infrastructure finance and institutional investors. A global perspective. Inderst Advisory, MPRA Discussion paper. 103006. https://mpra.ub.uni-muenchen.de/103006/8/MPRA_paper_103006.pdf

infrastructure, both private and public, is far from reaching the level required, nor is it always appropriate in view of changing needs and expectations. Regardless of major cash flows, an alarming gap in education infrastructure investment relative to current and projected needs has emerged. This results from years of underinvestment, especially since the global economic and financial crisis.

The European Investment Bank (EIB) estimates the annual infrastructure investment gap for EU27 until 2030 at roughly EUR 155 billion[29], i.e. 1.2% of the EU27 GDP in 2020[30]. The gap in education infrastructure comprises 5.2% of the total and amounts to EUR 8 billion per year (see the table below). Mapping data suggest that such gap could be increasing over time as more buildings and other infrastructure (e.g., ICT, laboratories, gyms, etc.) will require maintenance and renovations.

Table 11. Annual infrastructure investment gaps for EU27

	EUR billion	% of GDP
ICT (broadband and digitalisation)	50	0.38
Energy generation and grids	17	0.13
Water and waste	7	0.05
Social and affordable housing	6	0.05
Education	8	0.06
Health	17	0.13
Mobility	50	0.38
TOTAL	155	1.16

Source: Adapted from Fransen, L., del Bufalo, G., and Reviglio, E. (2018). Boosting Investment in Social Infrastructure in Europe: Report of the High-Level Task Force on Investing in Social Infrastructure in Europe. European Economy, Discussion paper 074. Luxembourg, Publications Office of the European Union.
Note: The investment needed is calculated as an increase of 25% of the current percentage of GDP identified for each sector plus a rough EUR 100 billion to address additional items, in particular long-term care and energy poverty.

Other studies reveal much higher gaps. The EU High Level Task Force[31] argues that the minimum gap in social infrastructure investment alone is around EUR 142 billion

[29] European Investment Bank. (2018). Investment Report 2018/2019: Retooling Europe's Economy. https://www.eib.org/attachments/efs/economic_investment_report_2018_key_findings_en.pdf

[30] Based on calculations made by the authors using Eurostat data on GDP and main components (output, expenditure and income) (NAMA_10_GDP).

[31] The High-Level Task Force (HLTF) on Investing in Social Infrastructure in Europe was initiated by the European Long-Term Investors Association (ELTI). It was chaired by Romano Prodi and Christian Sautter and comprised representatives from the European Commission, the European Investment Bank, the Council of Europe Development Bank, many National Promotional Banks as well as associations and experts from the social sector.

per year[32] – EUR 13 billion more than the estimate for economic and social infrastructure combined, which the European Investment Bank calculated. The gap in education and lifelong learning until 2030 is estimated at a minimum of EUR 15 billion per year (see the table below).

Table 12. Minimum estimate of the gap in social infrastructure investment

Sector	Current annual investment in EUR billion	Annual investment gap in EUR billion
Education and lifelong learning	65	15
Health and long-term care	75	70
Affordable housing	28	57
TOTAL	168	142

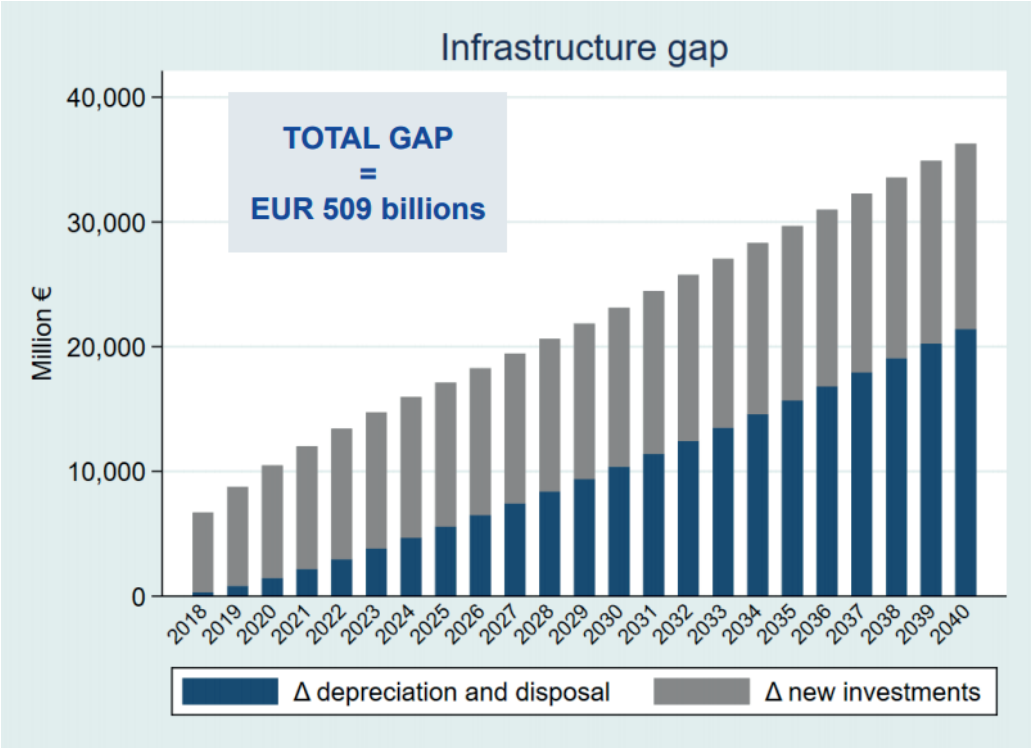
Source: Adapted from Fransen, L., del Bufalo, G., and Reviglio, E. (2018). Boosting Investment in Social Infrastructure in Europe: Report of the High-Level Task Force on Investing in Social Infrastructure in Europe. European Economy, Discussion paper 074. Luxembourg, Publications Office of the European Union.
Note: The investment needed is calculated as an increase of 25% of the current percentage of GDP identified for each sector plus a rough EUR 100 billion to address additional items, in particular long-term care and energy poverty.

SDA Bocconi suggests that the gap in education infrastructure investment per year will grow and, by 2040 will amount to a total of EUR 509 billion (see the figure below). Such estimate is based on the difference between a 'business as usual' scenario and a counterfactual 'policy' or 'maximising benefit' scenario of investment and existent real assets, aggregated across the different asset classes[33].

[32] Fransen, L., del Bufalo, G., and Reviglio, E. (2018). Boosting Investment in Social Infrastructure in Europe: Report of the High-Level Task Force on Investing in Social Infrastructure in Europe. European Economy, Discussion paper 074. Luxembourg, Publications Office of the European Union.

[33] Bocconi School of Management. (2018). EU Financing Policy in the Social Infrastructure Sectors: Implications for the EIB's sector and lending policy. https://institute.eib.org/wp-content/uploads/2018/11/EIB_Final-report.pdf

Figure 7. Education infrastructure investment gap



Source: Bocconi School of Management. (2018). EU Financing Policy in the Social Infrastructure Sectors: Implications for the EIB's sector and lending policy, p. 69. https://institute.eib.org/wp-content/uploads/2018/11/EIB_Final-report.pdf

A more accurate approach will require precise information about the current building capacity in terms of available seats and their ability to properly deliver the curriculum. In many cases, the lack of maintenance, the natural decay of the infrastructure and the rigidity of some building designs diminish such capacity to a point in which the gap between the demand for educational services and the supply of quality infrastructure becomes larger every year. Safety is necessary and so is reducing the consumption of energy, but the kind of investments that will pay "education dividends" have to be found by making a deep assessment of the educational adequacy of the educational facilities. It is very likely that such evaluation will show a much wider investment gap that could be reduced only by new construction, replacement of older facilities and serious renovation of the existing ones. Once such gap is reduced to a manageable level, routine infrastructure maintenance programmes should be put in place to keep the effectiveness of investment.

Given the lack of accurate and accessible data by country, the gap in education infrastructure investment at the national level is difficult to assess. Comparative data for each Member State of the EU27 is not available. The closest to this came SDA Bocconi which forecasted the evolution of net fixed capital formation and net

infrastructure stock in education by country for 2020, 2030 and 2040[34]. Nevertheless, needs were projected only at the aggregate level of EU28, which makes it impossible to assess country-specific gaps, at least based on the data published.

The national (regional) mapping did not capture any quantitative projections of needs or gaps either, at least not any reliable ones that would be aggregated at the national level and cover different levels of education. Some efforts were made, though, to provide quantitative estimates of future needs for investment at sub-national levels or selected levels of education. Examples include:

- **Belgium**: In 2018, the minimum annual funding needed for maintenance and renovation of buildings owned by six universities in Wallonia-Brussels Federation was estimated at EUR 55 million. This is around five times higher than the resources allocated. To develop auditoriums and laboratories that meet the pedagogical and scientific requirements of the 21st century and satisfy sustainability targets, additional EUR 564 million would be needed compared to EUR 5 million available[35].
- **Lithuania**: The need for infrastructure investment in higher and vocational education for 2019-2023 is estimated at EUR 303 million (VAT excluded). For the same period, resources to be made available through the national budget, European Structural and Investment Funds, and private investors amount to EUR 95 million, which suggests a gap in infrastructure investment in higher and vocational education of around EUR 208 million[36].

[34] Bocconi School of Management. (2018). EU Financing Policy in the Social Infrastructure Sectors: Implications for the EIB's sector and lending policy. https://institute.eib.org/wp-content/uploads/2018/11/EIB_Final-report.pdf

[35] Conseil des Recteurs. (2018). Mémorandum en perspective des élections législatives de 2019. http://www.cref.be/communication/20181204_Memorandum_CREF_2018.pdf

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Governance of education infrastructure and investment in it

Needs assessment and forecast

Despite not all of EU countries having equally elaborated systems of assessment of infrastructural needs, there are some common patterns in the ways how analysis is conducted. There is common understanding that the spaces where education takes place need to fulfil settled requirements of comfort and safety. This can be regulated on either municipal, regional, or national level, but either way involves assessment by public officials. It works in the opposite way for higher education institutions that are conducting self-assessment and have individual strategies of infrastructural development that can involve state support yet formulated autonomously.

Based on the national documents reviewed, the needs assessment in EU Member States has little to no emphasis on vocational education. This is contrary to EU and national level prioritisation to foster VET enrolment and modernise its education offer to new fields (AI, robotics, 3D printing), which require large infrastructure investment. The exceptions are Latvia and Romania which have evidence of assessment of vocational training infrastructures, and Germany that collects baseline data related to vocational training.

While more extensive investment in infrastructure is a common demand coming from educational systems in most EU countries, this expectation is adjusted to the level of accountable government structure and the degree of its accountability in every national context. In Estonia, for example, Ministry of Education is a key player responsible for assessment of needs on all the education levels there. In Belgium and Spain regional authorities are accountable for regular monitoring. In the Netherlands educational institutions on all levels irrespectively of their public or private status work on their development strategies individually. The common trend though in many models is that the needs of early childhood and primary education institutions are often monitored and fulfilled on the municipal level, while universities are communicating their needs (if such option is available) to the central government.

There are two types of regular assessment cycles educational institutions go through. One is related to planning of the budgets. That is done on the annual basis and includes infrastructural gaps to be covered. The second scenario applies to the cases in which educational infrastructure is assessed separately by the educational officials or responsible agencies. In this case, planning and assessment of effectiveness can happen:

- once a year (**Ireland, Hungary, Germany, Lithuania, Luxembourg, Malta, Poland, Slovakia**),
- once in 4-5 years (**Belgium (Flanders), Belgium (Wallonia), Denmark, Estonia, Finland, Spain**),

- or even every 10 years (**Portugal, Sweden**). [37]

As the mapping showed, some countries lack a proactive attitude to infrastructure development (**Slovakia, Slovenia**). In such cases investment decisions are conducted based on reaction to the perceived situation. It is also an option that in cases such as this, parallel assessments could take place at the same time, initiated by different donors (for example, a local one and one based on an EU-level project).

The key step in infrastructure assessment is conducting baseline data collection which can be done through national surveys (**Bulgaria, France, Germany, Hungary**), self-reporting by the educational institutions (**Belgium (Flanders), Cyprus, Malta, Netherlands, Poland, Spain**), collected at municipality level (**Denmark, Italy, Slovenia**) or aggregated by the ministerial bodies (**Austria, Bulgaria, Czechia Estonia, Finland, France, Hungary, Germany, Greece, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden**). It can be used for preparing the reports that identify gaps, produce forecasts, and plan the budgets.

A major tool allowing to conduct effective systematic infrastructure assessment is having a national digital dataset dedicated specifically to infrastructural needs. For example,

- geospatial information system of educational infrastructure in **Romania, Ireland, Italy**
- school buildings monitor in **Belgium (Flanders)**,
- AIKOS database of school buildings in **Lithuania,**
- Educational chart, a tool for infrastructure assessment by Municipal Education Councils in **Portugal**.

In fact, if there is some sort of centralised data collection happening, this is already an important key step for more effective analysis of existing gaps. However, as the experts who took part in mapping country profiles noticed, sometimes there is no evidence that existing coherent sets of monitoring tools are used by local authorities for effective investment planning.

The indicators used to forecast the needs for investment most usually include demographic development, migration trends, condition of current infrastructure and school capacity, accessibility for students with special needs and geographical proximity. There are other measurements specific to countries. For example:

- In **Romania** investment proposals for primary education include, in addition to the common indicators, a degree of marginalisation of the area, accessibility of transport, and age adequacy at the class level; for secondary education – student performance; for vocational education - correlation of the educational unit's offers with the labour market.

[37] Based on data collected through interviews and review of strategic documents.

- Apart from safety and hygiene regulations schools in **Belgium (Wallonia)** need to comply with energy performance standards.
- Pre-school and primary school infrastructure in **Luxembourg** is guided by the pedagogical concept of the school apart from regular demographic indicators.
- In **Belgium (Flanders)** there is an assessment of global maximum gross surface area, based on which a school is entitled for subsidies.
- Cartographic pieces with the school transportation network and school buildings, as well as the current and future supply and demand of education are prepared in **Portugal**.
- Together with the conditions of the school facilities, their level of digitalisation is one of the infrastructural measurements in **Germany**.

Mapping of investment practices in EU Member States did not allow to identify how risk assessment is conducted (due to the lack of specific assessment procedures for education facilities), and, if there are any standard procedures to deal with unpredicted events such as natural disasters or other emergencies.

Strategic vision and planning

Having a strategic vision for education infrastructure is common for EU Member States. There is no single format or scope, therefore such programmes can be either:

- exclusively dedicated to the issues of education infrastructure (**Belgium (Flanders), Romania**),
- part of general education development, which is the most common way of long-term education infrastructure planning (**Austria, Bulgaria, Croatia, Estonia, Finland, France, Hungary, Latvia, Lithuania, Netherlands**),
- part of general infrastructure improvement (**France, Ireland, Latvia, Netherlands, Sweden**)
- strategic visions offered by local governments or ministries (**Poland, Slovakia, Spain**), or
- part of national frameworks covering multiple areas, including, but not exclusively EU-funded recovery and resilience plans and other EU-funded initiatives (**Czechia, Cyprus, Denmark, Germany, Greece, Latvia, Luxembourg, Malta, Portugal, Slovenia, Spain**).

The length and comprehensiveness of the strategies vary significantly in different country contexts. In some (for example, **Portugal**) a bigger plan is divided into more narrow operational plans. Alternatively, the strategies themselves can be very specific and relatively short. For example, the Ministry of Education, Culture, Sport and Youth in **Cyprus** prepares their strategic plan covering activities of the respective departments every two years.

Mapping of the country strategies did not allow to learn much about methodologies used for planning. Yet the most common ones among identified approaches are:

- Evidence-based decision-making, making datasets for the needs of planning (surveys), or otherwise using national or local statistics

(**Belgium (Wallonia), Estonia, Germany, Hungary, Poland, Sweden**);
- Consultancy and expert contribution (**Denmark, Estonia, France**);
- Involvement with local stakeholders (**Malta, Netherlands, Poland, Portugal, Slovenia**).

However, there is not much data on how exactly the collected data or expert assessment is transformed into strategic decisions.

There are countries where there is no national strategic vision of education infrastructure. This can happen either because there is no capacity to do long-term investment planning (**Greece, Slovakia, Slovenia**) or because education is decentralized and the planning is happening at the local level (**Belgium, Denmark, Germany, Poland, Spain, Sweden**). The latter means that either regions or municipalities, or in some cases individual institutions, have their own visions of education infrastructure development without a united national vision. The availability of strategic documents also depends on the level of education. For example, universities are largely autonomous to make decisions about their strategic development irrespectively of how centralized the overall education system is. Meanwhile, secondary education institutions do not have this power, except those in **Denmark** and **Sweden** having a very high level of autonomy at a school level.

Assessment of needs is done by most of the states as part of the strategic planning (**Belgium (Wallonia and Flanders), Bulgaria, Croatia, Denmark, Estonia, Germany, Hungary, Latvia, Lithuania, Malta, Netherlands, Poland, Romania**), or as a regular process of baseline data collection (**Estonia, Germany, France, Hungary, Poland, Sweden**). Among the factors that play the role in the formulation of the agenda the following priorities were identified:

- To what extent a strategy facilitates energy efficiency (**Austria, Belgium (Flanders), France, Italy, Latvia, Luxembourg, Netherlands, Poland, Portugal, Spain, Sweden**),
- Environmental friendliness and sustainability (**Cyprus, France, Portugal, Sweden**),
- Improvement of ICT conditions (**Cyprus, Hungary, Ireland, Lithuania, Malta, Spain**),
- Adaptability to new pedagogies (**Belgium (Wallonia), France, Germany**)
- Compliance with EU priorities (**Belgium (Wallonia and Flanders), Hungary, Romania**),
- Gender equality, such as measures against sex-segregated schools, gender equality in teaching staff, etc (**Spain**).

Despite the objectives and priorities are largely formulated in a clear and transparent way in the country strategies there is little to no information on how exactly they were selected and ranked based on importance. The **Bulgarian** case suggests the following procedure: assessment of needs leads to the formulation of the goals, which are followed by the groups of measures or actions for the achievement of the respective goals. Education infrastructure development is such a measure, while a bigger goal is modernization of education on the national level (it is a centralized system). It could be expected that in countries where long-term planning is accompanied by the

assessment of needs, the procedure would follow the same stages, yet there is no evidence.

Criteria and procedures for project prioritisation, approval, and funding

Aside from the fact that oftentimes funds are insufficient, cash flows are inconsistent, and seldom school building authorities are prepared for big catastrophic events, understanding how money is currently being spent gives us an insight on possible areas for improvement. The questions in this section were oriented to understand how decisions are made by learning about processes and tools.

Our country experts and their informants went as deep as it was possible to find a very open attitude of sharing information and, at the same time, some pushback on exposing politically motivated decisions. The fact that certain items were not reported to our informants, like, for instance, school design standards or project prioritization criteria, does not mean that such standards or criteria do not exist. On the other hand, the fact that certain standards or criteria do exist, does not mean that they have been updated or that their implementation has been a total success.

Common sense would say that the highest need equals the highest priority. Oddly enough, such criteria were not mentioned, most likely because of the intrinsic difficulty of objectively assessing needs without solid background information on a wide spectrum. Of course, the reality of each country is different, but we also observed that extreme degrees of decentralization lead to a variety of approaches with no apparent coordination between, for instance: policies for big metropolises and rural areas, public and private initiatives, or even between different educational levels.

Criteria and procedures for project prioritisation, approval, and funding

Design standards are meant to be used to design new schools, renovations, etc., and also as a parameter for the evaluation of existing facilities. They reflect the current state of technology by indicating what is possible and what is needed to perform educational activities in any given space or facility. These characteristics make a set of standards a living document that must be periodically updated and adapted to the changing construction technologies and teaching-learning requirements. A strong commitment to generate and maintain design standards and criteria that would lead to **smart, effective, and inclusive capital investments** in education was not perceived during the mapping. There were however some isolated examples of what could be considered good practices, even though we have not seen a clear path to turn these model solutions into good examples for others to follow.

Several countries like **Austria, Belgium** (Flanders and Wallonia), **France** use general design and construction standards that are not specific to school design. **Bulgaria, Croatia, Denmark, Estonia, Finland, Germany (Bayern), Greece**, and **Slovakia** have created standards for early childhood, primary and secondary education.

Other countries have a variety of situations. In **France** (in addition to general standards) and the Netherlands, standards are done project by project. **Poland** has only standards on safety, hygiene, and equipment that are specific for schools, and

Slovenia has design standards only for early childhood. Ireland, besides having a full set of standards, also uses design models that are adapted to the conditions of each site. Standards in **Lithuania** are done in cooperation with education and health authorities.

A few countries have a complete set of design standards. **Romania** has very specific norms for each education level, including pre-university education. **Spain** has design standards at central and regional levels. And **Portugal** not only has standards at the central level but also encourages municipalities to establish additional local guidelines.

The lack of specific unified standards or criteria for **higher education design** was reported for **Greece, Hungary, Portugal, Slovakia, Spain**, and **Sweden**. **Slovenia** has specific standards only for science facilities. In general, and due to the autonomy of university systems, it is common to observe a great disparity in design standards at this level.

There is no perfect entry point to start a process of making investments in educational facilities smarter, more effective, and more equitable; all are good and necessary. However, a national discussion on design standards and criteria that includes education and build environment experts, along with users and managers, could have a highly mobilizing effect generating broad support from all kinds of stakeholders. For now, the situation seems to be quite stagnant. An explicit process for updating such standards, to look back and evaluate their effectiveness, or to view design standards as part of a broader equation that would include space utilization and network efficiency was not observed in any of the countries analysed.

Regarding **furniture and equipment**, the information is scarce, with only **Austria, Croatia, Denmark, Estonia, Germany (Bavaria), Slovakia**, and **Spain** reporting specific standards and a known procurement process. Considering the number of "old" school buildings in most European countries and the relatively low cost of updating furniture and equipment compared to full building renovations, decisive action on this front could yield critical educational benefits. Yet, just buying from a catalogue does not necessarily assure that learning and teaching objectives will be met. Conversely, and much as having genuine design standards, an in-depth set of furniture and equipment standards and guidelines will certainly support student's health, attention in class, group collaboration and open a full range of new learning possibilities.

The objective of **monitoring and decreasing energy consumption** has specific statutory levels in **Bulgaria, Estonia**, and **Ireland**. In **Slovakia**, the goal is to reach almost zero energy demand. Not every country is so specific with energy efficiency requirements, but they are also present in **Austria, Denmark, France, Lithuania, Malta**, and **Portugal**.

Project prioritization is a necessary but uncomfortable step that every school facilities office must take at a certain point. As usually happens, needs are larger than the capacity of addressing them. Regardless of the criteria applied or the weight given to each criterion, the two most important factors that determine the success of a project prioritization process are transparency and consistency. None of these considerations were brought to the attention of our country specialists during the interviews; neither are they explicit on the school facilities offices' websites. In some

cases, a website describes the need to implement a certain program, and a certain amount is allocated to address it in the next 5 years. But there is no clear indication of what projects will be done in the first year, second year, and so on. There is no clear explanation of what happens if the funds run out and some projects do not get funded.

Project prioritization criteria also vary from country to country and from programme to programme. In general, the highest priority is given to projects to improve safety, health, energy performance, accessibility; such is the case of **Belgium** (Flanders and Wallonia), **Bulgaria**, and **Finland**. In **Italy**, the same type of projects have the highest priority with the added benefit that the central government provides funds to increase the planning capacity of the local authorities. **Croatia** uses a specific set of criteria for each funding scheme, and **Finland** and **Ireland** leave the decision of what projects to do in the hands of education providers. **Latvia** has recently given a high priority to vocational education using EU funding and also to project aiming to reduce regional disparities, and notably, project stakeholders are involved in the project prioritization process. **Bulgaria** gives a very specific emphasis to "transition" or less developed areas. **France** uses the same criteria for all government projects, and **Estonia** gives priority to projects that meet long term government priorities. In the **Netherland**s, each municipality applies its own criteria. In **Malta, Portugal**, and **Spain**, priorities are based on demand pressures and infrastructure conditions, which seems to be a sensible approach.

Capital investment in education projects is prioritized at a regional level first and then at national level in **Bulgaria, Cyprus**, and **Spain**. The opposite happens in Lithuania, where projects are prioritized at the national level first and then at the municipal level through a points system. Portugal and Romania report the use of well-defined projects steps.

No project prioritization criteria have been reported at early childhood to primary and secondary levels by **Austria, Luxembourg, Slovakia**, or **Sweden**. Another unique situation that merits to be expanded is the inclusion of school directors, teachers, and other stakeholders in the discussion of school priorities, like it is done in **Cyprus** and **Denmark**. In **Estonia**, even the Association of Architects is invited for public hearings.

A common concern is that projects that are not very high on the priority list are still necessary, and their realization could take a long time. **Belgium** (Flanders) and **Greece** reported long delays in project processing, which also makes evident the need to improve the efficiency of administrative systems.

Priorities in higher education investment projects are different for each country and institution except for **France**, where the same rules apply to all public buildings. **Bulgaria** and **Denmark** assign priorities regarding labour demand; education factors are cited for **Poland** and **Estonia**; **Latvia** and **Netherlands** follow EU guidelines (European Regional Development Fund). It is interesting to notice that none of the respondents mentioned the physical condition of the building as a prioritization criterion, which leads us to believe that they may be in a fairly acceptable condition.

Higher education projects seem to be more market driven than projects in other education levels. There is a greater consciousness about the value of attractive educational facilities for capturing new students and consequently have more revenue. Concerns about the lack of coordination and uniformity among regions was observed in **Spain**. To elucidate, the willingness and need to invest in education infrastructure vary significantly across the regions since the issues of concern range from need for digitalization due to COVID-19 crisis, relatively high early childhood education costs, lack of students to increased risk of safety problems (e.g. fires, floods in schools, etc.).

Processes to ensure value for money

Mapping results revealed that there is lack of processes in place to ensure value for money in EU27 countries, which raises concerns about how **smart** the current investments are or if the concept of value for money is understood in the first place. Obtaining the highest possible educational value for the money invested goes beyond an exercise of efficient management. It allows liberating funds to increase the quality and quantity of educational programs, replace obsolete didactical aids, attend to projects that are needed but are lower in the priority list, and much more. In other words, an effort to make investments smarter also makes investments more **effective**.

Mapping also revealed some misconceptions in some of the answers that were obtained. For instance, in **Bulgaria**, value for money is expected to be achieved by following the procurement law, and in **Finland**, it is left to the discretion of the education provider, whether it is public or private.

Other interesting attempts are made in **Latvia** where the government seeks to improve value for money through the dissemination of good practices and the implementation of cost limits. **Portugal** tries to achieve the highest efficiency through initiatives agreed upon by the central government and the municipalities. In **Poland**, value for money is earned by better managing building resources, improving insulation, and installing photovoltaic panels. **France** analyses behavioural patterns by users. **Bulgaria** reported evaluating buildings 5 years after they have been built. And **Denmark** is the tries to reduce operating costs through the co-location of different education levels.

Lithuania, Estonia, Poland, Portugal, and **Spain**, report using **cost-benefit analysis** for EU funded projects. Instead, **Austria, Croatia, Cyprus, Denmark, Germany, Greece, Hungary, Italy, Luxembourg, Netherlands, Romania**, and **Sweden**, indicated that they do not have a systematic process for cost-benefit analysis.

Bulk purchases are not a common practice, and some of the countries surveyed voiced doubts about its effectiveness to the extent that in **Poland** is estimated that such practice increases costs. Yet, **Estonia, Latvia**, and **Luxembourg** report using bulk purchases for selective school equipment, and **Belgium** (Wallonia) use central contracts to purchase energy through multiyear programming.

Supervision of projects and ensuring investment performance

The project cycle does not end when all drawings are finished and permits issued. Neither is it finished after construction is completed and the newly built or renovated facility is fully occupied and functioning. Assessing education results requires a long-term view that goes beyond the initial excitement of project completion.

To better find out how investments in educational infrastructure are made, we devised a series of questions oriented to:

- Verifying if the initial objectives of the investment program or project were accomplished, and
- Seeing how the programme or project was conducted. In other words, we wanted to measure external effectiveness and internal efficiency.

Methodologies used to supervise education infrastructure projects

The construction process is risky and was identified as a significant area of concern in many of our interviews. This is where most of the cost overruns happen, along with time slippage and specification changes that could compromise the quality of the end product.

Mapping results revealed differences in project supervision strategies and the type of authority that oversees construction. In **Lithuania**, the Ministry of Education takes responsibility for projects, including those at state and municipal levels. In **Romania**, the responsibility is taken by the municipalities with the oversight of the central Ministry of Education. In **Portugal**, the supervision of early childhood and primary education investment projects is done in compliance with an ad hoc manual of procedures. For secondary education investment projects, **Portugal** uses a public company. In **Latvia** and **Poland**, it depends on the funding source, and mixed systems are used in **Belgium (Flanders), Estonia, Netherlands**. **Finland** relies exclusively on the project owner, **Bulgaria** only on private firms, and Sweden entirely on municipalities.

Periodic government inspections for health, safety, and maintenance conditions are performed in **Belgium French, Bulgaria, Cyprus**, and **Italy**.

No specific project supervision strategies are reported in **Croatia, Denmark, Germany, Hungary, Ireland, Italy, Luxembourg, Malta, Romania**, or **Slovakia**. However, some type of government oversight of time, budget, and quality of construction projects is mentioned in **Belgium** (Wallonia), **Bulgaria, Estonia, Greece, Romania**, and **Spain**. **Estonia** is a rare exception as it is reported that the government verifies how objectives of access, quality of education, and quality of the learning environment are achieved.

The differences on who does what is not relevant to the end result, which is more affected by how it is done. Construction supervision quality depends mostly on the systems and procedures utilized and on the professional capacity of the persons in charge of such supervision. Mapping results did not reveal any of these issues in

analysed EU27 countries. Data collected suggests that there is no system that would be better than others.

Community oversight and involvement in project planning and design was mentioned in **Sweden**, where quality control of school infrastructure is conducted randomly or at the request of an external agency or persons, often parents. In **Finland**, school principals usually bear the main responsibility of engaging teachers, students, parents, construction service provider and all other relevant stakeholders in designing process of school facilities and giving recommendations from users' point of view. In **Denmark**, parents, students and school staff are involved in the planning processes for the schools. In **Germany**, primary and lower secondary schools are established and removed in consultation with the local authorities involved (parents' councils and higher church authorities). However, similar stakeholder involvement was not mentioned by any of the other countries that are the object of this study. Parents associations, or local non-profits with the proper training, have the potential of being very protective guardians of investments in education. Moreover, their involvement from the beginning of the project creates a sense of ownership that often carries over the phases of building operation and maintenance.

Stakeholders' participation and full transparency can only make projects better. However, mapping results did not reveal any easily available report on project audits, qualification of construction companies, or the results of quality assurance and quality control reviews.

Methodologies used to monitor and assess investment performance

How money is spent is fairly easy to determine. **How well money is spent** is a totally different issue that has to do with the results obtained in comparison with the initial expectations measured through predetermined criteria. Mapping results indicate that there is no decisive action towards verifying if the building built, renovated, equipped, etc., has contributed to increasing education levels - in other words, how effective the investment has been. The lack of information in this regard hinders the ability of school building offices to eventually find areas that need improvement or to totally adjust the course.

No explicit methodologies to **monitor and assess investment performance or asset performance** were found in **Croatia, Denmark, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Spain**, or **Sweden**. **Luxembourg** monitors only energy performance. **Portugal** and **Spain** report having done some performance studies, but not in a systematic way. The only exception found was **Ireland** that reveals having well developed methodologies to assess investment performance and asset performance.

Hungary reports doing feasibility studies, but it is not clear if they are done to all projects. **Luxembourg** does feasibility studies only for university projects. Feasibility studies are a valuable tool, especially when it is necessary to make the final evaluation of projects that are high on the priority list. The natural follow up after the project has been in operations for a while would be to perform an ex-post evaluation to verify if the initial project premises were valid and the results were what was initially expected.

Methodologies used to ensure asset performance throughout its lifecycle

Once a building is completed, the investment phase is done, but expenditures continue in the form of building operations and maintenance. In fact, investment costs are about only one-eighth of the cost of running the facility over a 30-year life cycle. It is common in many parts of Europe for school buildings to provide service with very little modifications for 50 years or more. This highlights the importance of not only extreme care in the planning and design phases but also having a building maintenance plan that assures the continuation of the services at the level of a new building.

Mapping results did not identify an explicit government run preventive maintenance strategy in place in **Bulgaria, Croatia, Denmark, France, Greece, Hungary, Italy, Latvia, Luxembourg, Malta, Netherlands, Portugal, Slovakia**, or **Spain**. In **Estonia**, preventive maintenance is done regularly for certain equipment. Data found also suggests that school principals are tasked with school maintenance responsibilities in **Belgium (Wallonia)**, and **Poland**; it is not clear, though, if they have the available funds to carry on the works.

With the intention of reducing operating costs, **Austria, Belgium (Wallonia), Luxembourg, Poland**, and **Portugal** report some experiences with photovoltaic panels, but no evidence has been presented on the value of the savings achieved.

To conclude, performance remains a grey area. Achieving the objective of smart, effective, and inclusive investments in educational infrastructure may require starting by drawing a base line of acceptable levels in each category. In very simple terms, whatever is under such an acceptable level, needs immediate attention. Higher values over such base line, also require a significant effort to maintain such levels. And extremely high values constitute good practices to be evaluated and possibly replicated.

Collection and disclosure of data on education infrastructure and investment in it

Data on infrastructure

As previously mentioned, inventorisation efforts in most EU27 countries were observed to be not as systematic as expected. However, majority of the countries carry out fragmented data collection (for example, at local level (schools, universities, etc.), municipal level or have some databases that include only a part of the education infrastructure).

Mapping results suggest that the data about education infrastructure is most often collected in databases or inventories. These can be separated into two distinct sections:

- Database/inventory covers some levels of education in the whole country (for example, pre-primary, primary and secondary, just primary and secondary or just higher education, etc.). This is usually the case for countries that have different institutions/levels of institutions

responsible for different levels of education and state or EU funding is more common for the infrastructure that is included in the database/inventory. For example:

- In **Bulgaria**, data about early childhood, primary and secondary education institutions is collected by carrying out inspections and presented in reports and assessments, while data about higher education institutions, such as area of space used for teaching or number of books in the library is collected in a dedicated register (AdminUni).
- In **Croatia**, primary and secondary education infrastructure is inventoried in a portal, where the number of schools with their buildings is registered and updated regularly.
- In **France**, despite the decentralisation, several country-level databases exist for education infrastructure. For example, "eCarto" inventory maps data of ICT infrastructures of all early childhood, primary, lower and upper education institutions in France, and "The Technical Framework for Higher Education and Research" database holds data on all higher education buildings, including their condition and other parameters.

- Database/inventory covers some or all levels of education in the territorial units of the country (municipalities, communes, federal states, etc.). This is most common in decentralised countries or countries where region (municipal) autonomy is high and where regional (municipal) investment is the most common funding source for that level of education that is covered in the database/inventory. For example:
  - In **Spain**, there are multiple databases for ICT infrastructure, furniture, and the buildings themselves. The inventory of educational infrastructure at the national level covers the infrastructure of educational institutions and general ICT equipment. Other types of equipment and the inventory of the specific furniture of each institution is generally collected at the level of each Autonomous Community, or even each municipality.
  - In **Austria**, there is no one central database that would include data on education buildings. However, the infrastructure is partially inventoried by each education institution: data on geographical position, structure and type of E&T is collected by education institutions in states, and is then passed on to the central statistical database of Austria (Austria statistic).
  - In **Belgium**, every 5 years AGION (Agency for School Infrastructure) prepares a school building monitor for primary and secondary education. It describes the quality, use and management of the educational buildings in Flanders and Dutch education in the Brussels-Capital region.
  - In **Sweden**, there are no central databases for education infrastructure, however, inventories for early childhood, primary and secondary education infrastructure are made by each school within the municipalities.
  - In **Denmark**, education infrastructure for all education buildings is collected at local level and not aggregated for the whole

country, as each of the municipalities and private/independent institutions has their own system for inventory.

It is evident from the monitoring results, that even though most of EU27 countries make efforts to monitor their education infrastructure, there are quite a few instances where the data is collected (either centrally for the whole country in one database, or in several databases/inventories available at country or region level), but not available publicly. For example:

- There is no unified database that is available for public in **Greece**. However, databases that exist in the country ("Myschool" for schools in Greece and "Quality Data Management System" for higher education institutions), do not allow public access to the data.
- In **Lithuania**, only a part of data is made accessible to the public. There are several databases ("AIKOS" (Open Information, Consultation And Guidance System) register that covers all education levels, "ŠVIS" (Education Management Information System) database that includes only primary, secondary, higher and VET education and the database of the Statistics Lithuania, that includes data about all education levels), however, "AIKOS" only presents limited data to the public. Moreover, "ŠVIS" holds the most extensive data, including data on the condition of the buildings, but it is only available internally for the education institutions and employees of the Ministry of Education, Science and Sports.
- In **Luxembourg**, some institutions, for example, universities, have their own inventories of infrastructure, but the data is only collected at the institution level and is not publicly available.
- In **Malta**, extensive data is collected by the Foundation for Tomorrow's Schools, the Ministry for Education and the education institutions, including the condition of education buildings, however, this data is only accessible internally and not made public.
- In **Netherlands**, there is no national register or inventory of education infrastructure, as collection of this data is managed by individual municipalities. To access infrastructural data an individual municipality must be contacted. Similarly, university infrastructure inventory can be found in the respective university's yearly reports, but information is not compiled on a national level.
- **Romania** has a unified database for early childhood, primary and secondary level education infrastructure ("The Integrated Information System of Education in Romania") in the country that is updated yearly and offers a wide range of data, but full data is not accessible to public and is only accessible to the Ministry of Education and Scientific Research.
- In **Bulgaria**, inspections of schools and kindergartens (education levels from early childhood to secondary) are carried out yearly and data on the infrastructure as well as education quality is collected centrally but is not accessible for public.

Data on investment in infrastructure

In most countries, systematic data on investments in education infrastructure is not collected. However, based on mapping results, some data on investment in infrastructure is collected in most of EU27 countries (**Austria, Belgium, Bulgaria, Denmark, Estonia, Greece, Ireland, Lithuania, Hungary, Latvia, Luxembourg, Malta, Netherlands, Poland, Portugal, Slovakia, Slovenia, Spain** and **Sweden**).

Although data on investment is collected, it is either in multiple databases (for example, in **Luxembourg** there are separate websites and inventories for state and EU funding, but no aggregated database/website that would include all investment) or not aggregated (for example, in **Spain**, data is not collected centrally and there is no specific systematic report, but this data can be extracted from the Statistics on Public Expenditure on Education and Investment Plans in Educational Infrastructure). The aggregation of data is reported to be a challenge in many countries, as different institutions invest in infrastructure. Mapping results suggest that only **Austria, Belgium, Denmark, Ireland** and **Malta** aggregate their investment data in one database/registry that is managed by one institution. The aggregation of investment data for these countries may be feasible because the most important investment sources in these countries are local or state budgets, that usually require accountability for investments made and are more centralised or easier to track, therefore creating ground for collection of investment data.

However, as is the case with data about the infrastructure itself, the data on investment in infrastructure is not always available to the public. Based on mapping results, it is fully available in only a few countries (**Austria, Belgium, Bulgaria, Denmark, Estonia, Ireland, Poland, Portugal, Slovenia** and **Spain**).

Funding arrangements and delivery modes

Funding arrangements

Mapping results revealed that regional funding (municipal/federal/communal) is the most common funding delivery mode in most of EU27 countries or at least is the primary funding source for some education levels in that country. This is the case in **Austria, Belgium, Bulgaria, Denmark, Estonia, Finland, Germany, Hungary, Latvia, Italy, Luxembourg, Netherlands, Portugal, Poland, Romania, Slovakia, Slovenia** and **Sweden**. The second most popular funding source is state funding, that covers both countries that were not mentioned above as well as some of those that were (in some countries different levels of education are funded using different sources): **Croatia, Cyprus, Denmark, Estonia, France, Ireland, Luxembourg, Malta, Portugal, Slovenia** and **Spain**.

Since higher education institutions have more autonomy than other education institutions in most countries analysed, higher education institutions receive investment in their infrastructure either from the state or EU funds and rely more heavily on private investors, investment loans from banks (like EIB) or invest their own funds. On the other hand, pre-primary, primary and secondary education are mostly the responsibility of the state or regional authority (municipalities or communes), therefore their investment sources usually include municipal and state budgets.

Mapping results suggest that funding for education infrastructure in EU27 countries is decentralised either at country level (where most of funding is regional/municipal or local) or at some levels of education (for example, pre-primary and higher education funding in most countries is decentralised due to high autonomy of these education levels), as most countries rely on a few sources of funding, including municipalities, the EU funds and private investment. However, there are some exceptions of countries that use state funding as their primary funding source and have centralised funding for most of education levels. For example:

- In **Malta**, the state funding for pre-primary, primary and secondary education is centralised and mostly consists of direct transfers.
- In **Ireland**, national budget is used to finance primary and secondary education infrastructure, therefore a part of investment is centralised.

The importance of EU investment for education infrastructure was already mentioned previously in the chapter "Scope and source of investment". However, EU investment appears to be an important source for higher education infrastructure in countries where state and regional investment is the main source for pre-primary, primary and secondary education institutions (for example, **Hungary, Estonia, Latvia, Malta, Portugal**).

Mapping results revealed some unique private funding sources, for example, lotteries, fairs and raffles are used to fund investment in pre-primary and primary education in **Denmark**. In **Hungary**, business associations are directly involved in financing VET beyond paying taxes to the state budget. Enterprises pay so-called "VET contribution" to a joint fund, which supports the development of practical training. The fund provides contributions to state-run VET institutions, private institutions with a VET agreement with the State, higher education institutions (where Bachelor's degrees require practical training) and adult training institutions.

In most countries, infrastructure funding is directly related to tax collection, as mapping results suggest that majority of countries use state or municipal budget as a primary investment source. Municipalities, regional authorities (such as autonomous communities in **Spain**) and the state, consequentially, collect taxes to fund a variety of activities and services that they provide to residents, including education infrastructure. For example:

- In **Belgium** (Flanders), funding for investments in educational infrastructure in primary and secondary education comes directly from taxes (70% overall costs for investment projects in primary and 60% for secondary education institutions).
- In **Bulgaria**, the financing of educational infrastructure at the national level is contingent on tax collection, as taxes are one of the components of the state budget that is allocated to fund education infrastructure.
- Similarly in **Denmark**, the public financing of education infrastructure is a part of the budget for the municipalities and the state and the funding comes from the general tax revenue (income tax, VAT, land tax, etc.).
- In **Latvia**, income from all taxes is divided between the State, municipalities, and State special budget. The State and municipalities then form their annual budgets that fund educational infrastructure.

Funding delivery modes

Mapping results suggest that the most common investment delivery mode among all the countries mapped is public procurement. It is the primary delivery mode in **Austria, Bulgaria, Croatia, Denmark, Finland, Greece, Ireland, Lithuania, Latvia, Malta, Netherlands, Poland, Portugal, Slovakia, Spain** and **Sweden**. As mentioned previously, most of these countries rely on municipal and state funding as the biggest part of investment in education infrastructure. As public funding often requires higher levels of accountability, public procurement, in theory, should ensure that. The countries have rules in place to ensure the correct use of funds. On the other hand, direct public provision as a primary funding delivery mode is not very common and was only observed in **Estonia, Belgium** (Flanders) and **Romania**.

Mapping results suggest that even though public-private partnerships (PPP) is used in several countries (**Belgium, Estonia, Finland, Greece, Ireland, Lithuania, Poland, Slovakia, France**), it is only used for certain projects, in small scale or as an addition to public procurement of public provision procedures. For example, PPP was used in **Finland** (in Jyväskylä municipality) to build a new school with the total investment of 30-40 million euro with some school modernisation/reconstruction projects. In **Ireland**, PPP projects were used to fund primary and secondary schools in the previous decade, and The National Development Programme 2018-2027 includes PPP programme, which will deliver 11 new buildings across Institutes of Technology. In **France**, PPP was initially the delivery mode imposed for the renewal of 21 campuses of higher education institutions. However, from 2013, public project contracting was allowed for the project that led to PPP's being chosen less often and public contracting favoured.

Solutions to reduce costs differ across all countries, as funding sources for infrastructure in each country differ as well. According to the mapping results, cost-benefit analysis is not very common among the countries, but other solutions are used instead. For example:

- In **Bulgaria**, public procurement procedure is considered to reduce costs. Each individual school or municipality can start a public procurement procedure and it is often used to make bulk orders of equipment.
- A similar approach is used in **Denmark**, where public procurement is employed to reduce costs: municipalities purchase all items according to public procurement rules, while private institutions use tenders and, in some cases, several institutions join in a tender to obtain better discounts.
- In **Cyprus**, it is common practice to purchase some items like school equipment in bulk to reduce the costs of investment.
- In **Estonia**, where possible, bulk purchases are used to reduce the costs of investment as well. For example, in 2020 Estonian Ministry of Education and Research has purchased computers, printers, servers, network equipment and VPN equipment in bulk.
- In **Spain**, purchase of furniture is coordinated between educational institutions and the competent authority to obtain a better price for a large-scale purchase. For example, in the case of Catalonia, a framework agreement on furniture was developed and a catalogue

containing the possibilities for furniture was established. Consequently, the schools in Catalonia were offered better prices for the furniture.

Involvement of and coordination between different levels of government

Centralization of the governance of investment in the context of this research corresponds to what extent decision-making related to education strategies and their financial components are delegated to the subnational level. This means that a case in which there is no state planning because it is all done on the regional or municipal level would be considered an example of a highly decentralized system. Respectively a case in which all the decision making about education financial flows is happening on the level of one ministry would illustrate centralization.

It would not be correct to conduct a simple count of how many centralized and decentralized education investment authorities there are mostly because there is variation between different levels of education within the Member States. For example, early childhood education institutions are mainly supervised on the municipal level even in relatively centralized contexts (like **Austria** or **Slovenia**). Meanwhile, decision-making regarding support of public universities, irrespectively of how autonomous they are, is done in the state level in a vast majority of cases. The most diversity is seen on the level of general education.

In **Austria, Bulgaria, Hungary, Ireland, Luxembourg, Malta, Slovakia, Slovenia**, and **Romania** schools, especially when it comes to upper secondary education level, are governed on a central level. At the same time in **Belgium, Poland,** and **Spain** responsibility for school-level investment planning is shared among regions. **Croatia, Estonia, France, Latvia, Portugal** have mixed models where decision-making and financial responsibility for secondary education are shared within two different levels. For **Denmark, Finland, Greece, Lithuania, Netherlands, Sweden** schools are within the scope of responsibility of the municipalities.

Ministry of Education (in all the variation of its titles in different national contexts) is the most commonly involved actor in the process of education infrastructure strategy and investment planning in more centralized settings. It can be cooperating with other ministerial bodies (for example, the Ministry of Regional Development in **Bulgaria** or the Department of Housing, Planning and Local Government in **Ireland**). Sometimes ministries form a council to cooperate on infrastructural matters (**Bulgaria**) or work together on irregular basis as an executive network (**Greece, Luxembourg, Spain**). In the systems which are characterized by complete decentralization and delegation to the subnational level, local authorities obtain funds and cooperate with stakeholders on the respective territories to arrange effective distribution (**Denmark, Poland**).

The main roles Ministries play in any system are providing finances for infrastructural changes, and in more centralized systems they are also responsible for the implementation of the strategies. In some cases, for more effective financial distribution special governmental agencies are employed. Wallonia and Flanders in **Belgium, Estonia, Ireland, Latvia**, and **Lithuania** are using such agencies.

Coordination of the different actors across the national and subnational divisions, as well as across different levels of education is a task that does not have a single solution. Among the possible ways how this is solved in different countries the following ones were identified:

- Assigning the role of coordinator to the agencies that already exist (regional education departments in **Estonia**, Education Sector Conference in Spain);
- Having a separate coordinating entity (**Belgium (Wallonia), Ireland, Portugal, Sweden**);
- Meeting on a voluntary basis to share the experience on workshops or commonly organized events (**Denmark, Netherlands**);
- The organization of the consultation process, both among the actors involved, and using the expertise of external agencies (**France**).

Despite the expected active involvement of stakeholders especially in decentralized systems, there is not much data about such consultations. Local expertise of the institutions involved in the programs is considered as well as voices of NGOs, parents and student bodies (**Portugal**). Academics are one of the groups whose knowledge and experience is also taken into account not just as consultants, but also as a community affected by the prospective changes (**Bulgaria, Ireland, Latvia, Lithuania**). Similar logic applies to consultations with local industries (**Latvia**).

There are occasional partnership projects allowing to attract money to public education. For example, the Belval Fund in **Luxembourg** is actively involved in infrastructure development. However, there is not enough evidence to make a comprehensive description of private funds participation.

Principles of good practice and illustrative case studies

Introduction

In this section we will focus on illustrative examples taken by governments in the Member States of smart, effective, and inclusive investments in education infrastructure which have contributed or are expected to contribute to improved learning outcomes in a unique way.

The eight cases presented for analysis in this chapter were selected from 39 cases suggested by local experts from EU 27 Member States. No one case will completely encapsulate a comprehensive approach to good practice. The aim of the good practice case studies is, thus, to highlight positive examples of particular aspects of the investment process, so that taken together they provide a comprehensive array of possible action areas. 5.2 Good practice framework

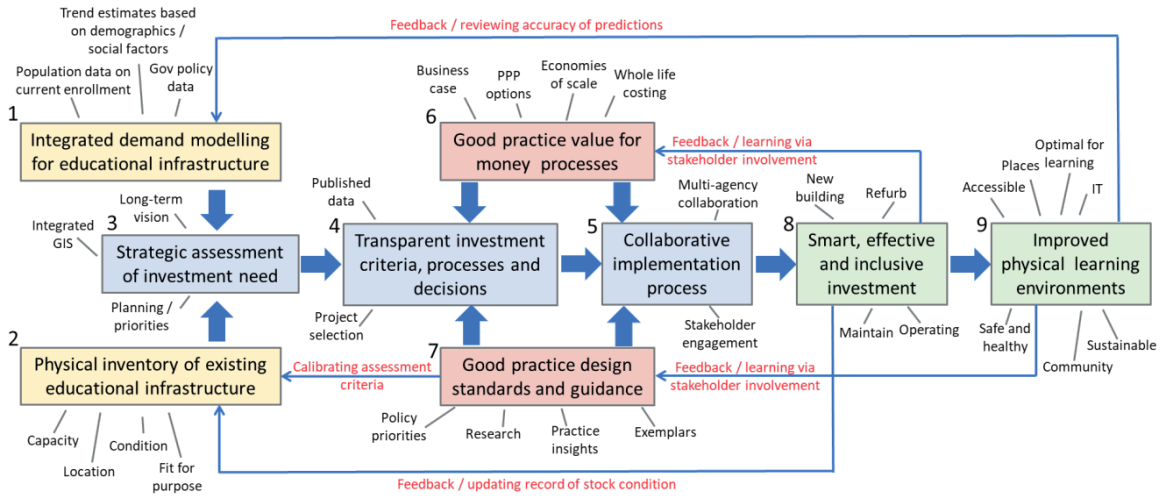
To provide coherence to these focused "inspirations", a holistic model of an idealised investment process for educational infrastructure was developed – the "good practice framework". This drew from relevant literature but is also grounded in the intelligence

gleaned from the national (regional) mapping. This process of "truth tracking"[38] was continued as the cross-case analysis was developed, so that the idealised model is in fact grounded in the best aspects of the EU Member States' systems. The resulting good practice framework model is provided in the next figure.

The framework developed can be seen to have a number of dimensions as set out in the figure. Reading left to right:

- What: the first three boxes concern making an assessment of what investment is needed based on the demand for and supply of educational infrastructure.
- How: the next four boxes are focused on how to efficiently and effectively deliver the chosen investments.
- Why: the final two boxes reinforce the desired outcomes, or why the investments are being made. As well as being "end points", these elements are crucially the sources of experiential learning that feeds back into the upstream processes to create a dynamic system that "learns" and from its outcomes.

Figure 8. Good practice framework



Systemic characteristics:
1) Data, analyses and processes all at a level of granularity that gives visibility to, age, level of education, special needs, mix of subjects, location
2) Levels from national – regional – local – project, connected synergistically and provided with appropriate integration and user support.
3) Stakeholders at all levels aware of opportunities and processes and engaged in the active improvement of what is done and how it is best achieved.

Source: Compiled by the authors

The following subsections will now explore each of the elements of the process through the experiences gathered in the good practice cases.

[38] Gibson B and Hartman J. (2014). Rediscovering Grounded Theory. London, Sage.

Integrated demand modelling for educational infrastructure

As it is difficult to create educational infrastructure at short notice, a keystone to a smart and effective national (or regional) system is a sound prediction of the medium to longer-term demand for educational space.

This will be driven by various factors, such as: modelling of the flow-through of existing pupils, demographic and social shifts sweeping in factors such as the likely geographical (re)distribution of the population and variations in birth rates by ethnic groupings and significant shifts in government policy, such as a change in school age for mandatory education or the extension of pre-school provision.

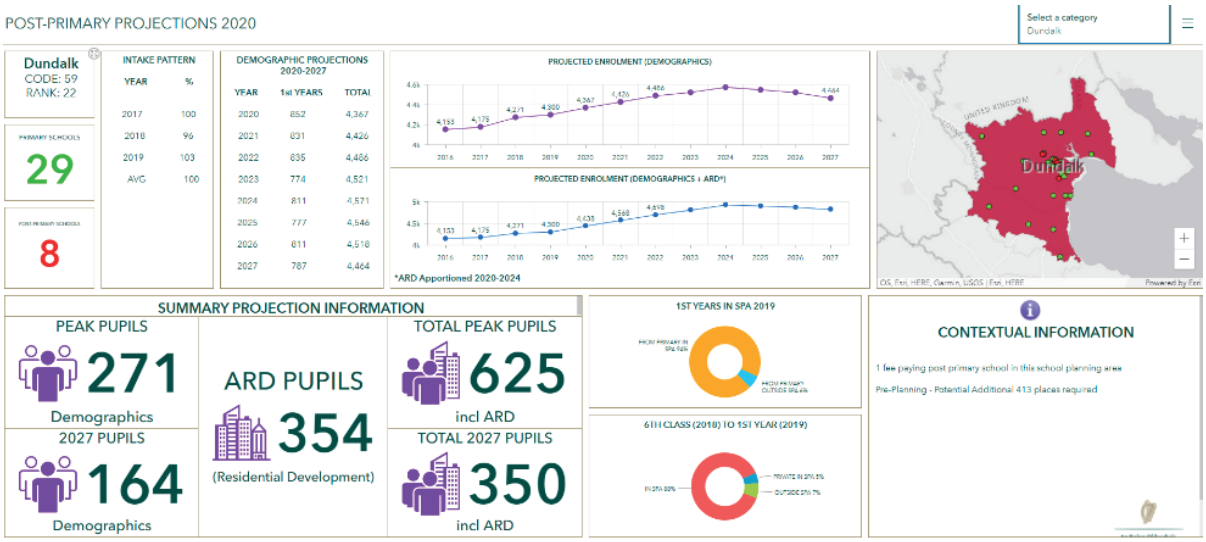
- **Ireland**: a successful approach to demand modelling has to address the wide variety of factors impacting on the demand for school places, and crucially, the geographical distribution and nature of this demand in terms of age and need profiles. It also has to make this intelligence readily available at different levels of granularity so that it can appropriately support decision-making where this actually takes place in the given country. In Ireland the capacity to predict pupil numbers in each of 314 school planning areas has been developed to the point where, reviews of past performance indicate, less than a 0.5% margin of error[39]. This success is the result of a long-term effort starting fifteen years ago. The formal strategy has been unchanged since 2008 providing a consistent basis for efforts to incrementally build up the capacity for and quality of the projections[40]. The core to the process is the Statistics Unit, which is "responsible for providing data and analysing trends on education". This appears to operate independently, draws in data from across a range of Government departments and has progressively finessed their methodology to improve its reliability. The model is fundamentally based on a combination of migration and fertility data drawn the Central Statistics Office. This, however, is supplemented by indicative data from other Government departments, such as the registry of Child Benefit Data and plans for new residential development (building) from Local Authorities. The reports produced forecast for each of the next eighteen years and provide sensitivity analysis through the inclusion of a number of scenarios. For example, "the projection for the 2019-2036 period has three migration and two fertility models". In the last two years the enhancement of the scope of this base data has been pursued further with the inclusion of a supply-demand model of teachers, which will be progressively evolved to be more subject-specific

[39] Department of Public Expenditure and Reform; Government of Ireland. (2018). National Development Plan 2018-2027.

[40] Department of Public Expenditure and Reform; Government of Ireland. (n.d.). Statement of Strategy 2005-2007.Available at: gov.ie - Statement of Strategy 2005 - 2007 (www.gov.ie)

in the future. The figure below gives an example of how the projections are made available for a particular planning area.

Figure 9. Sample 2020 post-primary dashboard showing enrolment forecast to 2027



Note: The main purpose is to show the estimated overall and entry level enrolment trend in the area, including the potential student yield from additional residential development (ARD) and the estimated timing of same.

Physical inventory of existing educational infrastructure

In order to assess future investments, what is available via the existing infrastructure has to be known. This involves studying the capacity of the existing infrastructure to accommodate pupils of different types and ages, but also the physical condition of the premises and the extent to which they are fit for purpose. On top of this, owing to major demographic shifts in some countries, typically from rural to urban locations, any record needs to make clear where (geographically) the provision currently is.

- **Italy**: Since 1996 it has been encoded in Italian law that school buildings are part of the educational system. The law also "requires a decentralized structure for the production and exchange of data … articulated between the regions and central government". In recent years this has led to discussions and agreement between the parties as to a common format for the data (2014) and how this should be implemented (2018). The aspirations of the joint effort are to identify the number and location of available school places, whether they are being used, but also the age, safety, stability and condition of the school buildings. It is a real issue, for instance, that spaces that appear to exist will be unusable in practice owing to earthquake damage. Another fundamental aspiration is that the information produced is openly available to be seen and interrogated by all. The Registry covers the whole country, but is populated, within the agreed format, by the regions and the schools themselves. This process is supported by a

central "node" at the Ministry of Education and "single nodes" in each of the twenty regions. The central facility provides guidance and support and a networked link to allow survey information from the regions to be uploaded in a consistent way. The regional nodes, with and supporting the schools, source the survey data, validate and upload it to the system, with information exchanged back and forth until it is finalised. The individual school administrators originate much of the data, such as the number of pupils and classes and the utility costs of running the schools, with the school building administrator sourcing more technical aspects about the building condition, etc. The Registry now contains data for over 58,000 school sites and over 8 million pupils. As a record of where the existing children are in the available spaces it is a huge repository of information. Future challenges appear to be: keeping the Registry up to date, making projections into the future and explicitly linking its findings with demographic data so that the published material can openly inform consideration of progress towards longer term strategic priorities.[41]

Strategic assessment of investment needs

Taking the demand for and supply of educational infrastructure in the above two sections, it is a non-trivial challenge to bring them together. However, this is exactly what is required if a rigorous assessment of the need for investment is to be made. Furthermore, this needs to done in a dynamic way that both looks over the coming years, but is also constantly updated as investments are actually made and quality criteria evolve. Rather than being a simple equation of demand / supply, the assessment also needs to be carried out in a clear policy context that makes explicit the strategic educational vision being pursued and the associated planning priorities. In addition, to effectively support this complex policy decision-making and prioritisation, an integrated visual interface, including linked GISs (Geographical information systems), can be very valuable. A core outcome of the process should be a clear assessment of the scale of the investment need and ways in which to prioritise where to invest most urgently, given the inevitable practical reality of limited resources.

- **Portugal**: In 2007, as an initial step in a major refurbishment and modernisation programme for its secondary schools, the Portuguese Government established a broad set of objectives to drive the planned investment. These were to renovate the building stock and open them up to the community, but also to invest in: health and safety, energy efficiency and sustainability, accessibility, provision of modern equipment and adaptations to support modern pedagogies and improvements in standards of education achieved. Once stated these objectives then became the basis for the use of "a matrix of criteria" to identify schools where investment could deliver most value. The selection did not favour any geographical area of Portugal, but: focused on secondary schools; considered for each the likely profile of student

[41] See: https://www.istruzione.it/edilizia_scolastica/anagrafe.shtml

numbers (not declining); and the severity of the repairs etc needed (not too minor); based on a technical assessment, looked for the feasibility of remodelling for a considerably extended life (not made of poor basic materials) and for the potential to improve the functionality of the spaces including opening up a good part of the school to the community.[42]

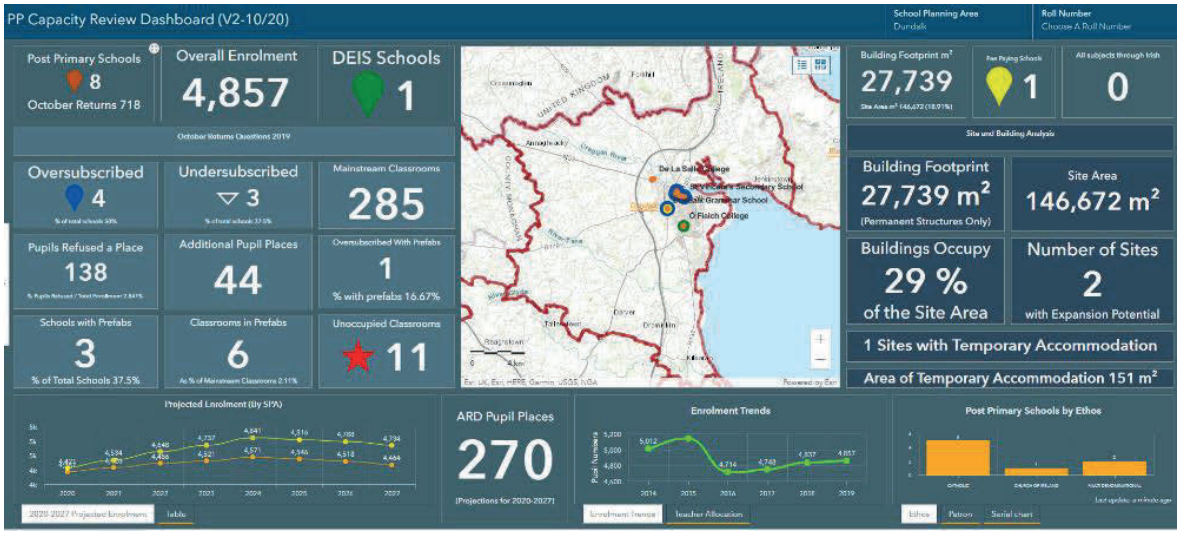
- **Italy**: In Italy, as we have seen, there is a large inventory of the existing school provision in terms of pupil places and building condition. This provides valuable information to support a balanced national assessment of investment needs. However, the linkages to future trends in demands is less clear. The data that exists is "a necessary condition for good planning, but not sufficient" in itself.
- **Belgium**: In deciding what standard to judge the need for improvements against, the "My School" initiative in Brussels provides an illustration of a collaboratively produced guide with tools to support the assessment of the quality of school spaces and to identify / prioritise improvements.[43] As with the Portuguese and Italian cases, what you define as important and so measure, will strongly influence the pattern of investment.
- **Ireland**: This has already been discussed in the section above, but an aspect that should be added here is the whole notion of how to effectively and efficiently draw together demand, supply and policy considerations into prioritised investment decisions. In the Irish case the broader political imperatives were to provide equal access to good quality education and balanced development across the whole of Ireland. More pertinent here, though, we have already seen that robust projections of demand are made, these predictions are linked to assessments of the quality and quantity of existing school provision and this is all presented via the interface of the GIS system in a way illustrated in the figure below. This use of the GIS interface to support policy decision making has emerged over the last decade, moving from primarily internal tool to a "key tool for staff involved in many aspects of school planning and delivery". This has been built up on enhancements of the technology and staff upskilling. The GIS interface is now seen as "an easy to use … at a glance tool … that allows officials to optimise the investment into and usage of school infrastructure in a data informed and transparent manner". The other notable aspect of the Irish case in the strategic assessment of investment needs is the way various organisational units in the Department of Education perform distinct, specialist roles (making projections, assessing existing provision,

[42] Council of Ministers. (2007). Resolution of the Council of Ministers No. 1/2007. Available at: https://dre.pt/application/conteudo/262302

[43] Perspective.brussels, Collectif ipé et +research. (2017). Etude relative à la qualité des infrastructures scolaires de l'enseignement fondamental ordinaire en région de Bruxelles-Capitale. Rapport final. Mars 2017. Service école, perspective.brussels. https://perspective.brussels/sites/default/files/documents/etude_qualite_infrastructures_scolaires_rapport_ipe.pdf

assessing the resources needed and strategically prioritising investment). Thus, the structure of the department precisely reflects in a "loose-coupled" way the assessment process taking place, supporting specialisation but integrating things as necessary.

Figure 10. Sample 2020 school capacity dashboard showing information on schools' capacity (Ireland)



Note: The main purpose is to show high level information on schools' capacity. This can be analysed further to inform decisions where it is likely that capital investment to provide additional school places will be required.

Transparent investment criteria, processes and decisions

Assuming clear investment priorities have been developed, then the availability of resources needs to be made known to those in need. This will then need to be articulated with the creation and delivery of change via multiple projects. This is very likely to involve a jump up in detail and a jump down in the administrative level involved. Where this is conceived of as a national scheme it will probably require clear linkages between national and regional / city areas, as well as clear distinctions between who does what at each level. Where a more "bottom up" process is pursued, those on the ground still need to have access to transparent published investment criteria, with processes and decisions that are also open and clear for all to understand. Without this the process will struggle to maintain credibility.

- **Austria**: This is quite an unusual case as it concerns a limited liability, publicly-owned real estate company that owns a large portfolio of educational buildings (focusing on secondary and tertiary education buildings). After deciding to instigate an ambitious sustainability drive the organisation did two things. First, after many separate initiatives since around 2010, in 2016-18 it created a set of guidelines to assess buildings and their sustainability. These exceed the EU legislative requirements and are updated annually. There are currently 75

measures, together carrying 1000 points across a wide range of topics. Second, they instituted a programme of improvements with their tenants, for example 18 out of the 21 universities in Austria, where improvements are instigated funded by loans to the company and repaid by an addition to the rents of the occupiers. The schemes have to implement a core minimum of measures, but most universities have opted for the full package. Although this case has a particular focus and context, it does illustrate how practical issues of clarity of direction, finance and relevant expertise on the ground have to be addressed.[44]

- **Italy**: Part of the open information system that has been created on school condition, is an entire section about possible lines of financing. These represent government initiatives that could be accessed, running from quite general schemes to those targeted to specific issues, such as fire prevention. So here the approach is less "managed" and more a matter of putting the opportunities clearly in front of potential project initiators.

Collaborative implementation process

As the process becomes less abstract and more local there arises the need to engage many stakeholders in a collaborative effort. As mentioned before, stakeholder involvement from the beginning of the project creates a sense of ownership that often carries over the phases of building operation and maintenance. On the user's side stakeholders may involve schools, but also teachers, parents, local businesses and communities. Handled well it can enhance suitability, acceptance, ownership and may even provide additional resources. On the institutional side multiple agencies can get involved. This can be governmental investors, local planners, budget holders for operating costs, etc. Crucially, across all these stakeholders, clarity in the process must be maintained and the motivation of all must be bolstered by everyone being able to clearly see their distinctive return on investing time and effort in the joint endeavour.

- **Finland**: The focus of this initiative is the development and use of a co-creation model of innovation. The activities were centred on improving business opportunities for educational technology companies and in so doing advancing the development of user-orientated learning environments. All levels of education are involved and virtual as well as physical spaces have been included. There have been around 200 "pilot projects" trying out a wide variety of ideas. The initiative involves six cities coordinated by Helsinki, but using the existing civic structures to reach into the companies, communities and universities in each area[45]. Events were organised and a common framework for co-creation

[44] Holistic Building Program. (2021). Retrieved 9 August 2021, from https://hbp.big.at/

[45] The Smart Learning Environments of the Future programme. (2020b). Guidelines for co-creation. https://www.oppimisenuusiaika.fi/materiaalit/

developed, refined and used. This case study exemplifies the essence of collaboration which included designing in distinctive benefits for each stakeholder, so that all are motivated towards the joint success of the endeavour. This does not expect those involved to work as a team, but rather sees them, much more realistically, as members of a consortium where each retains distinctive end. So, for example the companies valued access to schools and potential users to trial their products, while the educational establishments gained access to new technologies.[46]

- **Lithuania**: In the design of the Life Sciences Centre recounted in this case, on-going consultation with a wide range of the ultimate users of the spaces to be created was crucial. Without it the nuanced functional needs of the scientists, students, companies and potential visitors could not have been fully appreciated and reflected in the wide variety of linked spaces created.[47] These include: private spaces for individual scientists, laboratories with state-of-the-art facilities, more informal zones for sharing information, formal event spaces, a museum open to the public, a business incubator, etc. This is all aimed to reflect the strategy of stimulating collaborative achievement in science.[48]
- **Bulgaria**: Working from 2009-18 the independent educational charity in this case has worked with 85 schools and vocational education institutions in forty-six locations, involving 58,000 pupils across Bulgaria.[49] The aim was to bring modern technologies and pedagogies into the classroom. Two major issues are highlighted by this case: providing continuity across levels and over time and the necessity of taking a holistic approach to achieve significant and lasting change. In this case the "close involvement of the [charity's] core team in every step of the process" provided that continuous and consistent support and linked to the second issue of the orientation taken to the breadth of the intervention. The charity drove forward the idea that it was not just about equipment and classrooms, but fundamentally about teaching practices and pedagogy. This was not just rhetoric as the actions extended to leadership development in the schools and teacher training. However, it is now acknowledged that these human capital investments should have come first.

[46] The Smart Learning Environments of the Future programme. (2020a). Smart learning environments in future. Will do together. https://www.oppimisenuusiaika.fi/materiaalit/

[47] Caikauskas.G. (2021 August 19). Online Interview.

[48] VU LSC. (n.d. a). About LSC. Retrieved August 3, 2021 from https://www.gmc.vu.lt/en/about/about-us

[49] America for Bulgaria Foundation. (2018). „Училища на бъдещето" [Schools of the Future]. pp. 6 URL: https://us4bg.org/wp-content/uploads/2021/06/Schools_of_the_Future_final.pdf

Good practice value for money processes

This and the next section present key ways in which the investment process and the design standards are optimised over time. The principle here is, not that it has to be perfect first time, but that the process must include a means by which it can continuously improve. For this, reflection and feedback is crucial from stakeholders and experts so that lessons can be learned and processes enhanced. A major aspect will be the way in which a good business case can be constructed to release investment, and here the stance on future economies in running costs, as well as the initial building cost, must be clear. Other areas to consider will be procurement options such as PPP (public-private-partnerships) and releasing economies of scale through multi-project arrangements and bulk-buying for maintaining and running the infrastructure.

- **Bulgaria**: In this case the investment programme actively engaged with teachers, parents and local businesses connected to the schools to be refurbished. As a result schools actively fundraised with significant success, representing 25% of the overall investment budget.
- **Lithuania**: In the creation of these scientific facilities the project was supported by a Building Information Model (BIM), the first time in Lithuania.[50] This integrated digital model of the building was crucial to achieving the accurate evaluation of materials, costs and the time needed. It ensured time savings, cost effective planning and the sustainable use of materials. The BIM system further was central to networking the various technical teams (architects, engineers, etc) and supporting efficient workflows and data exchange between them, all as necessary to achieve a complex technical build.[51]
- **Portugal**: This case highlights two big issues in the pursuit of value for money: the balance of the focus on the existing stock versus new build and the balance of the emphasis on the construction phase versus the in-use period of a building's life. The initiative started in 2007 with the aim of renovating school premises in many dimensions, but also to open them up the community and to create a long-term school management system. Initially four pilot schools were addressed and as of 2021 176 schools have been renovated.[52] Key to this initiative was the creation of an independent body, Parque Escolar (PE) by the Government. Based on

[50] Architektūros linija. (n.d.) JGMC. Retrieved August 4, 2021 from: http://www.architekturoslinija.lt/index.php?pid=669

[51] Skaitmeninė statyba. (n.d.). Geriausias visuomeninių pastatų BIM projektas – Jungtinis gyvybės mokslų centras (AB ,,Panevėžio statybos trestas"). Retrieved August 23, 2021 from: https://skaitmeninestatyba.lt/projektai/geriausias-visuomeminiu-pastatu-bim-projektas-jungtinis-gyvybes-mokslu-centras-ab-panevezio-statyso-trestas/

[52] Parque Escolar. (n.d. b) Schools by Program Phase. Retrieved August 2, 2021 from https://parque-escolar.pt/en/schools/schools-phase-0.aspx

the pilot projects, PE produced extensive design guidelines and implementation processes. PE were heavily involved in the consultation and initial design phases with individual schools (see the following table), the design was then completed by contract architects and the work tendered and carried out.[53] On completion of the project the ownership of the school buildings is transferred by the State to PE who then become responsible for their maintenance and renewal for the next thirty years in return for rent, which is incentivised so that PE is motivated to maximise the available spaces. Owing to the involvement of PE in the concept design and the long-term operation of the buildings there is an unusually close dynamic between capital and recurrent expenditure leading to a natural imperative to build for the longer term. Projects ready for bidding were bundled and released to pre-qualified contractors / consortia. This was intended to be more efficient and release economies of scale, but it also limited radically the number of potential bidders as the scale of the projects became very large.

[53] Parque Escolar. (n.d. c) Conceptual model. Retrieved August 2, 2021 from https://parque-escolar.pt/en/program/conceptual-model.aspx

Table 13. Tender and appointment procedures of the Portuguese programme by Parque Escolar

Tasks	Stakeholders							Timeframe
	REA's	PE	Schools	Designers	Consultants	Inspectors	Contractors	
Schools' selection according to criteria	+	+						↓
National general overview meeting with all schools involved	+	+	+					**Milestone**
Regional general overview meeting with schools by region – presentation of online strategic plan questionnaire and respective filing instructions	+	+	+					↓
Selection of designers		+						
Strategic plan information submittal			+					
School visit		+	+	+	+			**Milestone**
Physical condition and anomalies survey					+			↓
Seismic analysis					+			
Project information delivery: design guidelines and photographic and building surveys		+		+				
Building survey (when needed)		+		+	+			
Brief development and delivery to the designers		+	+					**Milestone**
Concept design 1st draft presentation to PE				+				↓
Concept design 1st draft presentation to the School's Board of Management		+	+	+				
Concept design validation			+					**Milestone**
Schematic design 1st draft presentation to PE		+		+				↓
Schematic design 1st draft presentation to the School's Board of Management		+	+	+				
Schematic design formal presentation in the school		+	+	+				
Schematic design validation			+					**Milestone**
Building phases preparation		+	+					↓
Detailed design development and construction documents delivery				+				
Project revision		+						
Tender bids management		+						
Construction phase		+	+	+		+	+	**Milestone**

Source: OECD, 2012.

Note: It is evident from the available data that Parque Escolar is heavily involved in the planning and design process of the school buildings, and it is only at the construction phase that the responsibility is transferred to the contractor and Parque Escolar is less involved.

Good practice design standards and guidance

Similarly to the section above, the emphasis here is on injecting learning from the experience of stakeholders (especially users) and experts so that the facilities created are ever more suited to their purpose. Some clear statement of design standards and clear guidance will have a central role in judging the state of the existing infrastructure and may help informing the investment priorities and supporting the collaboration to bring projects to fruition. The form of this good practice design standard is likely to be some combination of policy priorities, research made accessible, plus insights and exemplars written up from practice as case studies. Some guidance will be focused on one issue, others will be more broadly drawn.

- **Belgium**: This initiative is focused on creating and keeping up to date a design guide for school buildings that can help all stakeholders assess the quality of school spaces and identified what improvements could be made. It was created in 2018 by a multi-disciplinary team, with extensive stakeholder consultation, for the schools in the Brussels region. With five broad themes and 31 criteria, all within a 110-page document, it is designed to be accessible and simple to use for all stakeholders involved in school infrastructure.[54] Supplementary checklists, an on-line toolkit and focused guides have been created too. Great efforts are made to keep it up to date in terms of regulations etc so that it can reliably be seen as a "base reference" or "central source" of information. Although focused primarily at existing buildings it is being used for new build by some parties too. The guide seems to have gained acceptance as the place to go for dependable access to guidance etc for all stakeholders, and as such it raises the knowledge level for all involved so facilitating a more efficient and effective bottom-up process.
- **Austria**: Sustainability guidelines for educational buildings, linked to, but exceeding, the base EU legislative requirements. Arranged as a set of measures with points associated in order to make them more easily actionable.[55]
- **Lithuania**: Given this case was about creating a large scientific centre of excellence, it was a problem for the designers to easily find the guidance and inspiration domestically. Thus, the architects for this project had to travel abroad to see exemplar buildings and build the knowledge to be able to approach their project. For specialist buildings this raises the issue of how to get the necessary expertise within the design team and whether to buy it in (from abroad) or allow time and

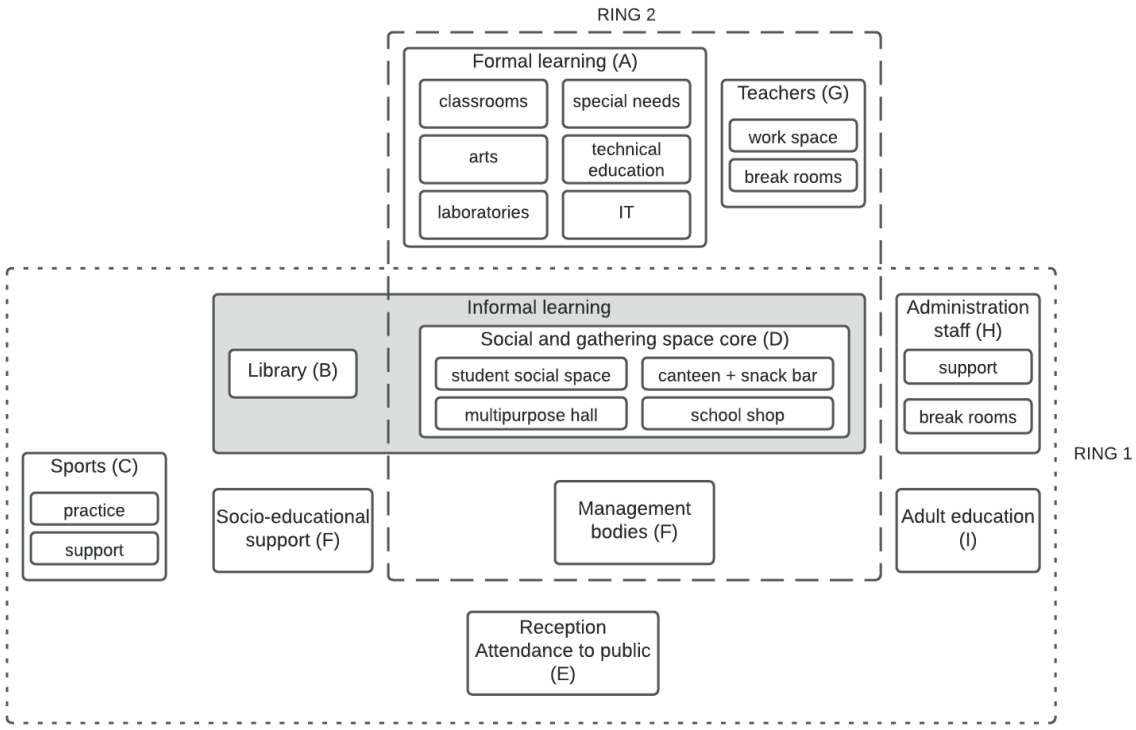
[54] Perspective.brussels. (2018). Mon école, un espace de qualité. Guide pour l'enseignement fondamental (D/2018/14.054/1). Service école, perspective.brussels. https://perspective.brussels/sites/default/files/documents/mon_ecole_un_espace_qualite_0.pdf

[55] See: https://www.big.at/fileadmin/user_upload/02_Leistungen/2_2_Bau-Projektmanagement/Holistic_Building_Program/2017_BIG_HBP_Broschuere.pdf

effort for it to be garnered. The latter can then have an up-skilling impact in the focal country, but it takes time.[56]

- **Portugal**: It is interesting in this case that one of the main drivers was the opening up of the school spaces to the community for various reasons, but actually one is to maximise the utilisation of buildings and so the value delivered by them. The programme of renovations to secondary schools was confronted with a wide range of very different school types each presenting very different challenges for achieving community access. The response to this was to drive the issue forward via a memorably simple, but flexible concept, the Double Ring Layout. This is illustrated in figure below and was achieved by targeted reconfigurations and additions to the existing buildings to achieve the possibility of this layered use of the buildings.[57]

Figure 11. Double ring layout logic (Portugal)



Source: Adapted from Parque Escolar, n.d.c

[56] Caikauskas.G. (2021 August 19). Online Interview.

[57] Care, L., Evans, H., Holder, A., & Kemp, C. (2015). Building Schools: Key Issues for Contemporary Design. Birkhäuser.

Smart, effective and inclusive investment

This section focuses on one of the main outcomes of the whole process described so far, namely the actual investment made and some reflection on whether it has been achieved smartly, effectively and inclusively. Unless confronted with a very simple situation, a wide range of options will need to be considered as to what to do in terms of its scope and focus. It is most likely that multiple approaches will need to be available so that appropriate solutions can be found for particular cases (requisite variety) and it is also likely that long-term initiatives (beyond political cycles) will pay dividends so long as they are expected to evolve and develop in response to objective experience.

- **Ireland**: In this case, where the priority investments have been identified, various "flexible investment programmes" are available. Major projects are only used if essential, whereas "additional accommodation" schemes are smaller, more flexible and more targeted. This approach has been found to be more cost effective, flexible and avoids "gold-plated investments".
- **Finland**: A lot of effort has gone into the development and refining of the co-creation model and there is now a lot of experience of its use. This has been put into a handbook and could be of great value to others hoping to drive similar projects. One of the findings is that it is unrealistic to expect everything to be clear at the start. The process needs to evolve as partners learn within the context of trust derived from real interaction. This all takes time and facilitation – and so resource, but is seen as a good early investment that pays dividends.
- **Portugal**: As a major long-term programme of refurbishment, including maintaining and running by the same organisation, there were (and are) many opportunities to improve design and processes through feedback. This did happen in the first instance, based on the analysis of pilot projects. After that the good intentions got swept away in the unremitting momentum of a fast-paced initiative. This is likely to always happen, unless reflection on what has been done in order to improve subsequent stages is funded and probably carried out independently of the actors in the thick of the programme of work.

Improved physical learning environments

The last stage of the process is, not the physical investment, but the impact the enhancements have on the learning taking place, as well as benefits to the broader community and the sustainability performance of the infrastructure. If lessons of dimensions like these can be captured and fed back into the earlier stages of the process, then effectiveness as well as efficiency can be achieved. However, these impacts are more likely to fully develop after a significant period of time and generally outside of the timeframe of investment projects themselves. Therefore, at this late stage they often lack ownership and are no longer in the discourse and policy agenda, especially in cases where the impacts are a mix of positives and negatives.

- **Austria**: The real estate company implementing environmental improvements to their estate have plans to develop a reporting programme to help institutions track their success towards

sustainability. This will be an important way to keep the initiative evidence-driven.

- **Finland**: Many (200) pilot projects were carried out, but the benefit of the learning about improved learning environments was lost to a great extent as it appeared in many fragmented reports. Greater investment in this aspect of the initiative might have created a much wider impact.
- **Lithuania**: Now the science centre has been open for five years it has been possible to reflect on its performance. A key dimension, that was explicitly considered in the design, is flexibility. At the level of the existing building the question of flexibility was severely tested by the Covid-19 pandemic and the facilities came out very well. Spaces were rapidly reconfigured to allow testing by the scientists. Looking beyond the existing building, however, there is little available flexibility for growth in the floor plans, especially for the burgeoning success of the spin-out commercial activities. The issue of flexibility in all its dimensions is highlighted as an important aspect to consider at the design stage.

Summary

It was intended that the good practice case studies would serve several roles in this report.

- These are real cases where people have tried their best to achieve ambitious goals. As such, it does seem likely that they can act as stimuli to action for individual stakeholders across the EU as they recognise common ground with the actors described and the challenges they faced.
- The cases have evidenced, in diverse ways, that actions in the various parts of the Good Practice Framework are feasible in the real world (thus, they can be followed by planners of investments) and have illustrated the type of impacts that can be achieved.
- Together the case studies do substantiate the practical utility of the Good Practice Framework for educational infrastructure investment. Indeed, the final version of the model was very much tested by the content of the cases, resulting in several improvements to the model.
- Together the cases do highlight the dynamic connections between the different parts and levels of the possible best practice investment process, stressing the importance of adaptive improvement through effective feedback, review and in some cases formal evaluation mechanisms.

No one case study exemplifies every aspect of the Good Practice Framework, and each case is rooted in its particular time and context. Thus, readers of this report are encouraged to treat the Framework as a roadmap and the case studies as contextualised inspirations that need to be unpacked and the principles reapplied into the new context of the reader's country / region. Noticeable amongst the case studies is how often they were a reward to long term commitment and repeated phases of learning and adjusting within a consistent determination to make progress.

Conclusions and recommendations

Trends in investment

Context of investment

The investment trends in educational infrastructure are generally driven by two main factors - numbers of enrolments in education at different levels, as well as scope, condition and fitness for purpose of the existing infrastructure. The number of enrolments in early childhood, primary and lower secondary education is further in the short term influenced by birth rates and net migration, as well as migration within country (e.g. from rural to urban areas). In non-compulsory education such as upper secondary and tertiary education demographics play a much smaller role and instead the absorption rates, education requirements, school drop-out rate, variety and popularity of existing post-secondary pathways, and quality of higher education services in the country play a role in enrolment dynamics and later in infrastructure needs.

While the birth rates in European Union are low, immigration as well as internal migration within countries (creating a need to optimise the network of educational institutions mostly in rural areas and a demand for new infrastructure in urban ones) means that a common challenge for many countries is the increasing demand for early childhood and primary education infrastructure investment. Taking all levels of education into account, overall enrolment levels in 2009-2019 were consistent with migration trends and had an upward trend or fluctuated in Western and Nordic EU Member States, while a downward trend was noticeable in Member States in Central and Eastern Europe.

Investment needs, priorities, and objectives

Based on the national (regional) mapping, in 2012-2020 some of the most common priorities and objectives identified in the Member States included:

- School network optimisation to address overcrowding or, in contrast, low occupancy rates, and to reduce the transit from home to school
- Health and safety (to tackle front-line challenges such as asbestos, fire hazards, leaking roofs, poor indoor quality, non-sanitary bathrooms, poor ventilation especially in COVID-19 situation etc.)
- Energy efficiency and sustainability to reduce the number of buildings with high energy consumption.
- Accessibility of facilities (to boost the inclusion of people with disabilities and special needs)
- Investment in ICT infrastructure (to improve internet access, and stock of computer hardware and software)
- Investment in equipment and modern laboratories (to support STEM education)
- Adapting to modern pedagogy and improving the quality of the buildings in general (to provide schools with spaces that provide multiple

opportunities for learning that fit current pedagogy needs (such as mobile walls, open classrooms, etc.) and improve learning environments in general)

Based on the scoping interviews and national (regional) mapping, a decade is too short for meaningful shifts in priorities and objectives of investment in education infrastructure to emerge. Such stability spanning a few political cycles has the potential to boost the efficiency of investment. Therefore, trends observed in the last decade are likely to continue. In line with the horizontal policies and objectives that go beyond education, some trends, for instance, investment in energy efficiency and ICT infrastructure are set to become more pronounced. Considering the shift towards the improvement of learning spaces to fit modern pedagogy, in the short-term significant changes are more likely in countries which have little challenges in relation to the accessibility, safety and health of their education buildings. Finally, whether or not COVID-19 remains a national emergency in most countries, the lessons learned on digital infrastructure for distance learning, having spaces suitable for maintaining distancing and ventilation are likely to continue to influence infrastructure investment for at least a few years.

No meaningful differences between investment priorities and objectives by source are observed. The national (regional) mapping suggests that countries treat EU and national funds as complementary and use both to reach pre-defined policy goals.

Scope and source of investment

Infrastructure investment falls under different economic activities, hence it is not classified as a separate item in national accounts. This explains why neither Eurostat nor other international data providers, including the European Commission, European Investment Bank, OECD, and World Bank, offer direct measurements of total infrastructure investment in education by country. While they provide national accounts aggregates and government finance statistics such as total expenditure on education, investment in infrastructure by industry or function of government is measured only indirectly.

Examining three types of assets closest to infrastructure and most relevant in education – other buildings and structures, machinery and equipment, and computer software and databases taken together – the trends show that investment peaked in 2010, plummeted to reach its lowest in 2012 as a result of austerity measures related to economic and financial crisis, and started recovering afterwards, with a short pause in 2016-2017. However, these variations were mainly on investment into buildings and structures; spending on computer software and databases, and machinery and equipment had not fluctuated that much.

The investment in education infrastructure remained largely public. General government GFCF in education comprised more than a half (58%) of the total

investment in education infrastructure between 2008 and 2018[58] and stabilised at around 0.3% of gross domestic product in 2017 in EU27[59]. Other important sources of funding were municipal or regional budgets and EU funding; the national experts report that, in general, the share of private investment in education infrastructure is relatively small.

Priorities by level of education differ across countries. In 2008-2018 ten Member States invested in infrastructure the most at the tertiary level, nine did so at pre-primary and primary levels, seven at the secondary level, and one in education not definable by level. This can be explained mainly by a cumulative effect of the trends in enrolment at different levels, and policy priorities.

Investment gap

The European Investment Bank (EIB) estimates the annual infrastructure investment gap for EU27 until 2030 at roughly EUR 155 billion[60], i.e. 1.2% of the EU27 GDP in 2020[61]. The gap in education infrastructure comprises 5.2% of the total and amounts to EUR 8 billion per year. Mapping data suggest that such gap could be increasing over time as more buildings and other infrastructure (e.g., ICT, laboratories, gyms, etc.) will require maintenance and renovations. In many cases, the lack of maintenance, the natural decay of the infrastructure and the rigidity of some building designs diminish such capacity to a point in which the gap between the demand for educational services and the supply of quality infrastructure becomes larger every year. This results from years of underinvestment, especially since the global economic and financial crisis. However, while safety and energy efficiency are of course top priorities, the investments targeted at these issues could barely create any 'educational dividends' in the future.

[58] Calculated without Cyprus and Croatia, and Denmark for 2018 to allow for a comparison with total GFCE for the same period. Based on Eurostat, General government expenditure by function (COFOG) (GOV_10A_EXP).

[59] Calculated based on Eurostat, General government expenditure by function (COFOG) (GOV_10A_EXP).

[60] European Investment Bank. (2018). *Investment Report 2018/2019: Retooling Europe's Economy*. https://www.eib.org/attachments/efs/economic_investment_report_2018_key_findings_en.pdf

[61] Based on calculations made by the authors using Eurostat data on GDP and main components (output, expenditure and income) (NAMA_10_GDP).

Recommendation 1: As well as the sheer numerical need for places, any estimation of the education infrastructure investment gap should take into consideration a deep assessment of the educational adequacy of facilities. Such assessment should be done from the bottom at an appropriate level of decision making, e.g. by local authorities reporting on the needs to regional/national level.

The national (regional) mapping revealed that aside from the enrolment numbers and condition of the existing infrastructure, other factors have had significant impact on the needs of educational infrastructure investment in various countries. Some of these factors are common to most Member States – e.g. climate goals and environmental targets (mainly leading to energy efficiency investments), education policy developments and reforms, horizontal policies such as inclusion of people with special needs and disabilities, digitalisation, and lately COVID-19 pandemic challenges (which naturally had an impact on investment in digitalisation and ventilation systems as well as more flexible use of learning spaces in particular). Other factors are more location-contingent and include early school leaving rates, terrorist threats, risk of earthquakes and other natural disasters, increased risk of heatwaves due to climate change, and historical heritage concerns.

Recommendation 2: In addition to educational drivers, the education infrastructure investment trends and challenges which are noticeable across all EU Member States (energy efficiency, inclusion of people with special needs and disabilities, digitalisation, pandemic-proofing) should be at the core of any further EU action in the field – strategic documents, investments, etc. A streamlined EU policy could provide a better common understanding of the infrastructure issues for different countries as well as at different levels within a country (national/regional/local).

Another current trend revealed by mapping was the increase in more inclusive enrolment of learners, in some cases from poverty-affected regions, but most often those with special needs and disabilities. Enrolment numbers of the latter group have been increasing in many Member States. This trend is in some cases self-reinforcing, as an initial investment in more equitable infrastructure may encourage more disadvantaged learners to enrol and further increase the demand for investment.

Recommendation 3: As evidence shows that creating inclusive infrastructure leads to more enrolment of special needs and disabled learners, and in turn to more demand for such investment, all Member States should be encouraged to follow the best practices in this regard and mainstream inclusive investment in their planning. It would be useful if good practice models and examples (e.g. value for money and design standards) were available to public or researchers / country officials in a European platform with recommendations, examples (from real life) and some links.

Governance

Needs assessment and forecast

Due to the nature of different levels of education, the needs assessment related to infrastructure is usually governed by different institutions and often at different levels of governance. In most cases, the needs of early childhood and primary education institutions are monitored and fulfilled on the municipal level, while universities are communicating their needs (if such option is available) to the central government.

Some countries conduct baseline data collection which can be done through national surveys, self-reporting by the educational institutions, or aggregated by the ministerial bodies. It can be used for preparing the reports that identify gaps, produce forecasts, and plan the budgets. A major tool allowing to conduct effective systematic infrastructure assessment is having a national digital dataset dedicated specifically to infrastructural needs. Nevertheless, in some cases there is no evidence at all that coherent monitoring and follow-up of needs is carried out either by municipal or by central authorities. It is worth mentioning that the mapping of infrastructural practices in EU Member States has little to no emphasis on vocational education.

Recommendation 4: It is recommended for all Member States to carry out centralised data collection on needs assessment; in case the needs are collected by different institutions or at different levels, an aggregation of data is necessary. A stronger involvement of vocational education and training in needs assessment is essential.

The indicators used to forecast the needs for investment most usually include demographic development, migration trends, condition of current infrastructure and school capacity, accessibility for students with special needs and geographical proximity.

Recommendation 5: Achieving the objective of smart, effective, and inclusive investments in educational infrastructure may require starting by drawing a baseline of acceptable levels in each category. In very simple terms, whatever is under such an acceptable level, needs immediate attention. The items to be considered should especially include size of the classrooms, safety, hygiene, air quality, lighting. Higher values over such base line, also require a significant effort to maintain such levels. Extremely high values would constitute good practices to be evaluated and possibly replicated. Over time, EU recommendations on baseline levels could be developed.

Strategic vision and planning

Most EU Member States do have strategies or visions at national level towards investment in education infrastructure. Where they do not, in some cases this is due to lack of capacity for long-term planning; elsewhere the planning is done at regional or municipal level without a national vision. Also, due to their autonomy universities are largely able to make decisions about their own strategic development and often this is done outside the scope of any national planning.

The documents outlining strategic vision and planning are rarely dedicated only to the issues of education infrastructure. In most cases this is done in general education strategies and plans, and in some cases in documents covering infrastructure planning in several areas. In countries where the governance of education investment is very decentralized, there is a noticeable lack of coordination between, for instance: policies for urban and rural areas, public and private initiatives, or even between different educational levels.

Recommendation 6: Whereas integration of education infrastructure planning with other aspects of education or other types of infrastructure needs may be highly beneficial, having all the aspects of strategic planning and vision towards education infrastructure outlined in a single document (at any level) is necessary for clarity and comprehensiveness, as well as better follow-up of achievement of strategic objectives. However, this type of document should be built bottom-up with participation of all stakeholders, including those at local and regional level, so that it is not artificial.

Criteria and procedures for project prioritisation

The two most important factors that determine the success of a project prioritization process are transparency and consistency. None of these considerations were brought to the attention during the mapping.

Design standards are meant to be used to design new schools, renovations, etc., and also as a parameter for the evaluation of existing facilities; a strong commitment to generate and maintain design standards and criteria that would lead to smart, effective, and inclusive capital investments in education was not perceived during the mapping. Instead, numerous countries only use general construction standards not specific to education, or use them only for some levels, notably early childhood education. Furthermore, an explicit process for updating infrastructure design standards to look back and evaluate their effectiveness, or to view such standards as part of a broader equation that would include space utilization and network efficiency was not observed in any of the countries analysed.

Recommendation 7: In different Member States, a national discussion on design standards and criteria that includes education and build environment experts, along with users and managers, could have a highly mobilizing effect generating broad support from all kinds of stakeholders. The challenges brought by COVID-19 pandemic at the same time open up an opportunity for discussion and reimagining of educational buildings, spaces and equipment.

Only a few countries report specific standards and a known procurement process for furniture and equipment. An in-depth set of furniture and equipment standards and guidelines could support students' health, attention in class, group collaboration and open a full range of new learning possibilities. Furthermore, compared to full building renovations, the cost of updating furniture and equipment is considerably lower and a decisive action on this could yield critical educational benefits.

Recommendation 8: Development of specific standards for furniture and equipment and targeting investment towards achievement of those standards is a relatively less costly and potentially important way to improve educational outcomes.

In general, the highest priority is given to projects to improve safety, health, energy performance, accessibility; Higher education projects seem to be more market driven than projects in other education levels. There is a greater consciousness about the value of attractive educational facilities for capturing new students and consequently have more revenue.

Supervision of projects and investment performance

The construction process is risky and was identified as a significant area of concern in many of our interviews. This is where most of the cost overruns happen, along with time slippage and specification changes that could compromise the quality of the end product. Construction supervision quality depends mostly on the systems and procedures utilized and on the professional capacity of the persons in charge of such supervision. The Member States typically had dedicated project supervision strategies and government inspections. However, mapping results did not reveal any easily available reports on project audits, qualification of construction companies, or the results of quality assurance and quality control reviews.

Recommendation 9: Community oversight (not identified in any of the analysed countries) could significantly improve the supervision of investment in education infrastructure. Parents and students associations, teachers unions, education services providers or local non-profits with the proper training, have the potential of being very protective guardians of investments in education. Moreover, their involvement from the beginning of the project creates a sense of ownership that often carries over the phases of building operation and maintenance. The needs of communities may also be included in relevant policy documents.

The supervision of investment performance or asset performance was much less developed. Most of the countries did not carry it out in a systematic way. The only exception found was Ireland that reveals having well developed methodologies to assess investment performance and asset performance. Mapping results also did not identify an explicit government run preventive maintenance strategy in most countries.

Collection and disclosure of data

Mapping results suggest that the data about education infrastructure is most often collected in databases or inventories. These can be maintained at national or regional/local level – usually at the level from which the majority of funding is obtained. Inventory or database development efforts in most EU27 countries were observed to be not as systematic as expected. Majority of the countries carry out only fragmented data collection (for example, at local level (schools, universities, etc.), municipal level or have some databases that include only a part of the education infrastructure). It is also evident from the monitoring results that even though most of EU27 countries collect some data on investment in education infrastructure and on the infrastructure itself, the complete data is not usually made available to the public, creating a paradox – even though national or regional institutions put in the work for collecting extensive information, for example, on the condition of education buildings in the whole country (or at least for some levels or education), the data is only available internally for those that directly participate in planning process of investments – usually the Ministry of Education, municipalities and the education institutions themselves. This not only reduces the accountability to the public but reduces the issue of education infrastructure itself. If such data as condition of education buildings was published and communicated clearly to the public, it could increase the use of PPP as well as increase overall attention to the infrastructure and lack of investment for it.

Some countries were documented to have separate databases for different funding sources, most notably, separate databases/websites for EU funding, where it was relevant. If using such (or similar) websites/databases was mandatory, at least some investments would be easier to track and compare between countries.

Aggregation of data (which is essential for proper analysis of regional/national trends) is reported to be a challenge in many countries. The main reason for this is that different institutions invest in infrastructure, with each maintaining their own data. As a result, the relevant data is either in multiple databases or not aggregated. Mapping results suggest that only Austria, Belgium, Denmark, Ireland and Malta aggregate their investment data in one database/registry that is managed by one institution. The aggregation of investment data for these countries may be feasible because the most important investment sources in these countries are local or state budgets, that usually require accountability for investments made and are more centralised or easier to track, therefore creating ground for collection of investment data.

Due to high popularity of public procurement as a primary funding delivery mode, investments in infrastructure are easier to monitor. Usually, public procurement procedures have clear rules and legislation that require at least some form of monitoring (both the size/use of investment and the infrastructure itself before/after investment). Countries that have strong regional institutions (municipalities, communes, states, etc.) with high autonomy collect their data on education infrastructure at regional level, as the funding for investment in it is also provided regionally. Consequently, countries that rely on state or EU funding to invest in education infrastructure tend to collect data at state level. This also explains data gaps in most countries – as there are differences in funding sources between levels of education, data collection also differs in the same country. For example, some data might be collected at state level, as the infrastructure is funded by state, and some

data might be missing, not collected or collected at regional (or even local) level as this infrastructure is funded using municipal budget or private funds. Selecting responsible actors in each country (be it municipalities, the state, some ministry or each school separately) and making sure that these actors collect comprehensive data would prove useful both in planning upcoming investments in education infrastructure and in making sure that public procurement procedures were up to standard.

Recommendation 10: Aggregated, updated and transparent data about education infrastructure is essential for many purposes, including assessment of investments, comparability within and between countries, evaluation of achievement of objectives, clearer identification of needs, possibility for cost-benefit analysis, development of feedback culture at different levels, capitalisation on lessons learnt, and others. It should therefore be a priority for Member States to a) make an effort to aggregate the databases currently maintained by different institutions; b) to make all data publicly available for transparency purposes. The role of the European Commission could be to develop and maintain a European database on education infrastructure; the commitment of countries to contribute to the database could also be an incentive to aggregate and make available the data at national level. Furthermore, specific rules on reporting the data in a common format could be connected to infrastructure investments made with EU funding.

Funding arrangements and delivery modes

Mapping results revealed that regional funding (municipal/federal/communal) is the most common funding delivery mode in most of EU27 countries or at least is the primary funding source for some education levels in that country. The second most popular funding source is state (central government) funding. Higher education institutions receive investment in their infrastructure either from the state or EU funds and rely more heavily on private investors, investment loans from banks (like EIB) or invest their own funds.

Mapping results suggest that funding for education infrastructure in EU27 countries is decentralised either at country level (where most of funding is regional/municipal or local) or at some levels of education (for example, pre-primary and higher education funding in most countries is decentralised due to high autonomy of these education levels), as most countries rely on a few sources of funding, including municipalities, the EU funds and private investment.

The most common investment delivery mode among all the countries mapped is public procurement. On the other hand, direct public provision as a primary funding delivery mode is not very common. Mapping results suggest that even though PPP is used in several countries (Belgium, Estonia, Finland, Greece, Ireland, Lithuania, Poland,

Slovakia, France), it is only used for certain projects, in small scale or as an addition to public procurement of public provision procedures.

Solutions to reduce costs differ across all countries, but bulk purchases (often coordinated among numerous educational establishments) are among the most popular saving mechanisms. Meanwhile, cost-benefit analysis is not very commonly used.

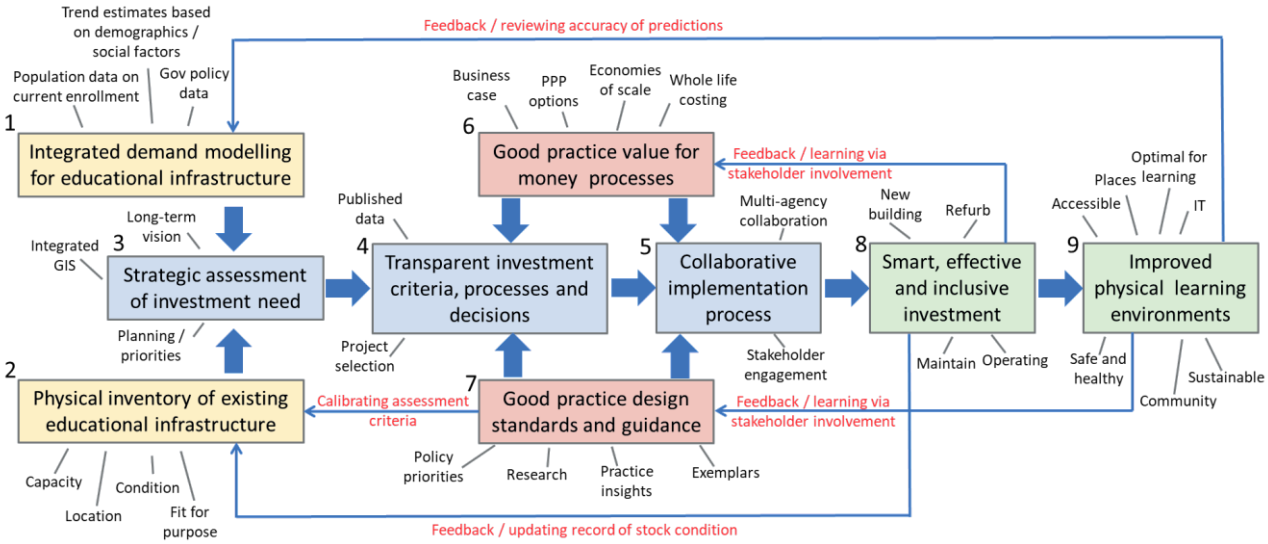
Involvement of and coordination between different levels of government

Although it would be logical to suppose that in more centralized education systems the investments in infrastructure would be governed at central government level and vice versa, the reality is often different. For example, early childhood education institutions are mainly supervised on the municipal level even in relatively centralized contexts. Meanwhile, decision-making regarding support of public universities, irrespectively of how autonomous they are, is done in the state level in a vast majority of cases. The most diversity is seen on the level of general education.

Ministries of Education are the most commonly involved actors in the process of education infrastructure strategy and investment planning in more centralized settings. The Ministry can be cooperating with other ministerial bodies, form a council to cooperate on infrastructural matters, or work together on irregular basis as an executive network. In the systems which are characterized by complete decentralization and delegation to the subnational level, local authorities obtain funds and cooperate with stakeholders on the respective territories to arrange effective distribution.

Good practice framework

As an analytical tool, but also for better illustration of conclusions of the study and potential recommendations for the future, we have developed a holistic model of an idealised investment process for educational infrastructure – the "good practice framework". The sources of inspiration for the framework were both the relevant literature and the best currently existing aspects of the EU Member States' systems. The resulting good practice framework model is provided in the figure below. No such 'ideal' system exists in any EU Member State; nor is it possible in all contexts. However, implementation of specific best practice elements (items 1-7 in the figure) outlined in the model may improve the results and impacts (items 8-9), which in themselves include decisions that should be explicitly considered as to the scope of the ambition being pursued.



Systemic characteristics:

1) Data, analyses and processes all at a level of granularity that gives visibility to, age, level of education, special needs, mix of subjects, location
2) Levels from national – regional – local – project, connected synergistically and provided with appropriate integration and user support.
3) Stakeholders at all levels aware of opportunities and processes and engaged in the active improvement of what is done and how it is best achieved.

Recommendation 11: We recommend that Member States take inspiration from different elements of the good practice model, many of which are related to the previous recommendations outlined above.

The strategic assessment of investment need (3) is at the starting point of sound planning of investment; it should take into account both the deep evaluation of existing infrastructure, concentrating on its capacity, location, condition, and fitness for purpose especially in constantly evolving latest educational practices (2) and demand modelling based on enrolment and demographics (1). The key elements of the investment itself are its transparency (4) and collaboration not only among institutions but also with the stakeholders (5). The properly developed cost-effectiveness processes (6) as well as design standards (7) contribute to transparency and collaboration. Finally, feedback loops are crucial in updating the information and informing future investments.

The good practice model, in addition to providing a comprehensive view of the parts of an ideal system, has allowed some of the key dynamics of successful systems to be revealed. This was achieved via the cross-case analysis of the eight country-specific good practice cases. This has resulted in two consistent success characteristics that are set out here.

First, successful initiatives have typically been long term. They have built quite slowly, evolving organically, as an initiative in one aspect is learnt from, finessed and success here is achieved (say baseline condition data). Then, from this sound foundation related developments have themselves been progressively built out (say demand modelling), which can then link around another aspect in due course (say, strategic needs assessment). This can look a bit like pragmatic "muddling through", but is akin to the practical reality of disjointed incrementalism [62] and twinned with a consistent strategic drive seems to be very effective.

Second, successful initiatives span various levels, from national to local. Linking up these domains can be difficult and successful initiatives have actively addressed the "meso-level". This can be through supporting data that is stratified meaningfully to the various levels and / or provisions for collaboration that are appropriate at each level and ideally link together, potentially through multi-level stakeholder engagement in good practice forums. These last will probably need to be created and supported from a national level, but located at the meso-level. The challenge seems to be how to create this coherence without getting trapped into a rigid bureaucratic solution. Clearly this may be easier in focused private initiatives, but for national systems loose-coupled solutions[63] can be a more robust approach. So, for example, a strategic assessment may identify where investment should be prioritised, but there could a range of transparent funding options that can be utilised by the people on the ground.

Recommendation 12: We recommend that Member States consider the apparent benefits of allowing a long term, evolutionary approach to educational infrastructure investment, such that expertise can be built up and so actions can be steered to meet current imperatives. An important aspect of any sustained effort should be a proactive approach to bridging the gap between high level policy and local implementation. A positive action could be investing in multi-stakeholder engagement in good practice forums (which would also be beneficial across the EU). This could be in a form of an online, physical, or blended meeting, conference, or working group (annual or more frequent), where policy makers, experts, academia, practitioners could meet to discuss.

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