GPSS | Global Program for Safer Schools

Roadmap for Safer and Resilient Schools

Guidance Note V2

THE WORLD BANK
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GFDRR
Global Facility for Disaster Reduction and Recovery

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Global Facility for Disaster Reduction and Recovery

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Will we value and invest in school disaster resilience for the sake of our children's safety and the future of our communities? Or will we fail to act until after our schools and communities experience irrecoverable loss that could have been prevented? This is a choice, and we choose the former. We hope you do the same.

—Federal Emergency Management Agency *Safer, Stronger and Smarter: A Guide to Improving School Natural Hazard Safety.*

Acknowledgements

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The RSRS at a Glance

What is the RSRS?

The Roadmap for Safer and Resilient Schools (RSRS) is a step-by-step guide intended to provide support to governments of developing countries that are exposed to natural hazards. Specifically, it focuses on the design of intervention strategies and investment plans to make schools safer and resilient at scale. The guide also encompasses the recovery and reconstruction of school facilities affected by disasters.

The RSRS aims to promote cooperation among stakeholders involved in the planning, design, and implementation of risk reduction programs across large stocks of school facilities. Key stakeholders in this effort are school infrastructure managers, relevant government agencies, ministries of finance,[1] the World Bank, and other international financing institutions (IFIs) and development partners. The RSRS stems from the experience of World Bank task teams working in this field.

Why the RSRS?

Understanding disaster risk in school infrastructure typically involves at least three levels of complexity: multidimensional risk factors, multistakeholder environments, and issues relating to scale. In this context, the decision-making process requires a structured dialogue through which stakeholders can achieve consensus around the roots of the problem, attain an understanding of the potential consequences of future hazard events, and identify opportunities to reduce risk. Creating this enabling environment allows policymakers to make more informed decisions about investments and policy reforms that will lead to safer and resilient schools at scale.

[1] Not all national governments have ministries. The term is used generically throughout this guidance note to refer to government departments or agencies.

Whom is it for?

We expect the primary users of this guide to be government officials responsible for school infrastructure management and task teams from IFIs and development partners (such as the World Bank) with an interest in school infrastructure. Practitioners, professionals, and researchers may also find in it useful concepts and content regarding disaster risk management and reduction with respect to school infrastructure.

Context of application

The RSRS takes into account both normal and post-disaster conditions. The former refers to risk reduction intervention plans, while the latter refers to plans for the resilient recovery and reconstruction of school infrastructure affected by hazard events. Since "risk reduction" and "resilient recovery and reconstruction" are conjoined, the guide approaches the two conditions in parallel. It also addresses considerations related to reconstruction planning.

Structure of the RSRS

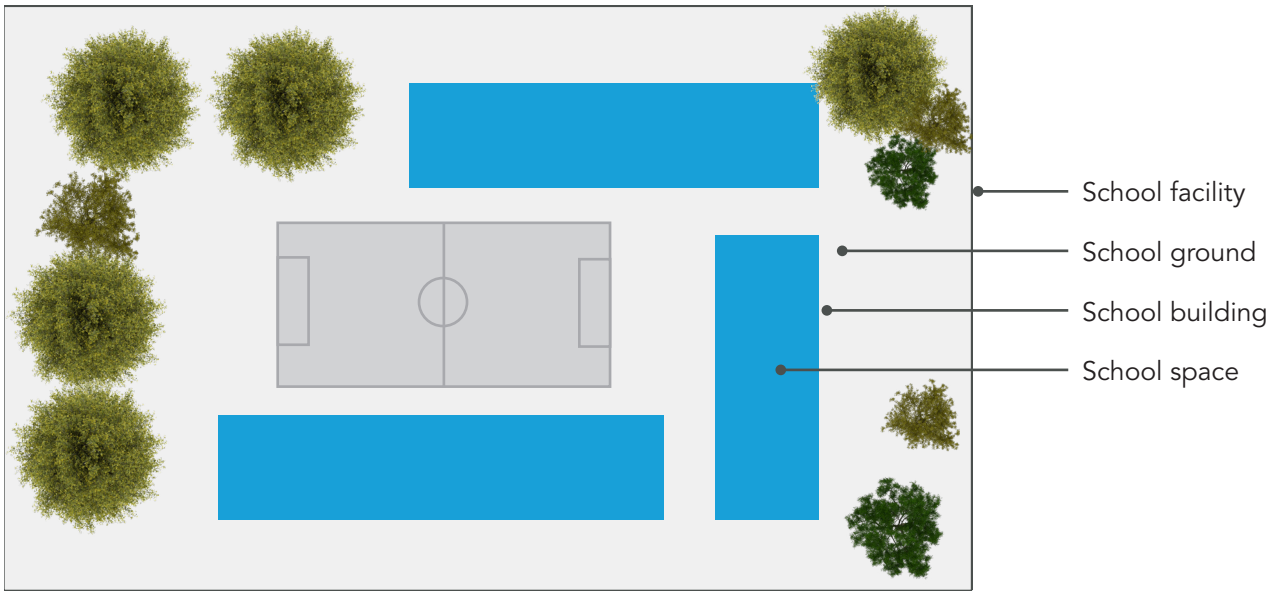
The roadmap consists of eight steps that follow a logical sequence from diagnosis to analysis to planning at scale.

Figure 1. Structure of the RSRS

Concepts

This section describes the basic concepts of school infrastructure, disaster risk, safety, and resilience. While different perspectives and approaches pertain to these concepts, the design of the RSRS is based on the following definitions.

Figure 2. **Different spaces within a school facility**



What is school infrastructure?

School infrastructure is formally defined as the network of school facilities, campus grounds, buildings, furniture, and equipment that enable teachers and administrators to offer educational services in accordance with a country's regulatory framework.[2]

What is disaster risk in the education sector?

Disaster risk refers to the likelihood of severe disruptions to the normal functioning of the school infrastructure network caused by hazard events. Disaster risk occurs over a specific time frame and interacts with vulnerable social conditions, leading to adverse human, economic, social, and educational effects.[3]

Poor performance of school infrastructure exposed to hazard events produces a number of direct consequences:

> Fatalities and injuries among children and teachers

> Economic losses from the damage to school infrastructure

> Disruption of educational services, resulting in downtime and reduced infrastructure network capacity[4]

Overall, the cumulative impact of disasters exacerbates the education challenges faced by developing countries. Governments find it harder to finance and operate a growing stock of school facilities and ensure educational continuity, especially in the poorest areas. Although no comprehensive study has been made of the historical impacts of natural hazards on the education sector worldwide, partial data are instructive. A single earthquake event in Sichuan, China, for example, killed 5,535 children in 2008. As catastrophic as such a single large-scale disaster is, the accumulative impact of low-intensity and high-frequency events, such as floods and storms, may be even greater. In Mozambique, floods in 2013 and 2015 destroyed a total of 695 conventional classrooms and damaged 433, compared to an average of about 800 classrooms built during those years by the Ministry of Education and Human Development (World Bank 2016a).

[2] There may also be informal infrastructure that does not follow required norms recognized within a country as delivering private and public educational services.

[3] Adapted from IPCC 2012.

[4] Explained below.

Furthermore, in addition to these immediate direct impacts, hazard events can have indirect effects on the learning environment in the medium term, particularly as recovery and reconstruction proceed. Two years after the 2015 earthquake in Nepal, for example, nearly a million children were still attending classes in temporary facilities offering poor shelter from the weather.

What is safer school infrastructure?

Safer school infrastructure can refer either to existing school facilities where interventions are made to improve performance in the face of natural hazards or to new facilities whose planning, design, and construction include risk reduction measures. With safer school infrastructure, the probability of fatalities and injuries, economic losses, and downtime[5] caused by the failure of buildings and other infrastructure decreases significantly. Different levels of performance can be defined to meet safety and operational targets.

Intervening in a school facility means reducing hazard, exposure, and/or vulnerability. As the definition of safety is based on what a particular society sees as acceptable risk, there is no global standard. More objectively, safety is defined by the legal framework each country establishes for the planning, design, construction, and operation of school infrastructure.

From a broader perspective, interventions to reduce vulnerability in school infrastructure should be complemented by better preparation of the school community for emergency situations and the mainstreaming of disaster risk management in the field of education.[6]

What is resilient school infrastructure?

Resilient school infrastructure refers to the capacity of the school infrastructure network to cope with an emergency or disaster caused by a hazard event and to recover rapidly from it.

Conceptually, improved resilience can be understood as reducing the downtime of a service in the aftermath of a disaster. A disaster event is likely to cause unexpected disruptions to the service provided by schools, ranging from classroom interruptions lasting a few minutes to situations in which children are out of school for several months or must attend classes in temporary facilities, which are usually inadequate for learning purposes. The time needed for the educational service to be restored fully to its normal condition (that is, the downtime) is a useful measure of resilience by which improvements can be tracked over time within a given network.

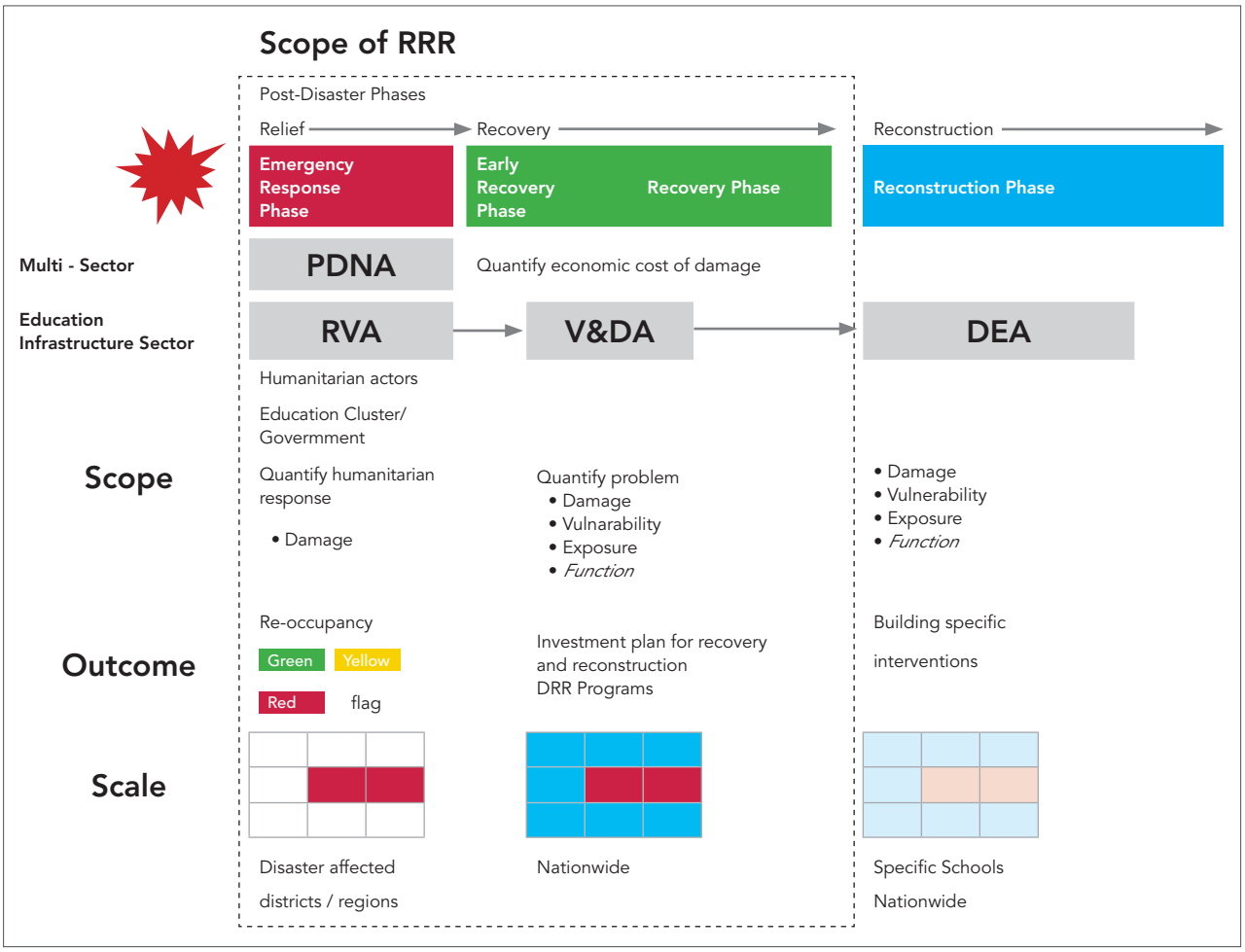
Several factors govern downtime in a disaster-affected network. Some are related to the overall capacity of the sector—in this case, the education sector—to manage and implement recovery and reconstruction interventions. Others are intrinsic to the level of damage to the network and its capacity to handle disruptions in several parts of it. More resilient school infrastructure tends to require less time to recover capacity and, in consequence, to restore quickly the educational service in an environment conducive to learning.

The achievement of resilience in school infrastructure is not limited solely to making improvements to facilities. It must also include having in place plans for business continuity, school emergency response, and reconstruction. The objective is to adjust existing school facilities so they can support contingency measures (provision of shelter or classroom relocation, for instance) included in the continuity and emergency plans. These plans define the decision-making chain, actions, roles, and resources required in case of emergency or crisis. Reconstruction planning considers the sector's capacity to assess the impact of disasters, derive evidence-based knowledge from infrastructure failures, and integrate findings in the reconstruction strategy. In doing so, reconstruction planning helps accelerate the implementation process, maximize investment efficiency, and reduce the vulnerability of infrastructure to future hazard events.

[5] Period in which the infrastructure is out of service.

[6] See Comprehensive School Safety Framework (CSSF), "A Global Framework in Support of the Global Alliance for Disaster Risk Reduction and Resilience in the Education Sector and the Worldwide Initiative for Safe Schools," March 2017.

Figure 3. Response, Recovery, and Reconstruction Phases (GPSS, 2016)



Post-disaster recovery and reconstruction of school infrastructure

The aim of the recovery and reconstruction process in the education sector is primarily to reduce disruption to schooling by restoring the normal capacity and condition of school infrastructure.

Recovery refers to activities that follow the emergency relief phase. It focuses on restoring educational services quickly for affected communities through temporary measures, which may include the use of temporary learning centers (TLCs), the reallocation of students and teachers to unaffected school facilities, and the provision of social support to mitigate the indirect impact of disaster on children during the recovery period (abuse and violence in shelter environments, for instance, prove to be aggravating factors). The recovery phase is a transitional period that lasts as long as reconstruction goes on.

Reconstruction refers to interventions in existing facilities in the form of repair, replacement, retrofitting[7], or relocation, resulting in the improved safety and resilience of school infrastructure. As the reconstruction phase may take years to complete, a thorough planning process is needed to align the intervention and implementation strategy to priorities and targets established over time. The goal is to maximize reconstruction efficiency and provide equitable benefits across the affected communities.

[7] Retrofitting refers to modifications made to structural and nonstructural components that enhance the performance of a building.

The RSRS

The RSRS addresses a wide range of topics and activities. To guide the user on the application of the RSRS, this section presents its approach, scope, and structure.

Key considerations behind the RSRS

The roadmap is based on the experience of World Bank task teams working on the safer schools agenda in developing countries around the world. The need for a shared understanding about the problem, a common language, and the definition of key concepts led to the preparation of this guidance note. More important, having a methodological framework in place will help foster efficient stakeholder interaction. The following are the considerations underlying the design of the RSRS.

Nothing happens without the will of the government. The decision to invest and intervene in school infrastructure at scale presents both technical and political challenges. The RSRS focuses on addressing the former, while indirectly contributing to addressing the latter. Through this process, all agencies involved will gain a common understanding of the intervention needs and potential solutions, and an informed dialogue among decision makers is ensured. Leading this process should be the government's entity in charge of managing school infrastructure, supported by relevant agencies. By no means can it be implemented by or transferred to a third party, such as a consultancy or nongovernmental organization.

School infrastructure safety is not a black and white issue. Perhaps the only common global understanding about safer schools is that no children should die or be harmed in the event of a natural disaster as the result of a failure of school infrastructure. This aspiration varies among countries in the realm of public policy, however. On one hand, there is no such thing as "zero risk," and elements (that is, buildings, their contents, and people) exposed to natural hazards can never be absolutely safe in any given place or time. Disaster risk management is, therefore, focused on reducing the probability of adverse consequences, which means societies will always have to deal with some level of risk. On the other hand, risk encompasses not only physical consequences but also indirect impacts from the cumulative effect of alterations to the children's physical, environmental, social, and emotional well-being. The concept of physical safety is nuanced, and the level of "acceptable risk" (that is, the socially accepted level of risk remaining once measures have been taken to reduce it) tends to vary across countries and communities.

Safety is just one of the conditions a good learning environment should meet. Provision of safer schools should not be a matter of standalone policy for two main reasons. First, safety is required but not sufficient to ensure a good learning environment. Second, the implementation of safety as a standalone policy is wrongly perceived by beneficiary communities. Under the term "functional condition," the RSRS gathers along with safety all other aspects of school infrastructure, such as energy efficiency, water and sanitation, air quality or climate control, and so on. The implementation of the RSRS should either be integrated into a broader school infrastructure program, or it should address the improvement of functional conditions where a broader program does not exist.

Reducing the vulnerability of a large stock of school facilities is a medium- to long-term effort. Improving the performance of thousands of school buildings is, in itself, an enormous task in terms of resources, planning, and implementation. Competing needs, like functional improvements or new classrooms, can make the challenge for governments even more difficult, and in the many years it may take to complete these interventions, some schoolchildren will remain at risk. Maximizing the safety benefits and cost efficiency of the investments must, therefore, be a priority of a safer schools program. Through a risk-informed prioritization process, the RSRS makes it possible to target efforts and benefit children in the highest risk areas.

Reducing the vulnerability of school facilities is not only about physical interventions. Policy reforms and the engagement of school communities are indispensable. Policy reforms are needed to strengthen the institutional environment, the regulatory framework, and school infrastructure management. Hence, once the capacity and condition of existing infrastructure have been fully diagnosed, gaps need to be identified in such areas as planning and design regulation, institutional roles at different government levels, and information management, among others.

In low-income countries especially, communities have an important role to play in the construction and main-

tenance of school infrastructure. Their participation in and ownership of the intervention strategy is central to success. While discouraging their direct involvement in the actual design and construction activities, the RSRS provides recommendations for communicating and engaging with school communities.

Scope

This section describes the main aspects of the approach, methodology, and context of application for which the roadmap was prepared.

The RSRS provides a methodological framework that can be adapted to a local context and tailored to the specific needs and capacity of the government. The RSRS is not intended to be prescriptive; it is a guide through a process. Its eight steps follow a logical sequence, from diagnosis to analysis to planning at scale, with each step addressing the different factors contributing to disaster risk. The roadmap can be implemented in its entirety, or in phases when resources, capacity, or available information are limited. Two recommendations are key: do not skip a step, or you might lose information crucial to the design of the intervention strategy; and focus on identifying scalable solutions and maximizing benefits for the most children.

> ***Intervention at scale:*** ***A strategy of affordable, articulated and prioritized interventions to meet safety and functional targets progressively for a large number of existing school facilities.***

The RSRS methodology deals with representative statistical conditions rather than individual building assessments. While a building by building assessment might be needed in particular cases (for instance, for small island states or cultural heritage schools), this approach is neither affordable nor efficient for planning interventions for large stocks of school facilities. The identification of school building types (typically associated with standard designs) and classification of school buildings using GLOSI taxonomy allow the stock of schools to be sorted into groups with similar characteristics and performance in the face of hazard events.

Capacity and condition are the two main characteristics of school infrastructure. Capacity refers to the ability of a school infrastructure network to respond to the demand for classrooms in line with national regulation. Condition refers to the physical state of a school facility in terms of safety, which relates to the expected performance of school buildings in the face of hazard events, and functionality, which relates to the quality and functioning of a wide range of components. These include water and sanitation, energy, Internet, food service, recreational areas, accessibility to children with disabilities, and gender-oriented provisions, among others.

> **Design capacity:** *The number of students a school facility was designed to accommodate in classrooms in a single shift, in line with the regulatory provisions. Adequate capacity means the facility offers the appropriate number and sizes of classrooms, laboratories, bathrooms, equipment, and recreational areas.*
>
> **Occupancy:** *The ratio between the number of students in a school facility per shift and the design capacity. A ratio value higher than 1 means the school facility is overused, while a value less than 1 means it is underused.*

The capacity of school infrastructure is commonly expanded by running more than one shift of students attending each day. Nonetheless, a trend is growing in developing countries to move toward a single-shift policy as part of the governments' efforts to raise the quality of the learning process. Although the RSRS emphasizes safety, the proposed methodology also takes into account the challenges related to the capacity and functionality of the school infrastructure.

Although the RSRS was initially developed in and applied to earthquake-prone countries, it can be applied to countries facing other natural hazards, as well. Given the catastrophic impact of earthquakes in the education sector, seismic risk was prioritized under the Global Program for Safer Schools (GPSS). So far, the RSRS has been implemented in countries around the world to reduce the seismic vulnerability of school infrastructure. The RSRS methodology is not restrictive, however, and key concepts are valid for addressing other natural hazards. New GPSS projects initiated recently include hurricane wind and seismic

risk. In the near future, through the Global Library of School Infrastructure (GLOSI), the GPSS will enhance available tools and resources to guide users in applying it to other natural hazards. The key here is the use of quantitative risk assessment.

The RSRS can be applied at the national or local level. The RSRS methodology focuses on large school portfolios and on addressing the issue of scale. As a result, the roadmap has primarily been implemented at national scale, covering thousands of school facilities and buildings. Recently, though, implementations at the municipal level have shown promising results. Although some adjustments are required at this scale, the methodology provides a plan which municipalities can use to identify and prioritize school infrastructure interventions and investments, since local governments are usually directly involved in managing them. As mentioned earlier, for very small stocks of facilities (for example, of less than a hundred school buildings), the RSRS approach is not applicable.

The RSRS is a living document that is continually improved, based on the experience and results of its application in developing countries.

Context of application

The RSRS has been designed to be implemented under two conditions: normal and post-disaster. In normal conditions, the planning process takes place within the regular operations of the education system. In post-disaster conditions, it takes place in an exceptional situation, in which the governments' priority is to restore educational (along with other) services affected by a hazard event. Conceptually, the approach and steps of the planning process in both conditions are the same. In practice, the post-disaster condition poses additional challenges in terms of carrying out a damage assessment of the affected infrastructure, implementing measures for temporary service provision, working under time constraints to restore the services fully, and responding to an increased demand from school communities.

Progress in reducing vulnerability, in normal or post-disaster conditions, brings benefits. It has been demonstrated that, in the aftermath of a disaster, a window of opportunity exists to move risk reduction policies forward. The reconstruction of damaged schools offers the opportunity to reduce the vulnerability of both affected and unaffected school buildings. On the other hand, any progress made on risk reduction before disasters happen not only leads to lower impact but also facilitates the reconstruction planning process after they strike. Although the aim of a safer schools program is to intervene in schools before a hazard event, capacity is often limited in developing countries to carry out interventions at a large scale. Thus, school infrastructure managers should have mechanisms in place to increase their capacity to respond to needs associated with post-disaster recovery. Implementation of the RSRS produces as its outputs a comprehensive set of data and intermediate results that can ultimately help increase school infrastructure managers' ability to respond.

In post-disaster conditions, the RSRS can inform the design of both the recovery and reconstruction plans. Recovery and reconstruction are interconnected phases, and, therefore, the planning process must integrate decisions regarding both. How the recovery phase is managed may either pave the way for a successful reconstruction process or generate an adverse environment with long delays. The RSRS provides tools to navigate this dynamic decision-making process. We know from experience that governments tend to face difficulties in managing the planning process while coping with the complexities of a post-disaster situation. The RSRS provides a roadmap to help them make informed decisions under the extreme conditions and social pressure that usually exist after a disaster.

Phases of the RSRS

The RSRS follows a sequence of three phases, starting with diagnosis, followed by analysis and planning at scale.

The diagnosis phase aims to gather information and establish a structured database with quantitative data related to condition and capacity and to gain an understanding of school infrastructure policies.

In the analysis phase, the construction and financial environments are analyzed, and risk is quantified.

The planning phase integrates the results of the first two phases to determine what to do (intervention strategy), how much investment is needed (investment plan), and how solutions will be implemented (implementation strategy).

The scope of these phases is described next.

Diagnosis

The diagnosis phase covers two steps: School Infrastructure Baseline (step 1) and School Infrastructure Policy (step 2). Step 1 focuses on collecting data about the condition and capacity of existing school infrastructure and on establishing a structured database of school facilities with a selected group of attributes. Step 2 focuses on the institutional and policy framework for school infrastructure and on estimating the future demand for classrooms.

A high-quality baseline is the foundation for a high-quality planning process. As in other infrastructure sectors, a proper and updated inventory of the assets (school facilities, buildings, campus, and so on) is the primary source of the data required to create a baseline for the planning process. The completeness and reliability of the baseline will significantly affect the quality of the analytical work performed.

> **Inventory:** *The gathering of data about capacity, condition, and location of school facilities that is required to manage the school infrastructure network.*
>
> **Baseline:** *The subset of inventory data that is required to conduct analysis (such as risk assessment or cost-benefit analysis) and serves as the basis for the formulation of the plan.*

If no inventory is available or the data are incomplete or out of date, the opportunity should be taken to make progress in closing those gaps. Without an updated inventory, it is impossible to manage infrastructure, let alone build an investment plan. Furthermore, the inventory should be in a dynamic information system that allows data to be updated systematically and improved over time. A specific action plan that includes resource allocation for data collection activities will be required. For a large portfolio of school facilities, the action plan for the inventory can be broken down into two or more phases, the first of which can focus on collecting the basic information necessary to create the baseline.

The RSRS indicates the use of quantitative methods in all aspects of the process. Structural engineering models can be used to assess the vulnerability of school buildings, while a probabilistic or deterministic approach will be taken to evaluate risk. Cost-benefit analyses are based on quantitative indexes derived from vulnerability and risk assessments. Estimation of the future demand for classrooms and the accessibility assessment are other processes to which quantitative analysis can be applied. Also, sensitivity and scenario analyses can be conducted to define an intervention strategy and build an investment plan.

Education policy should be the primary driver of school infrastructure policy. The learning process takes place in physical spaces that should meet specific requirements in terms of location, comfort, accessibility, occupancy, and so on that are ultimately defined by education policies. As a country implements the one-shift policy, it faces the challenge of enhancing the capacity of the school network while responding appropriately to demographic changes. In that respect, estimating the future demand for classrooms in line with the investment plan's time frame is a crucial aspect of the diagnosis phase. One of the biggest challenges for the school infrastructure policy will be to find a balance between the condition and capacity needs of the infrastructure and the demands of education policy and demographic evolution. This provides a unique opportunity to optimize investments in large school infrastructure networks.

Analysis

The analysis phase centers on three steps: Construction Environment (step 3), Financial Environment (step 4), and Risk and Resilience Assessment (step 5). The objective is, first, to understand the context in which school infrastructure is planned, designed, built, operated, and maintained. Second, it is to evaluate the government's current and future financial capacity to allocate resources to school infrastructure. Third, it is to quantify the damage and loss (together with their spatial distribution) likely to be caused by future natural hazard events. In post-disaster conditions, the focus of step 5 shifts from risk to resilience assessment to estimate the reconstruction time frame.

Analysis of the construction environment reveals vulnerability factors of poorly performing infrastructure. The focus of the analysis is to identify the contributing risk factors in the way school infrastruc-

ture is planned, designed, built, and operated. Weak planning and design, gaps in regulation, corrupt construction management, and even cultural practices commonly contribute to poor-quality construction and, therefore, poor building performance when hazard events occur. Understanding this is vital both to implementing interventions and to moving forward on policy reforms that are realistic, efficient, affordable, and sustainable. Our experience has shown that identifying the chain of causality in these factors has been instrumental in motivating decision makers to address these issues through policy reforms and medium-term plans.

The implementation of large-scale school infrastructure interventions presents financial challenges. Although the education sector tends to have the largest share of public funds within national budgets, spending on school infrastructure tends to be lower than other education expenditures. An understanding of the financing environment is important to identifying sources of funding, allocation mechanisms, types of expenditure, and opportunities for new financing mechanisms. Financial analysis is required to evaluate the efficiency of existing investments. Having in place a plan for school infrastructure will provide policymakers with a tool to guide public resources and investments toward articulated interventions—that is, interventions linked to form an intervention strategy—in line with the country's education policy.

For public policy purposes, measuring risk is important to inform decisions and investments, particularly when dealing with large school infrastructure portfolios. We stress the use of quantitative methods to assess disaster risk. Quantitative metrics provide essential information about the magnitude of the problem (its potential impacts) and its spatial distribution. Analysis using these metrics can quantify the benefits from different intervention options in terms of safety and functionality and compare costs. Such analyses are also useful for prioritizing and monitoring the implementation of the plan.

Planning at scale

The planning at scale phase relates to three steps: Intervention Strategy (step 6), Investment Plan (step 7), and Implementation Strategy (step 8). These three steps integrate the results from steps 1 to 5 and should enable task teams to deliver a proposal for intervention, investment, and implementation of changes to school infrastructure, with the aim of maximizing benefits, increasing efficiency of investments, and facilitating interventions at scale. This proposal will serve as the formal planning instrument (called the plan, master plan, or program) by means of which the institutional, legal, and investment framework will be discussed and finally adopted. The plan will have a higher chance of success if this technical path is the basis for future political decisions, and if the results of this work are disseminated and communicated to key stakeholders.

In our experience, five drivers enable intervention at scale. These are risk-informed selection and prioritization of schools to have interventions; optimization of engineering solutions; maximization of benefits; cost-efficient investments; and the convening of IFIs and donors to leverage government efforts. The RSRS has been designed to facilitate each of them.

The intervention strategy and investment plan are linked, so the activities related to them need to be closely coordinated as they are formulated. The intervention strategy comprises intervention options with high benefit-cost ratios, while the investment plan indicates the allocation of available resources to enable the implementation of the intervention strategy. Rather than a straightforward process, their coordination is a tuning-up in which both sides are adjusted until the expected results are met. This process can be time consuming, involving the analysis of large datasets. Task teams should use robust data management software and tools to optimize processing time and minimize calculation errors to ensure consistency across intervention lines and cost estimates. In medium- and long-term infrastructure plans, the investment plan is likely to be adjusted over time, given changes in policies, budget allocations, and priorities. Thus, it is important that the investment plan's structure, the cost estimates, data, and methodology used are transparent and replicable, that knowledge is transferred, and that information is made available to key stakeholders.

Prioritization, organization, capacity building, and communication are the main challenges when designing an implementation strategy. In our experi-

ence, the defining of implementation priorities is highly sensitive for decision makers, politicians, beneficiary communities, and other key stakeholders. Task teams can help by convening stakeholders and facilitating and guiding the discussion, using evidence-based arguments proceeding from steps 1 to 7. The implementation plan that emerges will likely pose challenges that require an additional effort on the part of the institutions and staff involved in managing the school infrastructure. Step 8 aims to identify detailed arrangements and capacity-building needs at different levels of government so as to put into place the technical, human, and financial resources necessary to start implementation of the plan. Finally, a critical factor for success is engagement and communication with beneficiary communities. No matter how technically strong the plan is, implementation will not be possible without ownership on the part of school communities and local stakeholders.

Getting Ready for Implementation

Starting point

The implementation process begins by prompting action at the highest political level. The minister of education, the minister of finance, and the mayor (in a municipality) are the chief decision makers and have a key role in advancing the safer schools agenda. The goal is to draw their attention to the importance of prioritizing school infrastructure and making schools safer and resilient at scale. Unfortunately, most of the safer schools programs around the world were triggered in the wake of natural disasters and the catastrophic loss of schoolchildren's lives; these included Mexico in 1985, Turkey in 1999, and China in 2008, among others. Even though the safety of schoolchildren should be a priority for both communities and politicians, a perception that school interventions are expensive and complex to implement has led to inaction. The RSRS aims to promote change and promote action, along the lines of the recommendations outlined below.

Making the case for decision makers

Lack of information and clarity on how to move forward is usually the first deterrent to implementing risk reduction programs for schools. The diagnosis and analysis phases laid out in this roadmap provide a framework and basic concepts that make it easier to identify and understand contributing risk factors and the need for interventions at scale for safer schools. The initial action is to conduct a preliminary diagnosis based on available information. The Global Program for Safer Schools, for instance, conducts a preliminary screening (a so-called rapid diagnostic) following the first four steps of the roadmap to get an overview of the main risk factors in school infrastructure and the overall capacity in a country for managing it. When the government agency in charge of school infrastructure leads the process and ensures the available information is provided to the designated task team, results are usually achieved within three months.

In our experience, evidence-based knowledge derived from quantitative analysis and the use of scientific methods provides a strong technical foundation for decision makers to advance policy reforms. Discussions of the need for disaster risk reduction investments tend to be based on stakeholders' perceptions or their reluctance to consider changes to current practices. In such cases, evidence-based arguments have proved powerful in getting the attention of and facilitating an informed debate among those involved. These arguments provide a foundation for decision makers in charge of school infrastructure to neutralize an otherwise politically driven environment and ensure investments are informed by technical results.

Opportunities can come from existing investments in the education sector, even when the safer schools perspective has not already been incorporated. Usually, the education sector as a whole accounts for an important share of public budgets,[8] receiving large investments annually. Although the smaller part is usually allocated to school infrastructure, the investment remains significant relative to the countries' financial capacity. As economic losses associated with natural disasters jeopardize government efforts, the integration of risk reduction is crucial to ensuring the sustainability of these investments.

Kickoff activities

Once the decision has been made to address disaster risk in school facilities, several kickoff activities are required to begin implementation of the roadmap. A few key recommendations for these activities are presented below.

Define the specific objectives, output, and time frame for implementation of the RSRS. As stated earlier, the implementation of the RSRS should address specific needs to improve the safety and resilience of school infrastructure in line with education policies and targets. An initial meeting should be held with the government's entity in charge of school infrastructure to identify and discuss these needs and priorities, based on which the objective, scope of activities, expected output, and estimated time frame for implementation of the RSRS can be determined.

[8] According to DataBank, education expenditure in 264 countries averaged 15 percent of total government expenditure in 2017. Minimum and maximum values ranged from 0.02 percent in Guyana to 30 percent in Costa Rica.

The time frame will depend on the expected output, as well as on the availability and quality of information to begin activities. The expected output may either be a school infrastructure plan (which requires full implementation of the RSRS) or intermediate results from one or more steps (which requires implementation in phases). A preliminary action plan should be prepared with a summary of all the points discussed at the meeting, which will serve as a basis for a detailed action plan and identify the human, technical, and financial resources required. In post-disaster conditions, this initial discussion should focus on understanding the recovery needs and priorities for school infrastructure in line with the recovery and reconstruction plan of the government and the education sector as a whole.

Define a core task team, contributors, and coordination mechanisms. Also key to successful implementation of the RSRS is to have in place a strong team with clear roles and responsibilities and to define the implementation arrangements and coordination mechanisms needed to ensure activities are implemented within the specified time frame. It will be necessary, first, to identify the core team and project coordinator who will lead implementation and oversee the entire process and, second, to determine what technical expertise (both within the government and among other local partners) will be required. IFIs can play a key role in support of the core team by facilitating knowledge sharing, access to the best global expertise, and the fostering of exchanges among developing countries.

Obtain endorsement from key decision makers of the action plan and their support for the resource requirements to begin implementation of the RSRS. A detailed action plan should include the following elements:

- Description of the expected output(s)
- Description of activities to be carried out in line with the expected output(s)
- Team composition (that is, core team members, technical experts, relevant government entities, and local partners) and coordination mechanisms
- Implementation arrangements
- Estimated time frame for implementation (particularly relevant in post-disaster conditions)
- Cost estimates for all activities

The last point is essential to determining if additional financial resources are required to carry out these activities. The core team should develop this action plan and ensure all activities during implementation are closely connected, as results will need to be integrated for the final output(s). The action plan should be presented to key high-level decision makers for endorsement and to secure their buy-in to the safer schools program.

Develop an information management strategy. Since a great deal of information will be gathered, shared, produced, and analyzed throughout the implementation of the RSRS, it is vital for the team to discuss and agree on a digital collaboration platform, such as OneDrive or Google Drive, that will be used during this process. The information should also be organized (preferably by step), and always kept up to date so all team members can have access to the latest information to carry out their respective activities.

Conduct a kickoff workshop. A kickoff workshop should be held to present, discuss, and agree on the overall objective, action plan, and next steps of the RSRS. Participants should include key stakeholders—that is, the core team, technical experts, relevant government agencies, and partners—who will play a role in the implementation. At the end of the workshop, all participants should have a common understanding of the overall scope of activities, their respective roles and responsibilities, and coordination mechanisms, and be in agreement on next steps to begin implementation.

Steps

the beginning of each step, the user is presented with its purpose; its objectives (in normal and post-disaster conditions); a table listing the modules and activities; and another one listing the suggested local partners and required technical expertise. This information is followed by a description of each of the activities (by module) to guide the user through the process. Orange arrows indicate activities applying to post-disaster conditions. At the end of each step, a table with a list of outputs (by module) is presented.

In addition, each step is linked to the RSRS toolkit, which provides a set of tools and resources to guide the user further during the design and implementation of the RSRS. These include, for example, technical notes, sample terms of reference, country case studies and videos, data collection templates, and access to a mobile application.

Step 1
School Infrastructure Baseline

Purpose

To establish a baseline and determine the condition and capacity of existing school infrastructure.

Objectives

In normal conditions

At the end of this step, the team should be able to do the following:

a. Establish the baseline of school facilities to be analyzed

b. Identify the main characteristics, conditions, and capacities of existing school facilities

c. Identify opportunities to manage school infrastructure information within the education sector's management information system (MIS)

In post-disaster conditions

At the end of this step, the team should be able to do the following:

a. Consolidate the damage assessment data related to affected school buildings and facilities

b. Establish the baseline of school facilities to be included in the recovery and reconstruction plan in the affected area

c. Identify the main characteristics, conditions, and capacities of existing school facilities

d. Identify opportunities to manage school infrastructure information within the education sector's management information system (MIS)

Modules and activities

Module	Activity	
1.1. Inventory of existing school facilities	1.1.1. Compile and organize available information about school facilities	1.1.1. Compile and organize available information about school facilities in the disaster-affected area
1.2. School facility baseline	1.2.1. Define the structure of the baseline and create a field inspection plan	1.2.1. Define the structure of the baseline and create a field inspection plan for the damage assessment
	1.2.2. Carry out a field inspection campaign	1.2.2. Perform damage assessment of school facilities in the disaster-affected area
	1.2.3. Identify building types and index buildings	1.2.3. Identify building types and index buildings
	1.2.4. Establish the baseline of school facilities to be analyzed	1.2.4. Establish the baseline of school facilities to be included in the recovery and reconstruction plan
1.3. School infrastructure network integration	1.3.1. Compile and organize available geospatial information about the urban/rural context in which school infrastructure operates	1.3.1. Compile and organize available geospatial information about the urban/rural context of the disaster-affected area
1.4. Exposure of existing school facilities to natural hazards	1.4.1. Identify the natural hazards to which school infrastructure is exposed	1.4.1. Identify the natural hazards to which school infrastructure is exposed
	1.4.2 Identify the building types exposed to natural hazards	1.4.2 Identify the building types exposed to natural hazards
1.5. Management of school infrastructure data	1.5.1. Integrate the baseline into an existing or new MIS	1.5.1. Integrate the baseline into an existing or new MIS

Local partners and technical expertise

The table below presents a list of suggested local partners and technical expertise required to contribute to or lead the activities of this step.

Key agencies

- Ministry of Education and any other agency involved in school management
- Local governments (in decentralized political systems)
- School principals (for schools included in the inspection campaign)

Contributing agencies

- Geological Service agency or similar (hazard maps provider)
- Statistical agency (if playing a role in the infrastructure inventory)

Technical expertise

- Senior structural engineer (usually external advisor)
- Senior hazard specialist such as an engineer or geologist from the Geological Service agency
- Ministry of Education: engineers and architects in charge of school infrastructure
- GIS specialist
- Information management specialist in charge of EMIS (if available)
- Engineering firm(s) to conduct field inspection campaign (for large portfolios)

Module 1.1.

Inventory of existing school facilities

Activities under this module will gather existing information on school facilities and evaluate its usefulness for implementation of the roadmap.

Activity 1.1.1

Compile and organize available information about school facilities

The focus of this first activity is on understanding the availability, quality, and reliability of the existing school infrastructure inventory. A database is to be created from available information that includes basic identification, location, and education-level (preschool, primary, secondary, and so on) data about school facilities. Such information will usually be found in the sector's education management information system (EMIS). This database will provide a framework for organizing the existing information and adding more to it—for example, the school facilities can be classified by location using georeferenced data. This review of the infrastructure inventory will also help with identifying existing mechanisms for collecting and updating data and any information technology (IT) systems and software available to manage them.

Guidance

Capacity, occupancy, and condition attributes should be integrated into the database. When an existing inventory is available, the task will be to identify and understand the definition and coverage of the school infrastructure's attributes and the reliability of this information. If these data are not available or not feasible to collect, the team should compile related information from other reliable sources and populate the database using a predefined template. This can be facilitated by, for example, identifying relevant agencies at the national and subnational levels that are involved, directly or indirectly, in school infrastructure management. Normally, information is shared among these agencies. With the help of senior architects and engineers, documentation can also be collected on the evolution of school building designs over time.

Keep in mind the purpose of this activity is not to conduct an inventory, but to gain a better understanding of the status of the school infrastructure inventory (if available). This activity focuses on identifying gaps, summarizing results, and identifying key sources of information to support the implementation of activities. Hence, it's important to make sure the data are consistent, complete, and reliable. If a school inventory is not available, this activity will concentrate on collecting all existing information from a wide range of sources.

➜ ***After the emergency phase, a rapid visual assessment (RVA) is conducted by government agencies to guide initial recovery actions.*** Results from the rapid visual assessment of affected schools should be organized and cross-checked with existing information. The RVA is generally conducted in such a way that data quality issues and inconsistencies are quite common. Indeed, in most cases no standard template or methodology is used for the inspections. Evaluators have heterogeneous profiles, and teams must operate under very difficult time and resource constraints in a complex environment. Task teams should evaluate the reliability of the RVA information as input for the baseline.

Module 1.2.

School facility baseline

Activities in this module will allow task teams to define the baseline of the stock of school facilities that will be included in the plan. Subsequent modules and activities will rely on the quality of the baseline.

Activity 1.2.1.

Define the structure of the baseline and create a field inspection plan

This activity concentrates on filling information gaps and completing the school facility baseline for planning purposes. It consists of selecting from the school inventory (if available) the facility and building attributes that will be required in the analysis and planning phases. Usually, the team will need to collect information that is missing or outdated. This can be done by carrying out field inspections of a group of representative building types and looking for additional information, such as the buildings' structural or architectural drawings. Since field campaigns are resource and time consuming, a realistic and efficient plan that defines the scope and objective of the campaign and identifies the human, technical, and financial resources needed to carry it out is essential.

Guidance

The attributes included in the school infrastructure baseline are important for the analysis and planning phases. As tradeoffs always exist among input data, analysis resolution (see activity 1.2.4, below), and expected results, designated core team members and technical experts who have a key role in this activity should participate in guiding the discussions to guarantee consistency in the approach and methodology used. Ultimately, analysis resolution is strongly determined by the quality, reliability, and coverage of the baseline information.

➜ ***The baseline for reconstruction planning following a disaster is a function of both the impact to the school network and the government's timeline to restore service.*** A common mistake is to use the RVA as the sole basis for reconstruction planning. Post-disaster conditions require a more detailed damage and vulnerability assessment of school facilities in the affected areas. The damage assessment for reconstruction purposes should be planned carefully and, in large-scale disasters, can take up to one year to complete. The task teams' main challenge is to deliver results in line with the government's needs and expected time frame to inform the reconstruction planning process. Based on our experience, the better the quality of the inventory before the disaster, the faster it may be possible to conduct the damage assessment after it.

➜ ***The quality of the baseline of affected school infrastructure is critical for the definition and optimization of reconstruction interventions.*** The focus of this activity is to ensure consistency among the damage assessment, baseline, analytical process, and expected results. In large-scale disasters, the team will usually start with very rough baseline information that will be finetuned over time as new data become available. To that end, task teams should set up a framework to integrate new information systematically into the baseline. Furthermore, given that information is usually scattered in post-disaster conditions, task teams should map the key sources to be used during this process.

Activity 1.2.2.

Carry out the field inspection campaign

This activity involves inspecting a group of representative school facilities as part of the planning process. The inspection of a large group of school facilities is a resource-heavy task, so data collection templates, IT tools, inspection teams, logistics, quality assurance, and coordination among institutions and local governments must be carefully planned and organized. If a school inventory is available, the initial field inspection process will consist of selecting the facility and building attributes required to establish the baseline (see activity 1.2.1, above). The information collected through the field inspection will be used to verify or update the existing data. The time frame for the field inspection campaign is usually determined by the number and location of schools to be inspected, the human and financial resources that are needed and

available, and the time needed to deliver the intervention and investment plans. Carrying out the inspections can take from a few months to up to two years.

Guidance

A successful field campaign relies on the collection of pertinent data, the deployment of trained task teams, and having in place an information management strategy and quality assurance process. The data collection templates used should build on existing information as much as possible. "Pertinent data" means the data called for by the analysis methods and planning activities. An initial effort to identify and focus the task teams' survey on them will save on resources and improve efficiency significantly. Also essential is to ensure the teams have a common understanding of the inspection plan and methodology, basic engineering concepts, standard terminology, data collection templates, and IT tools to be used. They should also be familiar with the local context, in particular its construction practices, language, and cultural norms.

To gather data in a systematic and structured manner and ensure smooth information flow, the task teams should follow and use agreed-on protocols and IT tools throughout the entire field campaign. While the use of technological innovations, such as mobile apps and smart tablets, has facilitated the information management process, the volume of data to be collected and the lack of Internet access in some rural areas may be a challenge for large campaigns. The GPSS is developing an app that addresses these issues. A key recommendation is to establish a "live help desk" to support task teams during the entire field campaign.

For the quality assurance process, a dedicated team should be assigned to monitor and review the results from the field and conduct validation tests on selected school facilities. This will help identify any issues with the data early on and ensure they are addressed. Furthermore, it will put the team in charge of quality assurance in a much better position to evaluate the overall reliability of the campaign results.

On-the-job training strengthens the capacity of local engineers and school infrastructure managers to carry out the inspections. Providing training to the task teams during the inspection campaign facilitates the discussion of key concepts, the sharing of international experience, and the fostering of a common understanding of disaster risk management. Moreover, the learning experience provides an opportunity to engage with young professionals and create incentives to boost their participation and interest in this field.

➔ ***The field campaign to assess damage to school facilities from large-scale disasters might unfold in several phases and require special provisions.*** As mentioned earlier, one challenge posed by reconstruction planning is the need to make informed decisions under severe time constraints. This is why damage assessment in large-scale disasters should be approached progressively rather than as a single-phase activity. The number of schools to be inspected, their accessibility (typically in rural areas), the spatial distribution of damage, the number of affected communities, and even political conditions are factors to be considered when planning a field inspection campaign. Compliance with legal provisions (for example, the formal certification of surveyors, as in Mexico), the role of local governments, and the participation of nongovernmental organizations must also be taken into account.

➔ ***During the recovery phase, it is necessary to coordinate activities with local authorities and communicate about activities with affected communities.*** Local authorities play a central role throughout the recovery and reconstruction process, usually providing permits, liaising with school principals, and engaging with communities. It is important to secure their ownership of and participation in this activity.

Communities should also be notified before the field inspection campaign takes place and details shared with them about the objective, scope, expected results, time frame, and participants involved in the activity. The effort to keep them informed also provides an opportunity to manage their expectations about future interventions and next steps.

During the field inspection campaign, task teams should take advantage of local logistical efforts already underway during the recovery phase to gain access to remote schools, arrange trips, enhance security and safety measures, and so on.

Activity 1.2.3.

Identify building types and index buildings

This activity helps define school building types and index buildings, based on the analysis of existing information and results of the field inspection campaign. A team of structural engineers will go through the data on structural characteristics of school buildings and classify each of them. For the classification of school buildings, a taxonomy was developed under the Global Library of School Infrastructure (GLOSI).

The activity will be conducted in two stages. In the first, building types will be identified according to three main parameters. In the second, each category of building types will be analyzed in terms of nine additional parameters to identify different representative buildings. These are called index buildings and can be understood as subcategories of a given building type that are representative (statistically) of the school buildings stock under analysis.

Table 1. GLOSI taxonomy parameters

Taxonomy Parameters		
Primary	1	Main Structural System
	2	Height Range
	3	Seismic Design Level
Secondary	4	Diaphragm Type
	5	Structural Irregularity
	6	Wall Panel Length
	7	Wall Opening
	8	Foundation Type
	9	Seismic Pounding Risk
	10	Effective Seismic Retrofitting
	11	Structural Heath Condition
	12	Non-Structural Components
Building Type:		
GLOSI Taxonomy String:		

Guidance

This activity requires the participation and leadership of senior local engineers. Despite the use of a standard classification, building types can only be classified by senior engineers with extensive experience in local design and construction practices. In this type of activity, task teams made up of junior engineers and led by senior ones operate very efficiently. The participation of international experts may also be needed when task teams do not have experience in this area or local capacity is limited. As the outcome of this activity will have an impact on the RSRS steps that follow, the selection of a strong core team, advisors, and international partners (if needed) is vital to success.

Further activities and steps will be based on the analysis of the performance of the selected index buildings. Note that, through this approach, the effort will be focused on understanding the current performance of the index buildings and identifying the intervention needs; then, results can be extrapolated across the whole stock of school buildings. This approach has proved efficient in analyzing large stocks of school buildings and planning interventions. Moreover, it is common to find that vulnerability and risk are concentrated in a small number of index buildings. The 80/20 rule[9] is a practical reference to identify index buildings—that is, those with the highest frequency within the stock, the lowest values in the GLOSI parameters, and records of poor performance in historical hazard events (if that information is available).

Task teams will find in GLOSI a comprehensive set of information about index buildings in different countries. GLOSI is composed of five sections: taxonomy, catalog of index buildings, vulnerability, risk reduction solutions, and country databases. In these sections, users will find technical documents, tools (for example, applications for data collection), and a catalog of index buildings with specific information about failure modes, vulnerability functions, and documented retrofitting projects. This provides local structural engineers with plenty of information to facilitate their tasks.

[9] The Pareto principle (also known as the 80/20 rule, the law of the vital few, or the principle of factor sparsity) states that, for many events, roughly 80 percent of the effects come from 20 percent of the causes.

➔ ***GLOSI also applies to the classification of school buildings affected by disaster events.*** In fact, damage assessment results provide additional evidence about typical ways in which buildings fail and the overall performance of building types and index buildings. In addition to building characteristics, the classification will identify failure modes under each group of building types, their frequency, and the spatial distribution of damage within the disaster area. Different damage levels within the same index building will also indicate how the hazard differs in intensity by location.

Activity 1.2.4.

Establish the baseline of school facilities to be analyzed

Establishing the baseline requires setting up a database with the attributes of the school facilities that will be analyzed. In it must be defined and organized basic information about the school facilities and index buildings, as defined previously. The data (attributes) in the baseline relate to the location, capacity, and functional condition of each facility and the index building information.

Guidance

The reliability of the baseline is crucial, as it serves as the basis for the planning process and informs decision making. Although this task may seem straightforward, the challenge will be to ensure the available information is complete, reliable, and consistent. Task teams should then decide upon the final content of the database to meet the requirements for information in subsequent steps of the RSRS.

The scope of the plan and resolution of the analytical work drives the baseline requirements. The higher the resolution, the more detailed the baseline requirements. At this stage, task teams might need to present the final version of the baseline to the specialists involved in further activities so they can adjust the methodology and resolution of the analytical work to the actual available baseline.

For large school infrastructure portfolios, proxies normally are used to fill information gaps in the baseline. Problems should not arise as long as the proxies, any assumptions made, and their effect on the final results are clearly described, communicated to, and agreed on with the key stakeholders and decision makers involved.

➔ ***In post-disaster conditions, the baseline might have to be updated several times as new and complementary information becomes available.*** When a damage assessment is carried out in phases, results from each phase will inevitably lead to modifications of the baseline. Changes can also originate from interventions undertaken in school facilities by local stakeholders, communities, or nongovernmental organizations. Task teams should plan the analytical work progressively, running the analysis as many times as needed. Proper documentation of changes in the baseline is essential to ensure the consistency and replicability of results.

Module 1.3.

School infrastructure network integration

The activity in this module provides an understanding of how the network of schools is integrated into the territory (urban versus rural) and other infrastructure. Aspects such as accessibility and land adequacy, among others, are analyzed.

Activity 1.3.1.

Compile and organize available geospatial information about the urban or rural context in which school infrastructure operates

Task teams must gain an understanding of the school infrastructure network within the context of the territorial (urban or rural) environment by analyzing the way in which school infrastructure, like other social infrastructure, is integrated into the territory and communities it serves. This integration can be analyzed by investigating the adequacy of school facility locations in relation to land use regulations, school accessibility in terms of the road network, proximity to other key public infrastructure, such as emergency health facilities, and the classroom supply-to-demand ratio. This analysis requires access to georeferenced information on, for example, transportation, health, sports, and emergency, utility, and communication infrastructure, as well as demographic data, land use maps, and so on.

Guidance

This activity is key, as the information and output(s) generated throughout the RSRS should have a geographical representation. Throughout the RSRS activities, geospatial information is either collected or produced at different levels: school facility, municipality, region, and country. Task teams should plan to have resources—such as a geographic information system (GIS) specialist and software—to manage geospatial information throughout the implementation of the RSRS steps.

➜ ***As this activity is especially relevant for the recovery and reconstruction process following a disaster, recovery and reconstruction planning should be based on both the condition of affected school facilities and the territorial and demographic characteristics of the disaster area.*** The intervention strategy will be strongly correlated to accessibility conditions. In the early emergency phase, for instance, getting access to the schools is a challenge for response teams. In addition, large disasters usually have a negative impact on households' assets and income and can result in forced displacement and migration. Therefore, the reconstruction of school infrastructure should go hand in hand with the recovery of other social services and the restoration of livelihoods and economic activity.

In the context of this activity, task teams should not only identify sources of information but also establish communication channels with relevant parties involved in recovery and reconstruction.

Module 1.4.

Exposure of existing school facilities to natural hazards

Activities under this module will identify the natural hazards to which school facilities are exposed. The activities rely on the existing hazard information and relate to one or more hazards.

Activity 1.4.1.

Identify the natural hazards to which school infrastructure is exposed

This activity aims to ascertain the exposure of school infrastructure to hazards in hazard-prone areas. Task teams are to gather all information relevant to natural hazards (maps, studies, databases, and so on), as well as on the historical impact of hazard events on the education sector and on land use regulation in disaster-prone areas.

Guidance

This activity should not focus on generating new hazard maps, since this is a huge endeavor. Based on our experience, in the case of most developing countries, this information may not exist or is incomplete and lacks the required resolution. Collecting, reviewing, and organizing this information will be important for step 5. Open access to specialized websites may help complement local information or provide general insight into natural hazards in a given country.

It's important to understand local hazard events. In general, earthquakes, cyclones, hurricanes, tsunamis, and large floods are likely to have catastrophic, large-scale effects on the education sector. Local hazard events, such as landslides, small floods, snow avalanches, or liquefaction, might also have fatal impact, although concentrated in small areas. In terms of the analysis, the difference is that the larger events will be addressed at scale and the local ones on a case by case basis. Thus, the school infrastructure plan should encompass schools exposed to local hazard events as well as large-scale ones.

Task teams must rely on the knowledge of local experts. Work in many topic areas requires expert advice—for example, regarding the resolution of hazard maps, the reliability and interpretation of hazard categories, hazard assessment methodologies, and so on. Senior specialists with extensive experience in natural hazards and knowledge of the local context can be found in government agencies, universities, or private firms. Even in the cases where hazard maps do not exist, local experts will be in a position to provide valuable input and guidance.

➜ ***Resilience sometimes means addressing more than one hazard.*** The reconstruction process provides an opportunity to reduce the vulnerability factors that led to the disaster, as well as vulnerability to other natural hazards to which school infrastructure could be exposed. Events in Haiti provide a good example. In 2010, when a magnitude Mw 7.0 earthquake struck the country, over 200,000 lives were lost, and about half of the nation's 15,000 primary and 1,500 secondary schools were affected. Then, in 2016, Hurricane Matthew (Category 4) struck southwestern Haiti, affecting close to 2 million people in one of the country's poorest regions and leaving an estimated 450,000 children out of school. Schools that had been reconstructed after the earthquake were damaged by the hurricane winds six years later.

Addressing the multihazard conditions to which some schools are exposed is ultimately about improving planning, design, and construction practices and implementing mitigation and vulnerability reduction measures. Specific hazard and risk assessments have to be conducted separately (in step 5) and intervention measures tailored to meet specific performance improvements (step 6). A phased approach is usually the best way to proceed.

Activity 1.4.2.

Identify the building types exposed to natural hazards

Based on input from the previous activity, exposure maps are to be created by overlaying the location of building types and hazard maps in a GIS. As the hazard maps and locations of building types have been

defined in previous activities, the main task now is to identify the building types located within the boundaries of each hazard category. In a GIS, this consists of a simple overlay analysis. Some technical considerations, however, need to be taken into account.

Guidance

Do not generate or work with multihazard maps. The overlay analysis should be hazard-specific. Multihazard maps are limited in use because they combine and aggregate a variety of information that cannot be used to guide or inform any processes. Since, for RSRS activities, the aim is to conduct analytical work that guides risk reduction intervention strategies, all maps must be hazard-specific.

Clarify hazard categories on the map. Hazard maps generally use a color code (red-yellow-green) to represent different hazard categories. Unfortunately, this code does not include physical hazard parameters (like intensity or frequency) associated with each category. Task teams should address this issue with the support of local experts.

Ensure consistency in the level of resolution between hazard map(s) and school building type location(s). The resolution of hazard maps is conditioned by the characteristics of the natural phenomenon. Phenomena that affect large areas, like earthquakes, hurricanes, and some products of volcanic eruptions, can be represented on low-scale (for example, national) maps, while phenomena that affect areas more limited in extent, like landslides, tsunamis, or minor flooding, can be represented on high-scale (such as basin) maps. The overlay analysis resolution should be adjusted accordingly.

Understand the local concepts and terminology. The concepts of risk, hazard, vulnerability, mitigation, and resilience are often misinterpreted. It is common to see the terms "hazard" and "risk" used interchangeably or historical damage maps considered hazard maps, which is not correct and can lead to damaging consequences if used to inform interventions. The team should work at this stage with hazard maps, not risk maps.

➔ ***In post-disaster conditions, this activity looks at the exposure of building types to hazards other than the one that caused the disaster.*** Task teams should inquire about other hazards to which the school facilities are exposed—for example, following earthquake events, the team should ascertain exposure to landslides, floods, or hurricanes so measures to reduce these vulnerabilities can be integrated into the reconstruction intervention, in addition to measures to reduce vulnerability to earthquakes.

Module 1.5.

Management of school infrastructure data

The activities in this module will help to define how the information generated for the formulation of the plan will be integrated into the existing information system.

Activity 1.5.1.

Integrate the baseline into an existing or new MIS

This activity aims to define how the baseline can be integrated into an existing or new management information system (MIS). An extensive amount of information will be collected throughout the RSRS implementation. The baseline defines the structure of the plan's database. Task teams are asked to figure out how this new baseline can be integrated into the existing MIS.

Guidance

Ideally, the baseline should be integrated into the country's education management information system. Unfortunately, in developing countries, the education management information systems usually lack an infrastructure component. While an EMIS may include basic information about school facilities (name, location, number of students, number of shifts, and so on), it cannot be considered an infrastructure inventory. In other cases, an inventory of school facilities is available but is not integrated into the EMIS. This makes this activity challenging for task teams, who have the following options:

> To manage the RSRS information in an external database as a temporary solution until integration into the EMIS is feasible. In this option, task teams should work closely with EMIS administrators to agree on the tasks and time frame for the integration.

> In the absence of a proper EMIS, the implementation of the roadmap provides an opportunity to promote the development of an information system and to organize and maintain up-to-date information about school infrastructure. A recommendation to do so can be included as an action item in the school infrastructure plan (see step 8 for further guidance).[10]

Output

The completion of activities under each module will result in one or more output(s). For post-disaster conditions, the arrows in the chart below highlight the additional information that should be included in the output.

Module	Output(s)
1.1. Inventory of existing school facilities	- Database and report: Available information about school facilities ➜ Include results of rapid visual assessments conducted in the disaster-affected area (after disaster) - Mapping of agencies involved in school infrastructure data management
1.2 School facility baseline	- Database and report: Georeferenced attributes of school facilities that are required for the vulnerability and risk assessments ➜ Include georeferenced attributes of the condition and capacity of school facilities after disaster to inform the recovery and reconstruction plan - Catalog: Building types and index buildings - Training materials
1.3 School infrastructure network integration	- Database and report: Georeferenced attributes of the school infrastructure territorial integration
1.4 Exposure of existing school facilities to natural hazards	- Maps and report: Overlapping layers of hazard maps and school facilities ➜ Maps and report: Overlapping layers of hazard maps and school facilities in the disaster-affected area
1.5 Management of school infrastructure data	- Baseline accessible in a management information system

[10] The actual design and implementation of an EMIS is beyond the scope of the roadmap.

Step 2
School Infrastructure Policy

Purpose

To gain an understanding of the policy framework that governs school infrastructure and the projected demand for classrooms.

Objectives

In normal conditions

At the end of this step, the team should be able to do the following:

a. Identify infrastructure requirements based on the current education policy framework

b. Identify key decision makers involved in school infrastructure management

c. Identify ongoing school infrastructure plans

d. Identify the current capacity of school infrastructure

e. Estimate the demand for classrooms

In post-disaster conditions

At the end of this step, the team should be able to do the following:

a. Identify the policy framework that will guide the reconstruction of affected schools

b. Identify key decision makers involved in school infrastructure reconstruction

c. Identify ongoing or prospective school infrastructure plans in the affected area

d. Identify school infrastructure capacity in the affected area

Modules and activities

Module	Activity	
2.1. Government's school infrastructure policy	2.1.1. Identify infrastructure requirements based on the current education policy framework	2.1.1. Identify the policy framework that will govern the reconstruction of affected schools
	2.1.2. Identify ongoing school infrastructure plans	2.1.2. Identify ongoing school infrastructure plans before disaster
	2.1.3. Map institutional framework and identify key decision makers	2.1.3. Map institutional framework and identify key decision makers involved in the reconstruction process
2.2. Current and projected school infrastructure capacity	2.2.1. Identify the current capacity of school infrastructure	2.2.1. Identify the current capacity of school infrastructure
	2.2.2. Estimate current and new demand for classrooms	2.2.2. Estimate demand for classrooms in the affected area

Local partners and technical expertise

The table below presents a list of suggested local partners and technical expertise required to contribute to or lead the activities of this step.

Key agencies

> Ministry of Education and any other agency involved in education policy)

Contributing agencies

> Education research centers
> Statistical agency (demographic information provider)
> Local governments (in decentralized systems, data providers)

Technical expertise

> Senior education specialist (usually external advisor)
> Ministry of Education: team specialized in education
> GIS specialist
> Statistical specialist (for projection model

Module 2.1.

Government's school infrastructure policy

Activities under this module will facilitate the understanding of the infrastructure requirements of the education policies and the ongoing interventions, as well as the identification of key players.

Activity 2.1.1.

Identify infrastructure requirements based on the current education policy framework

This activity involves reviewing the current education policy and implications for school infrastructure nationwide. Education policy drives the condition and capacity requirements school infrastructure must meet to provide a satisfactory level of service. A familiarity with key aspects of policy is needed for task teams to identify school infrastructure requirements and priorities to include in the plan. The teams need to understand the country's education system, service structure (for example, education levels), national policies and programs, and expected medium- and long-term outcomes. An education specialist with local knowledge will help the teams collect more detailed information, such as coverage per education level, number of shifts, types of services provided by school facilities, and government's policy priorities and targets.

Guidance

While the RSRS emphasizes safety conditions, it recognizes the importance of also addressing functionality and capacity needs. This activity, like other steps under the RSRS, will provide opportunities for the task teams to diagnose and analyze the needs for improvement in condition and capacity, which can also be included in the plan. Since, as mentioned, implementation of the RSRS is flexible and can be tailored to address the needs of the government, the scope of the plan can be customized as needed.

While the link between education policy and the guidance of school infrastructure is clear, challenges arise in large portfolios. Considerable effort will be needed to adapt large portfolios of existing school infrastructure to new requirements imposed by changes in policy. Changes in regulation, allocation of additional resources in a budget-constrained environment, and restructuring of ongoing programs will be required to ensure a thoroughly planned process for nationwide implementation that will meet targets defined by the government and the education sector. This effort may also impose new intervention requirements on school facilities that may already have pending interventions to complete. The trend, for instance, toward adopting the one-shift policy in many developing countries is necessitating an increase of 50 percent or more in existing school infrastructure capacity. Another example of a requirement with an impact on the school infrastructure is the use of IT in the education process.

Throughout the implementation of the RSRS, it's important for task teams to identify key areas to discuss with decision makers. Once familiar with the education policies, the team should be able, based on the results of the analysis phase, to propose realistic targets to be incorporated in the plan and to have an informed discussion with decision makers.

In countries experiencing significant gaps in education coverage, decision makers are reluctant to allocate resources to improve the condition of existing infrastructure—even if prompted by education policy. Education and school infrastructure policy in developing countries tend to be disconnected. Often, education policy is updated, while school infrastructure policy remains in the past century. The RSRS strives to overcome this by inviting the participation of key stakeholders and providing a pragmatic and evidence-based approach to address this challenge.

➜ ***Time constraints will make it difficult to carry out this activity fully in a post-disaster context.*** Ideally, it should be conducted to inform the process and ensure the reconstruction of school infrastructure is in line with the sector policies. Based on our experience, however, this is easier said than done. When challenges arise, task teams should focus on understanding the current education policy framework and establish a checklist identifying the key requirements with which reconstruction interventions must comply.

Activity 2.1.2.

Identify ongoing school infrastructure plans

This activity looks at ongoing school infrastructure plans or programs at national and subnational levels. As part of the diagnosis phase, it is important to identify and map out all ongoing school infrastructure plans or programs managed by the central and/or local governments, as well as other relevant players. Additional information on the scope, structure, and implementation of ongoing programs can provide a glimpse into the sector's infrastructure management capacity.

Guidance

Task teams should concentrate on understanding the programs' general structure, scope, progress, results, beneficiaries, involved agencies, time frame, and so on. The allocation of resources financing these programs will be further analyzed in step 4.

The information relevant to ongoing intervention plans may be scattered or restricted in countries with decentralized school systems. In these cases, consultations with local agencies or authorities will be important to help complement the analysis. Before undertaking such consultations, task teams should also determine whether additional information is required from the local level for steps 3 and 4. Additionally, we recommend task teams conduct field visits with the support of relevant government agencies to school sites with ongoing interventions. These visits are a good way to learn about the process and approach being used in the construction of school buildings and related interventions. Task teams can also gain valuable insight into the dynamics of local schools by interacting with school principals and communities.

Programs receiving international support must also be identified and considered. These should be formal, existing programs approved by the government or sector that are receiving technical or financial support from IFIs and development partners. These types of programs are generally well documented and should have information available. It will be useful to receive input from these agencies regarding the challenges encountered during implementation. Isolated pilot interventions are not included in the analysis.

➜ ***This activity relates only to ongoing projects that are disrupted by a disaster.*** In the aftermath of a disaster, ongoing school infrastructure plans are put on hold in the affected areas. Part of the planning process is to evaluate whether reconstruction activities can be carried out through existing plans or integrated into the reconstruction plan. The latter is more likely to happen. In this instance, the capacity and resources in place before the disaster are crucial to the reconstruction process.

Activity 2.1.3.

Map the institutional framework and identify key decision makers

The aim of this activity is to map the institutional school infrastructure management framework and identify key decision makers. The institutional framework refers to the formal organizational structure and rules governing how the ministry of education, local governments, or other relevant agencies manage school infrastructure. Task teams should do a stakeholder mapping and describe the interdependencies within the ministry of education, as well as within other agencies, such as the ministries of economy and finance and of public works, and local governments, among others, that can have a role in managing school infrastructure.

Guidance

This activity includes reviewing the legal documentation and operating regulations associated with the institutional framework at all levels of government. Identifying the standards and regulations that govern school infrastructure is an important part of the diagnosis phase. Task teams should also identify areas where institutional gaps, overlapping roles, or duplication of efforts may occur and provide recommendations for improvement. The results of this activity will also be used to inform the definition of the plan's legal and institutional framework in step 6.

School principals are also key players and decision makers. Their roles may vary from country to country,

but principals know the school facility dynamics better than anyone, given their direct role in managing their schools and all related needs. Task teams should identify and map principals' specific roles with respect to infrastructure and any intervention planning and understand their level of autonomy and interaction with the different levels of government. A conversation with several principals would provide firsthand knowledge about actual operations at the level of the school facility.

Contributions to school infrastructure by non-governmental organizations and donors can only be part of the analysis if they are being coordinated by the government. In countries highly dependent on external aid and support from donors or nongovernmental organizations, it is important for the plan to guide these contributions and also to build the institutional capacity of the government and the sector to reduce that dependency over time.

➜ ***The role of institutions and local governments might change in post-disaster conditions as a result of special reconstruction arrangements.*** In large disasters, the usual approach taken by government is to centralize reconstruction management, either through a dedicated agency, with a special statute to accelerate the reconstruction process, or an existing agency or ministry. In such cases, the education sector will have an additional "layer" within the institutional structure with which to coordinate. In the case of local governments, the reconstruction agency generally takes over some tasks (at least temporarily) as well as decision making at the local level. For the implementation of the RSRS, we advocate the use of the existing institutional structure for the reconstruction process. These decisions are, however, determined at the highest levels of government. Whatever the arrangement set up by the government, task teams should become familiar with it and determine its implications for school reconstruction.

Module 2.2.

Current and projected school infrastructure capacity

Through this module, task teams will learn about the current capacity of the school infrastructure and estimate expected demand in the medium term.

Activity 2.2.1.

Identify the current capacity of school infrastructure

The purpose of this activity is to estimate the current capacity and occupancy of school infrastructure. As previously mentioned, "design capacity" refers to the number of students a school facility was designed to accommodate in classrooms in a single shift, in line with regulatory provisions. This means the school facility offers the appropriate number and sizes of classrooms, laboratories, bathrooms, equipment, and recreational areas. Countries with low school infrastructure capacity operate their schools in more than one shift. "Occupancy" refers to the actual number of students using a given school facility in one or more shifts. The ratio of occupancy to design capacity, or occupancy index (OI), can be used as a metric to identify either underused (OI ≤ 1) or overcrowded (OI ≥ 1) school facilities. The aggregate design capacity of school facilities within a territory (such as a country, region, or municipality) defines the capacity of school infrastructure for that territory.

More broadly, design capacity can be understood as the ratio of school building surface area to area per student. The area per student (that is, m2/student) is a basic school design provision that varies by education grade level. Occupancy, on the other hand, is estimated from the enrollment data. This information can normally be found in the education information management system; if not, it should be collected along with the baseline data in step 1.

Guidance

The analysis of school infrastructure capacity must include disaggregated figures by education level, urban versus rural distribution, regions, municipalities, and so on. Just as the population is not uniformly distributed within a country, neither is school infrastructure. For this reason, the generation of information and maps showing the school capacity distribution across a country or municipality is particularly useful. Task teams can learn about the differences and needs in demand within a territory by dividing capacity into the different education levels.

Other services can also be associated with school infrastructure capacity, like boarding school or special education. Given that these services tend to be marginal in large portfolios, they can be integrated at a national level if the baseline's resolution is high enough. Otherwise, their inclusion has to be addressed at a municipal level.

➔ ***Knowledge of the pre-disaster school capacity in the affected area is a priority, as it will help quantify both the impact of the disaster on the level of service (the loss of capacity) and remaining capacity to relocate students temporarily.*** If the school capacity and occupancy prior to the disaster is known, this information can complement the post-disaster damage assessment (see step 1). If the information is not available, it should be collected as part of the damage assessment. This can make it easier to estimate the remaining classroom capacity in each school facility and associated geographical distribution, which will be a primary input for the recovery plan. While temporary relocation of students is possible in urban areas within the framework of a recovery plan, accessibility and transportation time constraints may render this option infeasible in rural areas. In large-scale disasters this activity is resource intensive, as the analysis is conducted on a facility by facility basis, along with the damage assessment.

Activity 2.2.2.

Estimate current and new demand for classrooms

This activity focuses on quantifying the current demand for classrooms and expected changes resulting from demographic trends. Estimating the current demand is based on the analysis of a number of parameters that include school enrollment (both public and private), school dropout data, and school-age population. In addition to demographic shifts, fluctuations in public school demand over time can be attributed to changes in household preference for public or private education due to improved socioeconomic conditions, among other factors. To date, we have primarily used in our analysis the demographic shifts and the share of school-aged population attending private education as the factors that affect public school demand.

Guidance

The analysis should be conducted by education level. The RSRS proposes to calculate the demand within a given education level by estimating the number of students of a corresponding age group who are expected to attend schools in the public system. The current coverage can then be estimated in terms of the number of students who are actually enrolled and attending the public education system as a share of the demand.

Aligning classroom supply and demand in the long term is central to school infrastructure planning. Decreasing demand, which seems to be the case in several countries and regions, will call for medium- and longer-term planning for an intervention strategy and required investments that is very different than for growing demand (see the example of Cali). The dynamic nature of the main drivers of demand (changing demographic trends, education policies, and socioeconomic conditions) can add a layer of complexity to the analysis. A medium-term plan (for example, over a period of 10 to 12 years) should take into account expected changes in these variables. During implementation, we recommend the government entity in charge of managing school infrastructure keep track of major changes and update the plan, as needed.

The information required to conduct this analysis is not always easily available. In most cases, census data and information on migration flows, for example, are either undated or do not contain the level of detail required. Since the objective is to identify trends over time rather than obtain absolute figures, the analysis should be based on the most up-to-date information available and include expert advice to guide the development of proxies, if needed. Since the results of this analysis will inform activities under the planning-at-scale phase (steps 6-8), it's important for task teams to understand their implications and outcomes.

➜ ***The reconstruction of schools provides an opportunity to overcome location, condition, and capacity issues.*** School reconstruction must first take into account the improvement of school building performance against future hazard events. The analysis described above is not expected to take place in post-disaster conditions. Task teams should, however, seek the advice of experts to discuss and decide whether the capacity of the infrastructure to be reconstructed needs to be adjusted. The reconstruction process can, for example, provide an opportunity to merge schools with low OI to optimize the use of the school network.

Output

The completion of activities under each module will result in one or more output(s). For post-disaster conditions, the arrows in the chart below highlight the additional information that should be included in the output.

Module	Output(s)
2.1. Government's school infrastructure policy	- Report: Overview and findings about school infrastructure policy, ongoing plans, and institutional framework ➜ Overview and findings about government policy and institutional framework for recovery and reconstruction and summary of ongoing intervention plans for school infrastructure before disaster
2.2. Current and projected school infrastructure capacity	- Database: Current capacity and occupancy of each school facility by education level ➜ Capacity and occupancy of school facilities in the affected area - Report: Estimation of the short-, medium-, and long-term demand for classrooms ➜ Demand for classrooms in the affected area

Step 3

Construction Environment

Purpose

To gain an understanding of the regulatory framework, construction management practices, and construction technologies within which school infrastructure is planned, designed, built, operated, and maintained.

Objectives

In normal conditions

At the end of this step, the team should be able to do the following:

a. Get an overview of the regulatory framework and identify gaps and opportunities to improve it

b. Identify existing construction management approaches and contributing factors that might negatively affect the quality of school infrastructure

c. Identify typical construction practices, time frame, workforce capacity, and cultural factors

In post-disaster conditions

At the end of this step, the team should be able to do the following:

a. Get an overview of the regulatory framework and identify needs for updates in the reconstruction process

b. Identify existing construction management approaches and contributing factors that might negatively affect the quality of reconstruction works

c. Identify typical construction practices, workforce capacity, and cultural factors

Modules and activities

Module	Activity	
3.1. Regulatory environment	3.1.1. Identify the planning regulations for school location and strengthening opportunities	3.1.1. Identify the planning regulations for school location and need for changes in the reconstruction process
	3.1.2. Identify school building design and construction regulations and strengthening opportunities	3.1.2. Identify school building design and construction regulations and need for changes in the reconstruction process
3.2. Construction management	3.2.1. Identify procurement and construction management processes	3.2.1. Identify procurement and reconstruction management processes
	3.2.2. Evaluate the capacity and capability of stakeholders involved in school design and construction	3.2.2. Evaluate the capacity and capability of stakeholders involved in school design and construction
3.3. Construction technology	3.3.1. Identify typical construction practices and quality of main school building types	3.3.1. Identify typical construction practices and evidence of potential quality issues in affected infrastructure
	3.3.2. Review and identify potential school infrastructure design issues	3.3.2. Review and identify potential design issues in affected infrastructure

Local partners and technical expertise

The table below presents a list of suggested local partners and technical expertise required to contribute to or lead the activities of this step.

Key agencies

- Ministry of Education and any other agency involved in school infrastructure design and construction
- Government agency/body in charge of building codes, seismic codes, etc.
- Government agency in charge of construction services procurement (if not the Ministry of Education)

Contributing agencies

- Engineering and architecture professional associations
- Engineering faculty from local universities (knowledge of construction practices)

Technical expertise

- Senior architect or engineer with large experience in school infrastructure (usually external advisor)
- Ministry of Education: engineers and architects in charge of school infrastructure design and construction
- Ministry of Education: procurement specialist and senior legal advisor

Module 3.1.

Regulatory environment

Activities under this module focus on understanding the regulatory framework under which school infrastructure is planned, designed, and built.

Activity 3.1.1.

Identify the planning regulations for school location and strengthening opportunities

The aim of this activity is to gain knowledge of existing school infrastructure location and land use regulations to help identify opportunities to improve the infrastructure's safety and resilience. From a disaster risk management perspective, the most cost-efficient measure is the integration of risk reduction criteria early in the planning process. In theory, the farther schools are located from hazard-prone areas, the lower their exposure, and therefore the lower their risk. Yet this holds true only for certain types of hazards, like landslides, avalanches, or some volcanic eruptions. For hazard events like earthquakes, hurricanes, and floods that can affect larger areas in a country, exposure of the population and infrastructure is unavoidable. Planning and land use regulations may include provisions, for example, to limit as much as possible the development, occupation, and location of vital infrastructure, such as hospitals, schools, and emergency facilities, in high hazard areas. School planning may also take into account factors such as accessibility of the school, road networks and access to public transportation, and distance to other vital infrastructure. Also important is to review whether land that has been allocated for school infrastructure meets suitability requirements for this purpose.

Guidance

Planning regulation for school infrastructure is often defined by legal instruments that are beyond the sphere of influence of the education sector. For this activity, task teams will have to collect and review various instruments, such as land use and urban development plans, environmental regulation, building codes, and cadastral information, that is found under other sectors or departments. Informality in the location and construction of school facilities continues to be a challenge in many developing countries, so task teams should also inquire about the existence of regulations that address land property issues in public infrastructure. This will be important for the plan, since land property issues can become a major bottleneck during implementation.

Regulations that are vital to the plan and require updates may need to be prioritized. Changes in regulations entail discussions with a wide range of government entities and consultations with stakeholders and may require complex and time-consuming administrative and legal procedures. Task teams should identify key regulations that are essential to the plan and promote an environment during the implementation of the RSRS conducive to discussing the gaps and producing recommendations for improvement and next steps. Facilitating technical discussions among key local players and the sharing of international experiences can contribute toward achieving this goal.

This activity is particularly relevant in post-disaster conditions, as schools are frequently relocated during the reconstruction process. In the aftermath of a disaster, it may become apparent that inadequate location of infrastructure and human settlements has led to increased damage. In liquefaction-prone areas, for instance, the loss of bearing capacity of wet sand soil deposits can cause extensive damage during the shaking of an earthquake. In such cases, the use of evidence-based data is essential to identify aspects of the planning regulations that require improvement and to make recommendations accordingly. Decision makers should be informed of and encouraged to support such recommendations, even at the risk of creating a misperception that the progress of reconstruction will be delayed.

Activity 3.1.2.

Identify school building design and construction regulations and strengthening opportunities

This activity focuses on gaining knowledge of existing school building design, construction, retrofitting, and maintenance regulations that will help with the

identification of opportunities to strengthen planning and the design of interventions in school infrastructure. Improvements to building codes and enforcement mechanisms can contribute to the quality and resilience of infrastructure. In fact, the poor performance of school buildings in hazard events can often be linked to a lack of proper design or problems in the quality of the construction. The purpose of the activity will be to gain an understanding of regulations including not only architectural and engineering provisions for school buildings, but also the requirements for licenses, construction permits, and supervision of the work.

Guidance

In general, most of these regulations are derived from building codes. Schools also have sector-related documents that provide the design standards for facilities, as well as guidance on operation and maintenance. As school infrastructure management tends to become more decentralized, this analysis should also consider regulations at a subnational (municipality) level. Additionally, it is important to map all involved agencies and the instruments and mechanisms they use to enforce these codes and provisions.

The main objective of this activity is to understand the evolution over time of building codes (particularly seismic) and of standard designs used for schools. As mentioned under step 1, the use of standard designs in a country can facilitate the diagnosis of a large stock of facilities. By analyzing the evolution of building codes, a correlation can be made between the quality of design and the construction year, as will be exemplified in step 5. The evolution of building codes has been driven by lessons learned from infrastructure failures in past disaster events. Thus, changes in the seismic codes are usually associated with and follow the timeline of historic hazard events. For the task team, understanding these changes provides valuable insight into possible areas for improvement. For further guidance, the team should seek advice from local senior engineers and architects who have been key players and are familiar with this process.

In some countries the lack of regulation in school infrastructure design and construction continues to be a problem. Schools are built with varying standards that are established by external entities, such as donors, or they are built through informal means by the communities themselves (that is, they are nonengineered buildings). In both these cases, the focus of the activity will shift to identifying key players, conditions, and opportunities to develop regulations. Informality is perhaps one of the biggest obstacles to modernizing the construction and management of school infrastructure.

The analysis of existing regulation requires the participation of local specialists and international experts, when possible. The optimization of engineering solutions, which is at the core of implementing solutions at scale, is made possible by using advanced engineering techniques and innovations in technology. Since the use and application of new analytical approaches, modeling techniques, and construction technologies often requires changes in the regulations, it is important to understand the approaches currently in use in the country and to support capacity building to advance this optimization effort. The GPSS promotes the use of innovation to reduce disaster risk in school infrastructure, so any need to update regulations and move forward policy reforms in these areas should be brought to the attention of local specialists and the government entities in charge to see how new technologies and approaches can be incorporated.

Damage assessments provide evidence-based knowledge that can inform the reconstruction plan and updates to the building codes. A dedicated team of specialists is required to gather evidence of the building damage post-disaster and identify the ways in which specific building types fail. The time frame to collect this evidence from the field is very narrow, as rubble removal and reconstruction activities are quick to begin following a hazard event. Local partners, usually academic and research institutions, will be in a position to provide much-needed support to task teams in terms of human and technical capacity. In the aftermath of a disaster, this activity is crucial to push forward informed policy reforms and to ensure vulnerabilities are not recreated during the reconstruction process.

Module 3.2.

Construction management

Activities under this module will help task teams to become familiar with the procurement practices under which construction services are contracted and the capacity of relevant players to manage these projects.

Activity 3.2.1.

Identify procurement and construction management processes

Under this activity, identifying the existing procurement processes and management practices related to construction services for civil works at the national and subnational levels will help the team understand the delivery and quality of school construction. "Management practices" refers to the role of public or private entities, nongovernmental organizations, or communities in managing construction services. Understanding these processes will give task teams a clear overview of how school construction is managed, and the key players involved at the different levels of government. Results of this activity will be used to inform the implementation strategy (step 8).[11]

Guidance

Procurement and construction management practices affect three important aspects of construction: cost, delivery time, and the ability to scale up. Construction services for public infrastructure are governed by national procurement and public investment systems, with which intervention and implementation strategies must comply. The cost of implementing interventions will vary, depending on the procurement and management approaches used. Costs to rehabilitate or retrofit school facilities located in remote areas, for example, increase dramatically when procurement and management are centralized. For the implementation strategy, task teams should find the most suitable options to reduce cost inefficiencies.

School interventions, whether new construction or rehabilitations, must be delivered in a timely manner. Any delays in the implementation of civil works can trigger a backlash from the school community. Furthermore, if this occurs nationwide, the consequences can affect the credibility of the government and lead to social conflict and unrest.

The school construction environment is complex and requires transparency and accountability mechanisms be put into place. As with other infrastructure, a large amount of resources is involved in the construction of school facilities, as well as a range of players, some of whom may have vested interests in influencing procurement decisions. Regrettably, corruption is still rampant in the realm of school construction in several developing countries. The ultimate result is poor-quality infrastructure, which can lead to great loss of life in hazard events. Task teams must identify areas in need of improvement in the procurement process and construction management practices to ensure proper mechanisms are in place to increase transparency and accountability for those involved.

➜ ***During the reconstruction process, exceptional procurement measures and construction management practices are often approved to expedite reconstruction activities.*** As mentioned earlier, governments usually establish a reconstruction agency, which operates within an exceptional legal and administrative framework. An independent procurement and construction management body may be designated to accelerate the pace of reconstruction work and "fast-track" procurement provisions put into place. For task teams, it is essential to understand the scope of these exceptions and procedures to inform the implementation strategy of the reconstruction plan accordingly.

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[11] Examples of how to map procurement and construction management arrangements and the roles of all stakeholders involved and their interdependencies are provided in Serge Theunynck, *School Construction Strategies for Universal Primary Education in Africa* (Washington, DC: World Bank, 2009), link.

Activity 3.2.2.

Evaluate the capacity and capability of stakeholders involved in school design and construction

This activity examines institutional capacity, stakeholders' capability, and the need for capacity strengthening. The evaluation of institutional capacity is to focus on the human and technical capacity and the management capabilities of government entities that have a role in managing the school infrastructure cycle. Included in the assessment are in-house capacity (for example, the number of staff members, their profiles and fields of expertise, training opportunities, and experience), along with the availability of other resources, such as information and communication technologies, protocols, and monitoring and reporting systems. The evaluation applies to local governments in the education sectors of decentralized countries.

Guidance

The demand of their day-to-day activities and the implementation of the RSRS can strain the capacity of government agencies. While governments with high in-house capacity can go through each step of the roadmap with limited external support, those with limited capacity may not be able to implement it fully on their own and will require additional human, technical, and financial support. For the implementation of the plan, task teams need to identify key areas related to the capacity and capability of stakeholders that require strengthening.

Private architecture and engineering firms as well as universities may provide additional technical capacity and support to infrastructure managers. The participation of the private sector in school construction is another indicator of local firms' capacity. Countries that have transparent procurement systems and are open to the private sector's participation create a competitive environment that provides incentive for and promotes the provision of high-quality construction services. And as the topic of safer and resilient schools draws attention from academic institutions, task teams should also seek support from local universities and researchers interested in this area and learn about their work and their collaboration (if any) with their government's education sector. The participation of students in the diagnosis and analysis phases, for example, has proved an effective motivator to encourage interest in the safer schools agenda by a future generation of professionals.

Informal school construction activities shouldn't be counted for the purpose of this activity. Informality affects negatively the quality of the infrastructure and, therefore, increases vulnerability factors. The role of communities in managing school infrastructure varies across developing countries. Unfortunately, there are still cases in which communities are actively involved in school construction activities. Although there is no one way to approach the matter, a clear distinction must be made between the options for community engagement around schools and construction services governed by engineering practices.

➜ ***As reconstruction following a disaster strains the government's capacity for implementation, the results of this activity provide essential information for defining the intervention strategy.*** The analysis of stakeholder capacity serves two purposes: it ensures consistency between the reconstruction intervention strategy and the local technical capacity in place, and it identifies the need to include a capacity-building component in the reconstruction plan. Since capacity building is essentially a medium- to long-term undertaking, the choice of engineering solutions for reconstruction should rely, to the extent possible, on existing capacity; otherwise, external support will be required.

Module 3.3.

Construction technology

Activities under this module look at quality flaws in local construction practices and design activities.

Activity 3.3.1.

Identify typical construction practices and quality of main school building types

This activity focuses on identifying any quality issues related to local construction practices. Information needs to be gathered about known and recurring construction quality issues that may relate to specific building types, construction years and regions identified within the country where this problem may be concentrated.

Guidance

Issues with the quality of construction may originate from poor-quality materials, low standards of workmanship, lack of supervision and quality control, and/or poor implementation capacity. We see more issues with the application of building codes in rural than in urban areas. Overcoming these issues should be at the core of the plan's intervention strategy (step 6); otherwise, neither interventions nor investments make sense. The analysis of historic construction practices and evidence (if any) of construction quality issues will also provide inputs for the vulnerability analysis in step 5.

Official building inspection records are a valuable source of information. Construction services are normally subject to permit and inspection procedures by local authorities. Thus, technical documents are generated and preserved as official records. Getting access to these documents is an efficient way to become familiar with enforcement procedures while learning about quality issues. It is useful to inquire about architectural and engineering drawings of representative school building types. If they are not available, field activities should be conducted to gather this information.

The introduction of new technologies for solutions at scale should take into consideration and be aligned with prevailing construction practices in the country. The market for construction technologies for school buildings is growing globally. Innovative solutions bring many advantages, such as improved delivery time or energy and cost efficiency. While these advantages are desirable for large-scale interventions, their introduction must be conditioned by the local construction market, workmanship, and maintenance practices.

➜ ***Making changes to community construction practices in rural and remote areas remains a challenge for the reconstruction process.*** Addressing quality issues in the reconstruction of schools in remote rural areas usually entails changes in local construction practices. As this is a long-term effort, it is not realistic to expect outcomes within the reconstruction time frame using local services. For this reason, reconstruction managers prefer to hire services from external firms. In very remote areas, however, the reconstruction may take years, which may compel communities to begin reconstruction themselves. If this is so, task teams should look for local nongovernmental organizations and engineers to conduct the diagnosis and make recommendations to be included in the reconstruction plan.

Activity 3.3.2.

Review and identify potential school infrastructure design issues

The purpose of this activity is to determine whether widespread design flaws exist in school infrastructure. Design issues refer to a certain lack of quality or inability to meet acceptable standards, compromising school building performance. There are two types of design issues: building code deficiencies and designers' poor execution. Since the former has been partially covered in a previous activity, this activity will concentrate on the evaluation of design quality for specific index buildings.

Guidance

This specialized task requires the participation of local experts. Key recommendations will be made and capacity building needs defined through their analy-

ses. High-quality design is one of the parameters listed in the GLOSI classification and is directly linked to the results of this activity.

When standard designs are applied across a large stock of school facilities, any design flaw is replicated to thousands of buildings. In interventions carried out at scale, the impact of design issues is amplified by the thousands, and solutions are bound to be as expensive as they are complex. The short-column issue[12] illustrates this point: while it is technically simple to avoid this structural issue at the design and construction stages, corrective interventions to solve it are expensive and complicated to implement at scale. Clearly, this evaluation is particularly relevant to designs of new school buildings.

Throughout the implementation of the RSRS, the task teams can facilitate discussions among local experts through workshops. International experts can contribute knowledge when necessary, but local experts, in coordination with the government, should steer the conversation.

➜ ***The analysis of the ways in which affected school buildings fail in disaster events points to potential design issues.*** As previously stated, the analysis of evidence related to building type performance should influence the design of reconstruction interventions. We stress this basic principle because it is not common practice in the context of reconstruction.

Output

The completion of activities under each module will result in one or more output(s). For post-disaster conditions, the arrows in the chart below highlight the additional information that should be included in the output.

Module	Output(s)
3.1. Regulatory environment	- Report: Analysis of the regulatory framework and need for improvement in light of the plan's implementation ➜ Report: Analysis of the regulatory framework and need for improvement in light of the recovery and reconstruction process
3.2. Construction management	- Report: Mapping of construction management practices and stakeholder capacity, and recommendations to overcome existing weaknesses/gaps ➜ Include a definition of a construction management model for reconstruction
3.3. Construction technology	- Report: Summary of construction practices, analysis of effects on the quality of school buildings, and recommendations ➜ Include analysis focusing on the effects of construction practices on the quality of reconstruction work

[12] A column with a ratio effective length to its least lateral dimension smaller than 12 is usually considered as a short column. Due to its geometry characteristics, under earthquake load, this type of column tends to fail in a dangerous shear brittle failure mode instead of introducing relatively safer ductile yielding from the bending deformation. Short columns are usually generated when infill walls are not full-story height and not isolated from the columns.

Step 4

Financial Environment

Purpose

To gain an understanding of the financial environment within which school infrastructure is planned, designed, constructed, operated, and maintained.

Objectives

In normal conditions

At the end of this step, the team should be able to do the following:

a. Identify historical and planned investment programs

b. Identify the decision-making process for resource allocation

c. Identify the financing mechanisms within the public investment system

In post-disaster conditions

At the end of this step, the team should be able to do the following:

a. Identify historical and planned investment programs in the affected area

b. Identify the decision-making process for resource allocation

c. Identify the financing mechanisms within the public investment system under which the reconstruction should take place and other sources of financing

Modules and activities

Module	Activity	
4.1. Institutional budget for school infrastructure	4.1.1. Identify budget allocation for the sector and, specifically, for school infrastructure	4.1.1. Identify budget allocation for the sector and, specifically, for school infrastructure in the affected area (before disaster)
	4.1.2. Analyze budget execution for school infrastructure	4.1.2. Analyze budget execution for school infrastructure in the affected area (before disaster)
4.2. Current investments in new and existing infrastructure	4.2.1. Identify historical and current investment programs for new school infrastructure	4.2.1. Identify historical and current investment programs for new and existing school infrastructure in the affected area (before disaster)
	4.2.2. Identify historical and current investment programs to repair or retrofit existing school infrastructure	4.2.2. Identify historical and current investment engagements for the reconstruction of school infrastructure in the affected area
4.3. Financing investment system	4.3.1. Identify the funding mechanisms of current investments	4.3.1. Identify the funding mechanisms of current investments and additional funding sources for reconstruction
	4.3.2. Identify investment requirements and key decision makers	4.3.2. Identify investment requirements and key decision makers in the reconstruction process

Local partners and technical expertise

The table below presents a list of suggested local partners and technical expertise required to contribute to or lead the activities of this step.

Key agencies

> Ministry of Education and any other agency involved in school financing
> Ministry of Finance

Contributing agencies

> Ministry of Planning and Development (if any)
> IFIs, donors, and NGOs involved in school financing

Technical expertise

> Ministry of Education: team (economists, engineers, managers) involved in school financing and with knowledge of the public investment system
> Ministry of Education: senior economist involved in school financing
> Ministry of Finance: economist/specialist involved in budget allocation for school financing

Module 4.1.

Institutional budget for school infrastructure

Activities under this module will allow task teams to learn about the government's resource allocations for existing school infrastructure, as well as the capacity of involved agencies to implement them.

Activity 4.1.1.

Identify budget allocation for the sector and, specifically, for school infrastructure

This activity focuses on the education sector's budget allocation process and patterns of investment in school infrastructure. The goal is to have a clear understanding of the historical behavior and trends in school infrastructure budget allocation, which refers to funding for any type of intervention from central or local governments for new and/or existing infrastructure. Information obtained about the education sector's budget, preferably spanning the previous five years or more, is to be sorted sequentially into the various funding sources and respective allocations to school infrastructure. The challenge will be to collect and integrate information from various sources that do not always clearly separate out school infrastructure expenditures. The results from this activity will be used in the projection of investment scenarios in step 6 and 7.

Guidance

The analysis of the budget allocation should take into account public funding, as well as any external sources that have been approved by the government and are predictable over time. In low-income countries, public spending tends to be low, and IFIs and development partners play a key role in financing investments in, for example, school infrastructure. Often, the government entities in charge do not receive regular allocations from the public budget and must rely on external sources of funding. For task teams doing this analysis, such external resources can be included as long as the funding covers a continuous period of time (that is, five years or more) and has been under the government's oversight.

Budget resources allocated for the maintenance of schools are limited and poorly defined. This lack of maintenance of school infrastructure is reflected in the limited information available on these activities. Funding for maintenance usually comes from central and local governments and even communities. It is important for task teams to collect all available information and to understand the budget resources allocated and the frequency and types of activities undertaken as part of maintenance.

Comparing the budget allocation and spending on education and school infrastructure across countries can be useful to inform the plan. The comparison of education and school infrastructure allocation in a given country with peer countries or the use of benchmarks from developed countries—such as Organization for Economic Co-operation and Development (OECD) members—can provide key insights for the political economy of the plan. This comparative analysis can also be useful at the subnational level when, for example, comparing across cities or municipalities.

➜ ***This analysis in a post-disaster context remains relevant even though the reconstruction budget allocation may be exceptional and determined by the extent of the impact.*** The resources allocated for the reconstruction of schools should be included in the analysis of the sector's regular budget allocation. For the task team, it will be important to understand how and where these resources are distributed, in particular for the most affected areas. A surge of additional funds will also come from contributions by donors or international aid.

Activity 4.1.2.

Analyze budget execution for school infrastructure

This activity is focused on understanding the sector's capacity to spend on school infrastructure. The budget originally approved and allocated may vary from the actual resources spent as a result of factors ranging from administrative bottlenecks during implementation to emergency response activities after a disaster. Identifying these differences can provide opportunities to increase efficiency in the execution and allocation of resources. This activity builds on the

information collected under activity 4.1.1 to track the annual average figures of the amount allocated, final amount executed, and remaining resources.

Guidance

The information on school infrastructure spending, which comes from different government levels, should be disaggregated accordingly. The analysis of overall spending capacity, in addition to other parameters identified under this step, will inform activities for the investment plan in step 7, while an understanding of the spending capacity by level of government will inform the implementation strategy (step 8). In developing countries, spending capacity tends to be lower at the subnational level, often due to limited human and technical resources. In decentralized contexts, local governments have strong participation in managing infrastructure investments; hence, identifying capacity-building needs and other areas for strengthening will ensure the plan's implementation is not compromised as it moves forward.

This analysis should be led by relevant government officials. In particular, the ministries of finance and education should have both historical and current data on the budget, allocations, spending, and so on. Task teams should convene these key players and facilitate their participation to carry out this activity in line with the overall implementation of the RSRS and expected output(s).

➔ ***To accelerate the pace of recovery from a disaster, spending capacity should be increased during the reconstruction process.*** To expedite the implementation of reconstruction work and related activities, the sector's spending capacity can be increased by creating ad hoc implementation units or strengthening existing ones. Usually, these measures are temporary and will be discontinued as the reconstruction moves forward. For task teams, it will be essential to understand the sector's approach to and capacity for managing these additional resources, as compared to normal conditions. The results of this analysis will inform activities in step 7.

Module 4.2.

Current investments in new and existing school infrastructure

Activities under this module will allow task teams to learn about the government's resource allocations for new school infrastructure, particularly for vulnerability reduction interventions.

Activity 4.2.1.

Identify historical and current investment programs for new school infrastructure

This activity aims to gain an understanding of past and current investments in new school infrastructure programs. The objective is to understand to what extent and how the sector has historically been financing the enhancement of school infrastructure capacity. This requires understanding the methods used to estimate the demand for new classrooms, the prioritization criteria (if any) used to allocate resources, the timeline of progress, and costs over time. Also important is information on the spatial distribution of these investments in urban and rural areas.

Guidance

This analysis should provide rich evidence of how the need for new infrastructure has been and is being addressed. It is possible, for example, to identify links between investments and demographic changes or even school building types built in different periods, thus helping the task teams understand the rationale behind the allocation of resources for new classrooms and anticipate the need for adjustments to meet future demand.

New school infrastructure may be found to have design or construction flaws. In step 3, construction quality issues were analyzed. If quality issues are identified in the new infrastructure investments, task teams should collect information and discuss with the relevant agencies involved whether the issues relate to all of the investment program or just a portion. It is also

important to understand what measures have been taken by the sector to overcome the issue in the future.

➔ ***In post-disaster conditions, this analysis provides insight about the existing capacity of construction services for school infrastructure.*** Existing school infrastructure programs can serve as a beneficial foundation for the reconstruction process, without which it would need to start from scratch. Task teams will need to gauge whether the expected investments for reconstruction are manageable for local construction firms or if complementary support is necessary.

Activity 4.2.2.

Identify historical and current investment programs to repair or retrofit existing school infrastructure

The aim of this activity is to gain an understanding of the past and current investments in existing school infrastructure programs. The objective is to learn how the sector historically has financed the interventions[13] (repair, rehabilitation, retrofits, or maintenance) in existing schools and the decision-making process that has been followed. It is to examine how these investment programs are defined and formulated, and whether they are articulated within a broader school infrastructure investment program and linked to any government priorities.

Guidance

In the absence of national plans and/or school infrastructure programs, interventions and investments are addressed through a project portfolio approach, based on demands from local governments and school principals. The government entity in charge often receives requests from the subnational levels and even school principals, which are then consolidated in a school infrastructure project portfolio. As resources become available, these are distributed and allocated based on a set of criteria. With this approach, only a portion of the portfolio is commonly financed due to limited public resources. The inability to fund some projects implies some schools will not be served, and this can lead to problems with the principals of these schools and the communities in which they are located.

Investments in informal intervention projects should be excluded from the analysis. In general, these interventions are made with resources from communities and nongovernmental organizations and range from minor maintenance work to the construction of new floors or classrooms or new buildings in an existing school facility. They should not be combined with formal investments because they are not part of the public investment system, do not comply with the regulatory framework, cannot be considered permanent, and reflect an existing investment gap.

➔ ***Awareness of existing programs will facilitate their integration into the reconstruction plan.*** The reconstruction plan addresses not only the need for repair or replacement of affected school buildings, but also preexisting intervention needs. Indeed, in countries with good school infrastructure plans, reconstruction becomes an updated version of the existing plan. Thus, the analysis of historical investments sheds light on opportunities to leverage recovery efforts from subsequent programs.

[13] The term "lines of intervention" varies from one country to another. Task teams should inquire about the formal definition in the country of operation.

Module 4.3.

Financing investment system

Through this module, task teams will become familiar with the public investment system in the country and the decision-making process for school infrastructure investments.

Activity 4.3.1.

Identify the funding mechanisms of current investments

The aim of this activity is to gain an understanding of the existing funding mechanisms used to finance school infrastructure investments. The objective of the task teams is to review, analyze, and describe all sources of financing used for school infrastructure, such as the education sector's annual budget, transfers from the central government, internal and external loans, and donor contributions. The task teams are to work with the sector and with the ministry of finance to gain access to this information, which usually can be found in the ministry's budgeting system.

Guidance

Task teams should get to know the regulations and operating rules for the different funding mechanisms. Operating rules are established within the country's public investment system, covering expenditure eligibility, accessibility conditions, priorities, implementation time frame, and reporting, among other areas. Two expenditure categories are widely used: operating expense (OpEx) and capital expense (CapEx). The former relates to regular expenditures needed to keep infrastructure operative while the latter relates to one-time expenditure to improve or enhance the condition and capacity of the infrastructure. Dedicated funding mechanisms may exist for each of these categories. For the design of the plan's financial strategy (step 7), investments will be grouped by expenditure categories.

➔ ***In large-scale disasters, central governments use dedicated funding mechanisms for reconstruction.*** Task teams should familiarize themselves with reconstruction funding mechanisms so the plan's financial strategy can be designed accordingly. Funding mechanisms in the RSRS refer to formal financial options established and administered by the government. Other financial contributions (from donors or nongovernmental organizations, for example), which may be particularly abundant in the recovery phase, can only be considered in the analysis if they have been officially integrated into the government's financial strategy for reconstruction.

Activity 4.3.2.

Identify investment requirements and key decision makers

The purpose of this activity is to map the detailed processes for mobilizing resources for school infrastructure and the decision-making processes corresponding to each funding mechanism. These are to be broken down into factors like eligibility criteria, application process, technical documents, spending time frame, and key decision makers.

One objective of this activity is to recognize how central and local funding mechanisms are connected and, by that means, discover areas in which the education sector and municipalities can collaborate with the central government to inform future budgets. The decision-making process describes the chain of decisions made from the approval of submitted investment projects to the actual allocation of implementation resources, most of which are made by the ministries of finance, education, or public works.

Guidance

From the analysis in this activity, task teams should be able to facilitate and improve the way decisions are made. We have observed that inefficiencies in the public project cycle stem from the poor quality and flow of information at each stage and trouble with arrangements to make decisions. The plan can make important contributions to each. The diagnosis phase constitutes a solid foundation for the definition of investment projects in subsequent stages. The primary purpose is to make a transition in the investment project design from a case by case to an intervention-at-scale approach. The analysis phase will unveil bottlenecks, gaps, and weaknesses through the investment design

process and opportunities for simplification in the decision-making process.

This analysis reveals inadequacies in capacity among involved players that may ultimately affect efficiency in implementation. Low technical capacity within the government's project units has a cascade effect on the whole project cycle. The quality of the technical documents and implementation provisions is often disputable, especially at a subnational level. Task teams should define the qualifications required of team members throughout the process so capacity-building needs can be integrated into the plan. This is as important as the formulation of the plan in some low-income countries, in which cases we recommend training programs as part of its kickoff activities.

➜ ***Customarily, fast-track procedures are created to provide access to reconstruction funding.*** Task teams should become acquainted with the detailed procedures related to the mobilization of school infrastructure resources. The reconstruction plan must provide the framework and required information for the formulation of investment projects. A fast-track option helps expedite the mobilization of resources but can also complicate the timely definition of investments and their formalization. For this reason, additional technical contributions from universities or other technical organizations to the design and formulation of reconstruction investment projects is highly desirable in the wake of large-scale disasters.

Output

The completion of activities under each module will result in one or more output(s). For post-disaster conditions, the arrows in the chart below highlight the additional information that should be included in the output.

Module	Output(s)
4.1. Institutional budget for school infrastructure	- Database and report: Main findings on the historical budget for the sector (general, educational, and school infrastructure budgets) and budget execution of school infrastructure investments
4.2. Current investments in new and existing infrastructure	- Database and report: Main findings on historical and current investment programs for new and existing school infrastructure ➜ Include reconstruction investments
4.3. Financing investment system	- Report: Current structure of the relevant ministry's budget for school infrastructure investments, and main characteristics of the funding mechanisms ➜ Include current structure of the relevant ministry's income for reconstruction of school infrastructure, and main characteristics of the funding mechanisms for post-disaster conditions

Step 5

Risk and Resilience Assessment of School Infrastructure

Purpose

To allow task teams to identify different intervention options by quantifying the potential harm to children, damage and losses to existing school infrastructure, and disruption of services caused by the occurrence of hazard events of varying intensity and frequency.

Objectives

In normal conditions

At the end of this step, the team should be able to do the following:

a. Quantify the risk to school infrastructure in terms of potential fatalities and economic loss

b. Map the spatial distribution of risk

c. Identify the distribution of risk by building types and evaluate their current performance

d. Identify intervention options to improve the performance of different building types

In post-disaster conditions

At the end of this step, the team should be able to do the following:

a. Identify damage modes and levels and the spatial distribution of damage in the affected area

b. Quantify the losses and service disruption in the affected area

c. Identify the pre- and post-disaster performance of building types

d. Identify intervention options to recover and improve the performance of building types

Modules and activities

Module	Activity	
5.1. Analysis objective	5.1.1. Define objective of analysis	5.1.1. Define objective of analysis
5.2. Assessment of risk to school facilities	5.2.1. Undertake hazard analysis	5.2.1. Update hazard information based on data collected about the disaster event
	5.2.2. Establish the exposure model	5.2.2. Establish the exposure model
	5.2.3. Assess the fragility and vulnerability of index buildings	5.2.3. Identify damage modes/levels and analyze the fragility and vulnerability of index buildings
	5.2.4. Quantify risk in terms of expected losses and service disruption	5.2.4. Quantify losses and service disruption caused by the disaster, and estimate expected losses and disruption caused by future events
5.3. Analysis of intervention options for school buildings	5.3.1. Evaluate current performance of index buildings	5.3.1. Evaluate the pre- and post-disaster performance of index buildings
	5.3.2. Identify interventions to improve performance of index buildings	5.3.2. Identify interventions to recover and improve performance of index buildings

Local partners and technical expertise

The table below presents a list of suggested local partners and technical expertise required to contribute to or lead the activities of this step.

Key agencies

- Ministry of Education and any other agency involved in school management
- Geological Service agency or similar (hazard maps provider)

Contributing agencies

- Engineering faculty from local universities (knowledge in risk modeling)

Technical expertise

- Senior structural engineer (usually external advisor)
- Senior hazard specialist such as an engineer or geologist from the Geological Service agency
- Senior disaster risk management specialist (usually external advisor)
- Ministry of Education: senior engineers
- Risk modeler (from either a consulting firm or local university)
- GIS specialist
- Information management specialist

Module 5.1.

Analysis objective

In this module, task teams will discuss and define the scope and objectives of the risk assessment to inform the planning phase.

Activity 5.1.1

Define objective of analysis

Under this activity the scope and specific objectives of the risk assessment of the existing school facilities are discussed. With support from local experts, task teams are to define the objectives, resolution, and methodology of the risk assessment required to inform further steps in the RSRS. The risk assessment ranges from a low-resolution assessment (for example, at the national level) to a high-resolution assessment (for example, at the portfolio level with information per building). The resolution relates to the level of granularity at which risk will be quantified, which is governed by the resolution and quality of the available data on hazard, vulnerability, and exposure. This discussion will drive the decision as to whether fatalities, economic losses, and expected downtime, given few or several hazard events, will be quantified. It is important to ensure the study will be not only technically consistent but also feasible with the available resources and within the specified time frame.

Guidance

Do not overestimate the power of numbers or underestimate the value of analytics. As mentioned earlier, the RSRS advocates for the use of quantitative risk assessment. While qualitative risk assessments contribute to raising awareness, quantitative assessments are instrumental to defining priorities, designing solutions, and monitoring progress on school safety and resilience. Yet the misinterpretation of results and unreliable data can jeopardize the potential benefits of quantitative work. Although absolute values of risk or vulnerability may prove meaningless in some cases, logical analysis—or analytics—may prove fundamental to the design of intervention strategies, as it allows for the comparison of relative values within a territory or across different building types. Different disaster risk analysis methods can be used to derive the data needed to assess risk (see box 1).[14]

➔ ***In post-disaster conditions, the damage and vulnerability assessment may take precedence over the risk assessment.*** The vulnerability of affected school buildings changes as a result of the impact of a hazard event and, later on, of the reconstruction interventions. Damage and vulnerability assessments are needed to understand those changes and inform the definition of reconstruction interventions. If possible to conduct one, a scenario risk analysis is useful to reproduce analytically the impact of a disaster and calibrate the fragility and vulnerability curves of index buildings. In the long run, infrastructure managers will need to recalculate risk every time a disaster occurs. While a disaster modifies risk, it does not eliminate it, and reconstructed (new and repaired) school facilities will inevitably be exposed to hazard events in the future.

Box 1.

Analysis Methods

The following methods of analysis are among those used in risk assessment:

- Probabilistic risk analysis quantifies the magnitude of adverse consequences (fatalities, damage, economic losses) and the probability each will occur, given a large set of possible hazard events.
- Deterministic risk analysis quantifies the magnitude of adverse consequences (fatalities, damage, economic losses) given scenarios for one or more hazard events.
- Vulnerability analysis quantifies the likelihood that a specific element (a school building, in this case) will be damaged when exposed to hazard events of different intensities.

[14] Analysis methods for the resilient assessment of school infrastructure have had limited development so far. The Global Program for Safer Schools is developing methodologies in partnership with universities.

Module 5.2.

Assessment of risk to school facilities

Through the activities in this module, task teams, with support from specialists, will ascertain the likelihood and expected magnitude of damage, losses, and disruptions in the school infrastructure networks from future hazard events.

Activity 5.2.1.

Undertake hazard analysis

This activity aims to define the intensities, frequencies, and spatial distribution of selected hazard events with different probabilities of occurrence. The results of this hazard analysis will be used for the risk assessment.[15] The activity builds on existing hazard data sets and maps.[16] As it should be conducted by experts, the role of the task teams will be to facilitate access to the existing information and technical discussions with relevant agencies.

Box 2.

Sources of Hazard Information

The following sources of hazard information are commonly available options:

- Existing hazard event catalogs, including catalogs that describe various physical characteristics that could shape the definition of critical events for a scenario risk assessment
- Historical intensity maps for significant events
- Hazard maps
- Soil and geological information, including geospatial information on soil classes or condition, topography, and hydrology at the local and regional levels
- Global hazard information

Guidance

The existing hazard information (preliminarily screened in activity 1.4.1) should be reviewed to ensure quality and completeness. The different sources of information (see box 2) should be cross-checked, updated, and integrated to eliminate any discrepancies and/or fill in missing information in the existing hazard data sets and maps.

Then a decision should be made whether a hazard analysis will be conducted for the existing geological and climate-related phenomena in the area.

The hazard data sets and maps to be used under this activity should come from sources recognized by the government. In the hazard/risk information field, the reliability of the results is a sensitive issue, as it drives decisions from the government and perception from communities. Unfortunately, no "official" hazard maps are available in many developing countries. In addition, a wide range of methodologies and approaches exist for hazard analysis. In any case, task teams should ensure relevant government agencies participate in the discussion of the data and methodology to be used and, if possible, in the hazard analysis. In this way, the results of the study will be endorsed by those agencies.

➜ ***Task teams should be aware that hazard data sets and maps need to be updated after a disaster.*** In post-disaster conditions, experts should collect new data about the disaster event, such as information on event intensities and geolocation, new fault data, site effects, new attenuation relations, or new geodetic data, and integrate all the information into the existing hazard model. This activity is not related to the education sector, however, and its implementation is not within the scope of the RSRS. If needed, task teams should seek support from specialized government agencies.

Activity 5.2.2.

Establish the exposure model

This activity focuses on the creation of an exposure model of the school facilities and their occupants. From the baseline results (activity 1.2.4), school buildings

[15] A risk assessment integrates three components: hazard, exposure, and vulnerability.

[16] A hazard analysis from scratch is a big endeavor that goes beyond the RSRS.

in the exposure model are linked to index buildings with known fragility and vulnerability curves. Other building attributes, such as replacement value, location, capacity, and needs for functional improvements, among others, are also included in the model. Occupancy rates are adopted to simulate the use of the facilities by students and teachers at different times of day.

Guidance

As in the hazard analysis, this activity is to be conducted by specialists. It is important, however, that task teams understand the concept of an exposure model and how it fits into the risk model.

> **Exposure model (basic concept):** *A model composed of elements (buildings, roads, persons, and so on) at risk from one or more natural hazards, including their specific locations, whose expected performance in the face of such hazard event(s) can be represented by fragility and vulnerability curves.*

The fragility and vulnerability assessment of the selected index buildings is a critical and nontrivial task. As the risk model is very sensitive to changes in vulnerability parameters, it is essential to ensure the derivation and assignment of vulnerability curves are grounded in both advanced analytical methods and expertise from senior local and (if possible) international experts. This is further discussed in the next activity.

Task teams should work with infrastructure managers to establish realistic unitary replacement costs. The value of the elements at risk is needed to estimate economic losses. Replacement cost is usually used as the value for infrastructure assets in the exposure model. Replacement costs may vary by regions, urban versus rural areas, or even the education levels the facilities serve. Also important to note is that the replacement cost is higher than the actual cost of the existing school building, since the condition of a new building will be an improvement over the old one, and its lifespan will be longer.

➜ ***The exposure model of affected school facilities in post-disaster conditions can either be identical to that in pre-disaster conditions, or it can integrate the characteristics of the reconstructed school building(s).*** The exposure model in the former is used to reproduce the impact of the specific hazard event associated with the disaster, while that in the latter case will support the risk assessment of the fully recovered school portfolio.

Activity 5.2.3.

Assess the fragility and vulnerability of index buildings

The purpose of this activity is to construct the fragility and vulnerability functions of each index building. This is one of the most critical tasks specialists must provide for risk assessment, as these functions drive the quantification of expected damage and losses to the exposed elements from the impact of hazard events. Their development requires specialized knowledge and extensive experience.

> **Fragility and vulnerability functions:** *A mathematical representation of the correlation between the probability of damage and economic losses, respectively, to a specific element exposed to hazard events of different intensities.*

Through either empirical or analytical methods, structural engineers have studied the failure modes of a wide range of structures and developed their fragility and vulnerability functions. This information, fortunately, is progressively made available in specialized papers, providing local specialists with a reference on which to build. By no means, however, is the use of these functions a straightforward process. Local specialists will, in any case, need to go through a "tuning-up" process, based on the particularities of the index buildings.

Guidance

The role of the task teams in this highly specialized activity is mainly to ensure the participation of senior specialists from technical government agencies, universities, or even the private sector and facilitate

their access to international literature or (if feasible) international experts. In our experience, this activity presents one of the biggest challenges in terms of the use of quantitative methods for risk assessment. The lack of local expertise and constraints on access to global knowledge make the activity too complex in most of developing countries. At the same time, a growing number of research groups are interested in this work, and advanced structural analysis methods are now available that improve the reliability of these functions. This situation was the reason for the development of the Global Library of School Infrastructure (GLOSI).

GLOSI was developed under the GPSS with the purpose of making available experience with and results of fragility and vulnerability functions in several index buildings from different countries. In this way, local experts can obtain access through a common language to a catalog of index buildings with specific information about the methodology and results of these assessments. GLOSI saves users from having to conduct their own analyses from scratch and with no international reference.

Fragility and vulnerability curves are also useful to quantify the benefits of retrofitting interventions. Retrofitting solutions are better designed when critical problems affecting the building structure have been revealed by the vulnerability analysis. Factors that contribute to the vulnerability of the building include, but are not limited to, fragilities in the main structural system, irregularities in plan or elevation, large openings, soft stories, short columns, large unstable wall panels, weak foundations, and heavy roofs.

➜ ***The forensic assessment of the causes of failure in affected school buildings in post-disaster condition offers an opportunity to improve intervention measures for reconstruction.*** Task teams should seek advice from local senior engineers and facilitate their contributions to the reconstruction plan. The teams can collect and analyze new data on the structural performance of and potential damage to different structural typologies, and the discovery of new failure modes may contribute to updating knowledge on index building performance and retrofitting designs. Previous quantification of damage levels and associated losses may be replaced with new data, leading to the improvement of existing vulnerability functions.

Activity 5.2.4.

Quantify risk in terms of expected losses and service disruption

The aim in this activity is to quantify the probability of fatalities, economic losses, and downtime as a result of given hazard events. By integrating results from hazard, exposure, and vulnerability components, the magnitude and probability of adverse consequences (risk) from hazard events of different magnitudes can be estimated. At the end of this activity, task teams will learn not only about the magnitude and probability of potential consequences but also how they change across the country, regions, or municipalities and among different school facilities. Most important, decision makers will have science-based figures about risk for schoolchildren, teachers, and school communities.

Guidance

Rather than absolute values of risk, we look at relative values by which the risk conditions can be compared within the school infrastructure portfolio. Several sources of uncertainty are involved throughout the risk assessment, and it is important that experts make them explicit in their presentation of the results. Task teams should understand the meaning of risk values, associated uncertainties, and applications for risk reduction purposes. The following concepts will be helpful:

> Unlike in insurance applications, where risk values are used to estimate the cost paid for an insurance policy, *relative* risk values are used for risk reduction purposes to compare risk conditions among school facilities. In other words, for the selection and prioritization of interventions, what is needed is a risk metric that is applied consistently through the whole portfolio, even if it differs somehow from *absolute* risk values. This is what we mean by *relative* risk values.

> Risk and uncertainty cannot be separated. Analytically, uncertainty is addressed through a probabilistic approach. For decision-making purposes, risk values should be taken as reference to inform decision options. In practical terms, this means we should act to reduce risk in schools, no matter if our *best* risk estimate might differ from the actual consequences once the hazard event occurs.

> Safety benefits can be estimated in terms of change (reduction) of the relative risk, given the implementation of an intervention in a specific index building (such as structural retrofitting).

The resulting risk figures are instrumental for the focusing and prioritization of interventions. A key task with regard to the intervention and implementation strategy in the next steps is to define where interventions should be focused and prioritization criteria. Risk assessment results can be used to establish quantitative indicators of, among others, the safety benefits and cost efficiency of the interventions. By combining these indicators, the outcomes of the investment are optimized and priorities for implementation defined.

➜ ***A challenge, moving forward, is to quantify the expected downtime in a network of school facilities, given different hazard events.*** In the same way risk assessment results inform risk reduction interventions, a *downtime* assessment could inform measures to increase sector resilience and reduce indirect adverse consequences for children. Conceptually, the time frame for the recovery of an affected network of school infrastructure will be a function of four main components: the level of damage to school facilities, their location and accessibility, the redundancy of the system to redistribute students in the aftermath of the disaster, and the sector's implementation capacity.

Communication of risk information might become challenging if not managed properly. Task teams should be aware that the access to the results of risk assessment in school infrastructure must be restricted until the plan is finalized and a communication strategy is defined by infrastructure managers. In this sense, it is also very important for task teams, with support from the risk modelers, to explain thoroughly to relevant agencies the outputs of this study.

Module 5.3.

Analysis of intervention options for school buildings

Activities under this module focus on understanding the current performance of the existing school buildings and intervention options to improve it.

Activity 5.3.1.

Evaluate current performance of index buildings

This activity focuses on identifying the current performance of index buildings based on the results of the vulnerability analysis and risk assessment. The current structural performance of an index building is a measure of its as-is potential structural response to specific hazard events. Performance is evaluated against acceptance criteria prescribed in building regulations, guidelines, handbooks, and other technical documents, and an index building complying with the criteria is deemed to meet the specified performance level (see box 3). Performance refers not only to the building structure but also to nonstructural components, such as partitions, parapets, pediments, furniture, and equipment that can harm children, teachers, and staff if they fall. Moreover, nonstructural components that provide utility services are essential to the continuity of school operations in the aftermath of a disaster.

Guidance

Task teams should now understand the goal of a structural retrofitting intervention is to improve the performance level of the school building. Note "performance level" is a different way to describe and communicate risk. Unlike risk quantitative metrics, which are complex and difficult for nonexperts to understand, the use of performance levels has, in our experience, proved effective for engineering purposes, as well as for communication to stakeholders and communities. Even though it is not yet used widely in developing countries, we advocate for this approach. It will help in filling the regulation gaps for retrofitting design that, unfortunately, are very common in these countries.

Moreover, moving the attention of decision makers and school communities from risk to performance level is a strategic step toward a consensus in a society about safety or acceptable risk for schoolchildren.

➔ ***This concept and approach are fully applicable in post-disaster condition.*** Although their implementation goes beyond the RSRS and the education sector, task teams can promote and facilitate action from relevant agencies toward the definition of performance level targets for reconstruction interventions.

Performance Levels according to FEMA 310[17] and P-420[18]

Collapse prevention: The building is barely able to stand. Significant damage and losses may occur, possibly beyond repair. Probability of injuries and even life-threatening injuries is high.

Life safety: Includes significant damage to both structural and nonstructural components during a design earthquake, as specified in seismic building codes. At least some margin of safety remains against partial or total structural collapse. Injuries may occur, but the level of risk of life-threatening injury and entrapment is low.

Immediate occupancy: Includes very limited damage to both structural and nonstructural components during the design earthquake. The level of risk for life-threatening injury as a result of damage is very low. Although some minor repairs may be necessary, the building is fully habitable after a design earthquake, and the needed repairs may be completed while the building is occupied.

Operational: Includes very little damage, with backup utility services maintaining functions.

Activity 5.3.2

Identify interventions to improve performance of index buildings

The aim of the final activity in this step is to identify the need for interventions to improve the performance of index buildings. This activity should be conducted by local senior structural engineers with support (if needed) from international experts. Interventions relate to modifications made to structural and nonstructural components that enhance the performance of an index building. These modifications are known as "retrofitting." The change in performance can be simulated by using the mathematical models and calculation methods applied in activity 5.3.1. As a result of this activity, the team is to specify the needs for intervention across the group of index buildings to improve their performance to target levels.

Guidance

Note that the higher the performance level objective, the higher the cost of and the longer the time frame for the retrofitting work. The intervention measures, their cost, and their implementation time frame vary widely from one index building to another. Moreover, for the same index building, many retrofitting techniques may apply with different cost and implementation requirements. Cost-benefit analysis is useful to select among retrofitting options. Overall, task teams should request from the engineering team a comprehensive analysis of the intervention options and associated benefit-to-cost ratios. When the cost of retrofitting interventions and functional improvements is higher than a specified percentage (ranging from 40–60 percent) of the building's replacement value, the solution is considered not to be cost-efficient, and the intervention option shifts to the replacement of the existing building.

At this point the team should focus only on defining the need for intervention and the analysis of retrofitting options for index buildings. These inputs will be integrated into the design of the intervention strategy in step 6, where the decision for the intervention is

[17] FEMA 310: Federal Emergency Management Agency. "Handbook for the seismic evaluation of buildings—A Prestandard." FEMA (1998). Link.

[18] FEMA P-420: Federal Emergency Management Agency. "Engineering Guideline for Incremental Seismic Rehabilitation." FEMA (2009). Link.

made through a logic-tree method that addresses considerations beyond engineering criteria. In summary, this activity should make clear for each index building whether retrofitting intervention or replacement is recommended from the structural point of view.

➜ ***In post-disaster conditions, intervention work must not only be undertaken to repair damage to school buildings but also to improve their performance in the face of future hazard events.*** Different situations may occur for similar index buildings, depending on the intensity of the seismic demand experienced by the buildings during an earthquake—light to heavy damage, or even partial or total collapse. Even if a building sustains only light damage, this does not mean its performance is acceptable, as it may experience higher seismic demand in future events.

Output

The completion of activities under each module will result in one or more output(s). For post-disaster conditions, the arrow in the chart below highlights the additional information that should be included in the output.

Module	Output(s)
5.1. Analysis objective	- Terms of reference for risk assessment
5.2. Assessment of risk to school facilities	- Database and report: Risk assessment results, including hazard analysis and exposure model ➜ Analysis of failure modes by building types - Catalog: Fragility and vulnerability curves
5.3. Analysis of intervention options for school buildings	- Report: Lines of intervention for different index buildings and resulting performance improvements

Step 6

Intervention Strategy

Purpose

To set up objectives, priorities, and expected results within the time frame of the plan and design an intervention strategy accordingly.

Objectives

In normal conditions

At the end of this step, the team should be able to do the following:

a. Define objectives, priorities, and expected results within the time frame of the plan

b. Evaluate intervention scenarios and define the intervention strategy based on maximization and optimization criteria

c. Identify main technical, legal, and institutional challenges for the approval of the plan

In post-disaster conditions

At the end of this step, the team should be able to do the following:

a. Define objectives, priorities, and expected results within the time frame of the recovery and reconstruction plan

b. Define short-term interventions to be included in the recovery plan

c. Evaluate intervention scenarios and define the medium- and long-term intervention strategy for reconstruction based on maximization and optimization criteria

d. Identify main technical, legal, and institutional challenges for the approval of the plan

Modules and activities

Module	Activity	
6.1. Strategic framework for the intervention plan	6.1.1. Define objectives, priorities, and expected results within the time frame of the plan	6.1.1. Define objectives, priorities and expected results within the time frame of the recovery and reconstruction plan
	6.1.2. Define the legal and institutional basis for the plan	6.1.2. Define the legal and institutional basis for the recovery and reconstruction plan
	6.1.3. Define roles and coordination mechanisms for the implementation of the plan	6.1.3. Define roles and coordination mechanisms for the implementation of the reconstruction plan
6.2. Intervention strategy	6.2.1. Identify lines of intervention and scale-up opportunities	6.2.1. Identify lines of intervention and scale-up opportunities for recovery and reconstruction
	6.2.2. Define intervention scenarios and perform cost-benefit analysis	6.2.2. Define intervention scenarios and perform cost-benefit analysis for reconstruction
	6.2.3. Define the intervention strategy	6.2.3. Define the recovery and reconstruction strategies

Local partners and technical expertise

The table below presents a list of suggested local partners and technical expertise required to contribute to or lead the activities of this step.

Key agencies

> Ministry of Education: decision makers
> Ministry of Education: infrastructure manager and planning office

Contributing agencies

> Ministry of Planning and Development (if any)
> Ministry of Finance

Technical expertise

> Senior structural engineer (usually external advisor)
> Senior disaster risk management specialist (usually external advisor)
> Ministry of Education: senior engineers and education specialists
> GIS specialist
> Information management specialist in charge of EMIS (if available)

Module 6.1.

Strategic framework for the intervention plan

Through this module, task teams will discuss with decision makers the plan's objectives and main expected results, as well as institutional roles and legal bases.

Activity 6.1.1.

Define objectives, priorities, and expected results within the time frame of the plan

The formulation of the plan begins with the definition of three strategic drivers: objectives, priorities, and expected results. At this point, the diagnosis and analysis phases have been completed, providing a comprehensive understanding of the needs for intervention to improve the condition and capacity of school infrastructure. The task team's role at this stage is to present the results of the previous phases and facilitate effective discussions with decision makers, leading to a proposal for the plan's strategic drivers. Policymakers can now make decisions based on a solid technical foundation.

Guidance

This activity requires the capacity to synthesize information and for strategic thinking. Task teams should prepare a presentation for high-level decision makers and key stakeholders (if necessary) to validate the proposed objectives, priorities, and expected results. This is a back-and-forth process, possibly needing revision and adjustment along the way to ensure consistency with the government's financial and implementation capacity and overall sector targets.

School infrastructure plans should contribute to improving the condition of existing and new infrastructure, aligning capacity to the demand for classrooms in the long term, and strengthening institutional capacity to manage school infrastructure. Referring to the concepts introduced in the roadmap, improving the condition means improving safety (providing safer and resilient schools) and functionality (in terms of energy efficiency, classroom conditions, and water and sanitation facilities, among other aspects). Similarly, capacity is improved by optimizing the use of the infrastructure (the occupancy to design capacity ratio) and improving the accessibility of the school infrastructure network.

This technical framework offers a structure to guarantee consistency and completeness. It also facilitates the definition of intervention lines and a results framework. The technically based proposal should be reformulated in line with the government's policy framework. If, for example, the education policy emphasizes expanding coverage, the objective related to capacity becomes more relevant. Conducting a continuous dialogue with high-level decision makers ensures this alignment.

Because implementing interventions in a large stock of school facilities is a medium- to long-term effort, the establishment of objectives and priorities is key to guiding the definition of realistic outcomes within the time frame of the plan. In principle, education policies should guide school infrastructure investments. The correlation between education policies and infrastructure requirements arising from these policies, however, is not always straightforward. Policy changes might lead to increased demands on school infrastructure, which may be unaffordable. Confirming priorities with high-level decision makers is key. Priorities may refer not only to lines of intervention, but also to education levels, geographic regions, or targeted population groups.

Quantitative results from the diagnosis and analysis phases help gauge the size of the investment needs under each of the objectives and identify prioritization criteria. Prioritization criteria will be particularly important for defining the investment plan (step 7) and implementation strategy (step 8). For task teams, it's important to identify scalable solutions that can maximize benefits for the most children, bring international experience and expertise to the effort, and promote innovation. While this may seem evident, our experience suggests school infrastructure managers and decision makers tend to use only the case by case approach. This is an opportunity to begin promoting change and to present the intervention-at-scale approach.

Evidence-based information will guide the definition of the expected results and inform discussions with high-level decision makers to bring them on board. The plan is formulated in a political environment, and the likelihood of its formal adoption may often depend on ownership by key decision makers. Task teams should build and establish an informed and evidence-based dialogue with these decision makers and address their needs and expectations. Having these discussions early on to define the expected results will help ensure decision-maker ownership throughout the process.

Activity 6.1.2.

Define the legal and institutional basis for the plan

The purpose of this activity is to establish the legal and institutional framework for the adoption and implementation of the plan. Task teams must work with the sector's legal team to identify the existing legal and regulatory framework under which the plan can be formally adopted and implemented. Under step 2, the competencies among agencies and levels of government (in decentralized systems) to deal directly or indirectly with school infrastructure management was mapped. Under this activity, task teams will create the institutional map for the plan.

Guidance

Note that it might be necessary to propose adjustments to the existing organizational setup if gaps are identified. In fact, in countries lacking experience in school infrastructure planning, this activity may require discussions to define and establish new units, roles, and tasks to support the implementation of the plan, once approved.

Any reforms to improve the regulatory framework should be discussed with the sector's legal team and integrated into the plan. The results from the diagnosis and analysis phases will often reveal a need to make adjustments to the regulatory framework. This activity should be discussed carefully with the sector's legal team to gain an understanding of the timeline, dependencies with other planned reforms, and effort required. Reforms that are critical must be prioritized to ensure both that the plan can be adopted and implementation can begin. Task teams should also identify any potential impacts or delays in the timeline and the implementation of remaining RSRS activities.

Defining the legal and institutional basis for the plan can be sensitive and should be discussed and endorsed by high-level decision makers. The aim of the plan is to improve the planning and management of school infrastructure investments and interventions at scale. This may require changes to the institutional and regulatory framework and the way in which entities in charge operate, which may cause tensions among involved stakeholders. This may be the case, for example, in countries where school construction is used as a political tool to influence elections. Task teams should anticipate issues that may arise and address this as part of step 8, in particular the communications strategy.

➜ ***In post-disaster conditions, as mentioned earlier, the government operates within an exceptional legal framework and through ad hoc implementation units for reconstruction work.*** The reconstruction process can be a multiyear effort. For task teams, it is essential to understand the legal and institutional reconstruction framework being used by the government or sector and align the reconstruction plan for school facilities accordingly. This alignment may require adjusting some responsibilities under the sector that are temporarily transferred when a centralized reconstruction agency is created.

Activity 6.1.3.

Define roles and coordination mechanisms for the implementation of the plan

This activity defines the specific roles and coordination mechanisms for involved government agencies at national and subnational levels, school communities, and other relevant stakeholders. A range of government agencies will have a role in the implementation of the plan, including central government agencies (ministries of education, finance, and public works), local governments, public utility providers, regulatory bodies, and technical agencies. In addition, it will be important to clarify the role of nongovernmental and civil society organizations.

Guidance

Building on the plan's institutional map, task teams should propose adjustments to roles and responsibilities (as needed) and clearly define the coordination mechanisms among the agencies involved to avoid duplication of efforts and ensure articulation of investments. The institutional map should also provide guidance and define the areas where nongovernmental organizations and communities can participate. As mentioned earlier, while the RSRS provides recommendations for communicating and engaging with school communities, their direct involvement in the actual design and construction activities is discouraged. Nevertheless, school communities, as the ultimate beneficiaries, are key players in this process, and their ownership is important.

Establishing coordination mechanisms between institutions and the different levels of government will ensure articulated implementation of the plan. Difficulties usually arise from a lack of coordination between central and local governments. Since many decisions are made at the local level during the implementation phase, a mechanism should exist for them to be communicated, discussed, and endorsed at the central level. Coordination mechanisms can be intra-institutional (within an institution) or multi-institutional (among different agencies and governments) and have various modalities, like committees and working groups, with defined protocols and reporting. The aim is to facilitate the timely exchange and flow of information, as well as decision making involving the key stakeholders.

➜ ***This analysis can be a major success factor for the reconstruction process.*** As mentioned, one of the biggest challenges for government in the aftermath of a disaster is to restore education services and the capacity of the affected school network as soon as possible. This can only be done if the government leads a joint and coordinated effort, with the engagement of communities, nongovernmental organizations, the private sector, IFIs, and development partners, as needed. The roadmap provides a tool to integrate key aspects of school infrastructure in one articulated reconstruction plan, which can also serve as the foundation for future planning. This approach proposed by the RSRS provides a mechanism through which communities and civil society can have a clearly defined role in this process, as well as make information available to them.

Module 6.2.

Intervention strategy

Activities in this module will enable task teams to propose an intervention strategy to achieve the plan's objectives and results.

Activity 6.2.1.

Identify lines of intervention and scale-up opportunities

This activity identifies the lines of intervention to improve the condition and capacity of school facilities in line with the plan's objectives and expected results. As introduced in step 4, lines of intervention are physical interventions in school buildings, which can include structural retrofitting, replacement, rehabilitation, repair, and maintenance. School facilities may also need to be relocated and their capacity enlarged or reduced. The construction of new facilities is another option typically included in the plan. The need for specific lines of intervention is based on the results of the diagnosis and analysis phases.

Guidance

The definition of the lines of intervention should have several characteristics. These include being organized through a hierarchical structure (described below), having the flexibility to be aggregated and disaggregated according to this structure, and being directly linked and contributing to the plan's objectives and expected results. A proposed hierarchy for the plan proceeds from program to components to lines of intervention to activities. A program comprises several components, each of which comprises several lines of intervention, each of which in turn comprises several activities. Table 2 provides an example.

Table 2. Example of a structure for an intervention strategy

Program	Components	Lines of intervention	Activities
Seismic risk reduction in school infrastructure	1. Retrofitting of school buildings	1.1 Incremental retrofitting	1.1.1 Field inspection 1.1.2 Feasibility study and design 1.1.3 Retrofitting work
		1.2 Full retrofitting	…
	2. Replacement of school buildings	…	…

The intervention strategy is organized through the logical structure above which also drives the investment plan and the implementation strategy. The plan's intervention lines and activities will be carried out specifically to each school facility.

Opportunities to scale up lines of intervention are provided by those with affordable engineering solutions that can be used most often and in the most school buildings in the portfolio. For those types of interventions required in hundreds or thousands of school buildings, any savings from either optimizing engineering solutions or reducing implementation costs can make implementation at scale affordable. In general, structural retrofitting, energy efficiency improvement, and school building replacement cost the most and take the most effort to implement. As identifying scalable solutions is essential and should be a priority, task teams, along with local senior experts, should conduct a thorough analysis of the proposed engineering solutions.

➔ ***In affected facilities, the levels of damage and prevalent vulnerabilities will define the lines of intervention.*** The term "lines of intervention" is also applicable to the reconstruction process, where the damage assessment will inform the technical decision either to

repair or replace the school buildings affected by a hazard event. For unaffected school buildings within the disaster area, the vulnerability and risk assessments will help define the lines of intervention, as described under normal conditions. Changes to the capacity of the school infrastructure can be undertaken as part of the reconstruction strategy, but this is contingent upon the availability and analysis of information related to the demand for classrooms (see step 2).

Activity 6.2.2.

Define intervention scenarios and perform cost-benefit analysis

This activity focuses on defining intervention scenarios to maximize benefit, affordability, and scalability. In large school portfolios, relevant interventions usually include structural retrofitting, functional improvements, such as enhancement of energy efficiency, and the replacement of school buildings or the construction of new ones. Intervention scenarios consist of different combinations of intervention options (defined in previous activities) that offer different ratios of benefit to cost. By means of algorithms using the baseline database, a preliminary cost and expected benefits can be estimated for each intervention scenario. The cost-benefit analysis among different scenarios provides a basis for selecting the most worthwhile.

Guidance

One must distinguish between the case by case and at-scale approaches advocated by the RSRS. From this analysis, task teams will identify the important decisions regarding the plan's intervention strategy and its potential results and outcomes and determine the overall sensitivity of the strategy to changes. This process necessitates the analysis of several scenarios and then an iterative tuning-up process.

Governments are always faced with the challenge of addressing a high demand for school interventions nationwide with limited budgets. Table 3 illustrates the core of the problem surrounding interventions at scale: what combination of safety and functional interventions is optimal for maximizing benefits (that is, for providing the most improved learning environment) for the most children, given a specific limit on budget allocation?

The table presents a combination of levels of target improvements, ranging from basic to advanced, for different lines of intervention. At the extremes of the continuum are two scenarios: the least benefit (that is, the lowest gain in performance from the intervention) for the most children or the most benefit (the highest gain in performance) for the fewest children. In our experience, the most cost-efficient intervention strategies lie somewhere in the middle .

Table 3. Performance Level Combination Decision

	Level 1	Level 2	Level 3	Level 4
Safety	Life Safety	Life Safety	Immediate Occupancy	Operational
Energy	Basic	Basic or Higher	Best Practice or Higher	Innovative
WASH	Basic WASH	Intermediate WASH or Higher	Advanced WASH or Higher	Best Practice WASH
Number of Schools with Interventions				
Number of Students Benefited				
Cost of Intervention in Each Individual School	$$	$$$	$$$$	$$$$$
Duration of Intervention				

Two levels of optimization are equally relevant: improving engineering solutions for a higher benefit-to-cost ratio within a given line of intervention (step 5) and the combination of different lines of intervention with a different performance target (described in this activity).

Activity 6.2.3.

Define the intervention strategy

Building on the results from previous activities, task teams are to define the intervention strategy in line with the plan's objectives, results, and expected outcomes. The intervention strategy consists of a structured scheme of programs and lines of intervention, classified and grouped by school facilities in the plan. The classification is performed by means of a decision-making logic tree that considers eligibility criteria, dependency relationships (among lines of intervention), and cost-efficiency indicators. The process to define the intervention strategy will allow task teams to identify the specific interventions for each school facility based on its characteristics and needs for improvement.

The logic tree allows task teams to map each school facility to one or more of the plan's programs. The elaboration of the intervention strategy proceeds from the results of the scenario analysis, allowing task teams to justify the basis and advantages of each intervention option as compared with others.

Guidance

The logic tree should be coded and integrated into the baseline database. Each school facility goes through the logic tree and is classified into one or more programs. The intervention strategy also needs to be flexible enough to be subdivided into information related to building types, spatial distribution (urban versus rural), education levels, or geographical areas (municipalities, regions, and so on). The results of this analysis will provide task teams with a preliminary overview of the plan's structure and scope.

Task teams should note several iterations are required along the process, as well as discussions with relevant team members to review results and adjust the logic tree as needed. Given that large amounts of data will be analyzed under this activity, task teams should make sure the IT platform and statistical software used can support the amount of data, and ensure they can be transferred to the sector or government entity in charge.

Learning from Experience: The Case of Peru

When this analysis was undertaken for Peru, the baseline included an estimated 45,000 school facilities comprising 280,000 school buildings. For the logic tree analysis, more than a dozen attributes for each school building and facility had to be included. One key lesson learned from this project was the importance of using statistical software (in this case, Stata) to undertake this analysis. The original exercise did not use the proper software, which resulted in many challenges to running the analysis to address inconsistencies. The process of transferring the data to Stata was time consuming, but doing so allowed all the inconsistencies to be addressed and facilitated the transfer of information and results to the government entity in charge.

The intervention strategy, investment plan, and implementation strategy are strongly correlated and must be finetuned and adjusted along this process. The development of the intervention strategy is followed by a cost estimate, analysis of financial options, and establishment of implementation requirements. In cases where the forecast investment exceeds the budget or overemphasizes a single program, adjustments must be made to the intervention strategy, which will generate a new round of estimates, analyses, and requirements. This process will play out over multiple attempts to balance the intervention strategy (step 6), investment plan (step 7), and implementation strategy (step 8) until they are clearly articulated.

The intervention strategy is the cornerstone of the plan and must be endorsed by key decision makers. Task teams should present the intervention strategy to key decision makers, such as ministries of education, finance, and public works. During the ensuing discussions, it will be important to highlight the rationale and technical soundness behind the strategy and the benefits of using the interventions-at-scale approach. The planning process on which the roadmap hinges aims to provide the maximum benefit to the most children. The intervention strategy outlines how. This is the strongest argument to "sell" the intervention strategy to appropriate authorities.

➜ ***The definition of the intervention strategy for reconstruction follows a similar approach.*** The main driver of the intervention strategy in this case, however, is to accelerate the recovery capacity of school facilities while ensuring resilient reconstruction and is the principal point of distinction from the intervention strategy under normal conditions. In the aftermath of disasters, decision makers are willing to trade cost efficiency for a faster recovery pace when choosing among different intervention options.

The intervention strategy should define when a damaged school building is either going to be repaired or replaced. In addition to the level of damage, other elements should be factored in when assessing the level of damage and deciding whether a building is beyond repair—for example, the number of school buildings in a similar condition, the location of the schools, and accessibility conditions, among others.

Output

The completion of activities under each module will result in one or more output(s). For post-disaster conditions, the arrows in the chart below highlight the additional information that should be included in the output.

Module	Output(s)
6.1. Strategic framework for the intervention plan	- Document for the plan: three sections (one by activity) to be incorporated in the main body of the text ➜ Document for the recovery and reconstruction plan: three sections (one by activity) to be incorporated in the main body of the text - Annexes including details about activities 6.1.2 and 6.1.3
6.2. Intervention strategy	- Document for the plan: intervention strategy ➜ Document for the recovery and reconstruction plan: intervention strategy - Annexes: results of scenario analysis

Step 7

Investment Plan

Purpose

To estimate the cost of the intervention strategy and propose an investment plan within the plan's time frame.

Objectives

In normal conditions

At the end of this step, the team should be able to do the following:

a. Quantify the need for investment to implement the plan

b. Define an investment plan

c. Define a financial strategy for the plan

In post-disaster conditions

At the end of this step, the team should be able to do the following:

a. Quantify the need for investment to implement the recovery and reconstruction plan

b. Define an investment plan

c. Define a financial strategy for the plan

Modules and activities

Module	Activity	
7.1. Plan's structure and cost	7.1.1. Define a structure for the investment plan aligned with that of the intervention strategy	7.1.1. Define a structure for the investment plan aligned with that of the intervention strategy
	7.1.2. Estimate the cost of interventions	7.1.2. Estimate the cost of interventions
7.2 Investment scenarios	7.2.1. Define parameters for the investment scenarios	7.2.1. Define parameters for the investment scenarios to inform the recovery and reconstruction plan
	7.2.2. Analyze investment scenarios	7.2.2. Analyze investment scenarios for the reconstruction plan
7.3. Financing strategy	7.3.1. Analyze financing options	7.3.1. Analyze financing options for the reconstruction plan
	7.3.2. Analyze options for new sources of financing	7.3.2. Analyze options for new sources of financing
	7.3.3. Select an investment plan	7.3.2. Select an investment plan

Local partners and technical expertise

The table below presents a list of suggested local partners and technical expertise required to contribute to or lead the activities of this step.

Key agencies

> Ministry of Education: decision makers
> Ministry of Education: infrastructure manager and planning office
> Ministry of Finance

Contributing agencies

> Ministry of Planning and Development (if any)
> IFIs, donors, and NGOs involved in school financing

Technical expertise

> Ministry of Education: team (economists, engineers, managers) involved in school financing
> Ministry of Finance: senior economist involved in school financing and with knowledge of the financing system

Module 7.1.

Plan's structure and cost

Activities in this module focus on quantifying the cost of the intervention and proposing a structure for the investment plan.

Activity 7.1.1.

Define a structure for the investment plan aligned with that of the intervention strategy

The purpose of this activity is to define the structure of the investment plan, based on the intervention strategy. The investment plan tends to mirror the intervention strategy in structure. Adjustments may be needed to make the structure of the investment plan conform to that of the country's public investment system. With decentralized government structures, for instance, the investment plan has to be disaggregated by levels of government and according to the resource allocation schemes. Task teams should review the outputs under step 4 related to the public investment system requirements and define accordingly the investment plan's structure before conducting the cost estimate.

Guidance

Metrics must be consistent among the budgeting unit, programs, lines of intervention, and results. Each line of intervention has a specific metric, an associated unitary cost, and a result indicator. For the investment plan, however, investments are aggregated by budgeting units, which is the lowest level at which the cost estimate will be aggregated (usually, the school facility level). Infrastructure managers may also want to use other budgeting units to distribute investments, such as classrooms, education levels, or number of students. It is important that task teams ensure consistency among different options by properly defining the budgeting unit (for example, a classroom by area) and the associated aggregation algorithm.

The investment plan's multiyear investment structure should support its disaggregation over time. Task teams should work with the planning office at the ministry of education, or any other relevant agency, to learn about the annual budgeting process and make sure the investment plan, results, and cost estimate can be duly applied on an annual basis.

➜ ***In post-disaster conditions, the investment plan changes if it must operate under exceptional investment provisions.*** Sometimes governments incorporate temporary investment mechanisms (like dedicated funds) or provisions under which the private sector and civil society may participate in reconstruction. In these cases, the investment plan may differ slightly from normal conditions. On the other hand, since the public investment needs of a reconstruction plan also call for a multiyear effort, the budgeting process should be the same as under normal conditions.

Activity 7.1.2.

Estimate the cost of interventions

This activity seeks to provide guidance on the cost estimation process for the intervention strategy. The purpose is to quantify the investment needs for each line of intervention and program and, subsequently, for the entire plan. The three key elements of estimating intervention costs in large school infrastructure portfolios efficiently are, first, the definition of unitary costs; second, the definition of algorithms; and, third, the application of appropriate statistical software analysis. Unitary costs refer to the average cost per unit (U.S. dollars per square meter, for instance) of a single activity (such as the construction of a perimeter wall). These unitary costs may vary from urban to rural areas. Defining this metric is important, as the unitary cost for each line of intervention under the plan can be estimated by aggregating activities, as illustrated under step 6. This process can be systematically conducted by means of algorithms that combine activities and lines of intervention based on predefined dependencies and relationships. A structured database, coupled with supporting software, is necessary both to run the algorithms and visualize the results.

Guidance

The cost estimate analysis should be used to inform the planning and decision-making process. The use

of representative index buildings and, in some cases, proxies for some of the parameters means this analysis will use average values. Furthermore, the accuracy and reliability of the cost estimates for the interventions will depend on the level of detail and quality of information in the baseline database, the definition of engineering solutions, and the knowledge of the local construction market. Records from past public investment projects are valuable to complement the available information and to finetune costs. Relying on local experts with extensive experience in budgeting and implementing civil works in school infrastructure is also useful for this cost estimate analysis. ***Task teams should progressively incorporate several considerations in the cost estimation.*** Perhaps the most relevant is the tune-up exercise that must be carried out between the investment needs and available budget (see next activity). This balancing act will finally define the expected results of the plan. Other aspects that may also affect cost include different procurement approaches for construction services, the cost of transportation to remote locations, and the introduction of new technologies, among others.

➔ ***Estimation of the cost of interventions in post-disaster conditions involves additional considerations.*** A disaster affects the construction sector, with increased costs of labor and materials and shortages of engineering services and available workforce. To restore services as quickly as possible, the interventions also need to be implemented within a shorter time frame than under normal conditions, which adds even more considerations for the cost estimation. These market distortions, which tend to dissipate over time, have to be considered at this stage to ensure a realistic estimate.

Module 7.2.

Investment scenarios

In this module, task teams will compare investment scenarios to identify cost-efficient options.

Activity 7.2.1.

Define parameters for the investment scenarios

This activity is focused on defining the parameters that will be used to forecast school infrastructure budget allocation and proposing investment scenarios within the plan's time frame. The parameters used for this analysis should build on activities carried out under step 4, in addition to other key parameters. These may include, for example, the country's gross domestic product (GDP), spending on education as a share of GDP, spending on school infrastructure as a share of education spending, and expenditure capacity. Three investment scenarios are usually considered: base, pessimistic, and optimistic. The base scenario assumes historical trends will continue, while the optimistic scenario assumes an increase (for example, 10 percent from the base scenario), and the pessimistic scenario assumes a decreasing trend over time (for example, 15 percent). The degree to which the optimistic and pessimistic scenarios vary from the base scenario should be discussed and agreed on with the government and, in particular, with the respective entities managing the budget and resources for the education sector, as described below.

Guidance

This activity should be carried out in coordination with the technical teams and experts on these topics from the ministries of finance and education. Task teams should engage with key relevant departments within these ministries to secure their active participation. The definition of parameters and values for the projection will help determine the financial capacity of the education sector to allocate resources for the plan. The results from this analysis will provide decision makers with three realistic scenarios that project

the investment needs in line with the financial capacity of the sector and the time frame of the plan and useful guidance for discussions on how to move forward the implementation of the plan, given the available and projected financial capacity of the sector.

Nonpublic resources can be included in the projection as long as they are formally under the education sector. This activity focuses on the projection of public budget expenditure. While formally committed contributions may be included, given the vital role often played by donors, sources without this status could distort the actual investment scenarios. Any resulting financial gap will be addressed in the financing strategy design.

➔ ***Although investment scenarios must still be evaluated under post-disaster conditions, the budget allocation forecast is usually altered by an atypical flow of financial resources for reconstruction.*** Large disasters trigger an exceptional financial intervention from both the government and the international community to accelerate the recovery and reconstruction phases. With projections for the post-disaster condition under this activity different than under the normal condition, task teams should evaluate whether the additional resources can be applied to the whole or partial reconstruction. In any case, as the reconstruction is a multiyear effort, we recommend proposing more than one investment scenario, to take into consideration changes in the government's financial capacity over time.

Activity 7.2.2.

Analyze investment scenarios

With task teams having projected an expected average allocation of budget per year, the purpose of this activity is to assess to what extent the plan can be funded on an annual basis under each scenario. This analysis consists of comparing the available budget and the investment needs of the plan to determine whether the plan is under- or overfunded. Task teams will then be able to deduce the pace at which the plan's targets can be met over time under each investment scenario, and whether any investment gap will persist past the plan's time frame.

Guidance

Medium-term investment plans are rarely sufficient to meet fully the needs of existing and new school infrastructure. An investment gap will likely remain for the 10 to 12 years following the plan's implementation. A huge investment gap can signify that, for example, the school design and construction standards and/or the engineering solutions are too costly for the country. Conversely, a small remaining gap (less than 20 percent) suggests the intervention strategy is appropriate for the country. In the RSRS, we mean by "solutions at scale" those that do not necessarily cover 100 percent of the investment needs but help to meet them progressively while maximizing the benefits for the children.

Given these conditions, task teams should strive to craft solutions at scale within the proposed investment scenarios. Based on the initial results of this activity, task teams may have to review the intervention strategy (step 6) and find alternatives, especially for the highest investment lines of intervention. Alternative solutions may stem from the review of expected standards or policy (like the reduction of shifts), the focusing of interventions on high-priority regions or school building types, or the adjustment of regulations to introduce new construction technologies. The rationale, benefits, and implications of such changes should be discussed with and endorsed by relevant decision makers before being included in the plan. In cases in which the design and adoption of alternative interventions may take time and go beyond the RSRS implementation, the proposal can be developed under the plan's implementation phase.

➔ ***This approach is fully applicable to post-disaster conditions, albeit under a tight time frame.*** Since the full recovery of affected communities and infrastructure is at the center of a reconstruction plan, the analysis of investment scenarios and exploration of solutions at scale is even more pertinent. Task teams should keep in mind that the reconstruction process after a large disaster will be, in any event, a medium- to long-term effort.

Module 7.3.

Financing strategy

Activities in this module focus on defining the investment plan based on the analysis of the financing options and previous activities.

Activity 7.3.1.

Analyze financing options

This activity explores the funding sources available to the education sector for implementation of the plan. Task teams are to identify the financing options available for the investment plan, looking at both internal sources (public budget) and external sources (credit, donors, public-private partnerships, and so on). Task teams should be complemented by technical specialists from the budgetary and planning offices in the ministries of education and finance and other relevant government entities that oversee these areas and have access to this information.

Guidance

The available funding sources may be subject to requirements and conditions specifying what expenditures may be financed. It's important to understand the lines of intervention and, if applicable, the government levels and their roles and responsibilities related to these interventions.

In the case of new financing options being introduced, task teams must understand their operational characteristics and the need for adjustments (if any) to the existing financing system. Since the plan will introduce several changes in the investment lines, prioritization, and project designs, the teams will need to address the required adjustments within the existing financing framework. In decentralized systems, the autonomy of subnational governments implies the validation of financing options through subnational budget allocation policies. At the central level, new incentive mechanisms can be created as conditionalities for budget transfer to municipal governments. Likewise, in the case of existing dedicated funds for school infrastructure, the operational scheme may need to be reviewed.

➜ ***Despite an initial increase in the flow of resources following a disaster, the analysis of financing options is essential for the reconstruction plan.*** Even though large amounts of resources are channeled to dedicated funds in the early phases of the recovery and reconstruction, the financing strategy should cover the time frame of the reconstruction plan and ensure resources will be allocated beyond the early phases of it.

Activity 7.3.2.

Analyze options for new sources of financing

This activity aims to complement the above and identify new sources of financing. It is part of the financing analysis, in that it promotes the need to identify new financing mechanisms that can complement the existing ones, given the limited public resources available.

Guidance

The task teams should note this process can require making changes to the legal and regulatory framework, in particular if the mechanisms have not been applied in the education sector. This may include, for example, the use of public-private partnerships (PPPs), which can bring in the private sector and accelerate the rate of implementation, particularly if the government has experience with the use of PPPs in other sectors. Other financing mechanisms allow private firms to finance infrastructure projects in lieu of future taxes, so that governments can redirect public funds to other high-priority areas as the private sector assumes the upfront costs and management of the new infrastructure projects. Social impact bonds and land use–related financing mechanisms are other alternatives to leverage resources for school infrastructure.

Activity 7.3.3.

Select an investment plan

The purpose of this activity is to select an investment plan to support the implementation strategy. The investment plan is based on the integration of the results of the aforementioned activities and has three key areas: total investment needs, estimated annual

resource allocation needs, and the financing strategy. Investment needs refer to the financial resources required for the plan (programs, lines of intervention, components, and so on). Annual resource allocation needs are based on the expected targets defined by the government in line with the plan's implementation time frame and intervention strategy and projected financial capacity of the sector. The financing strategy defines the existing funding sources that can be used and the need for new financing options to leverage additional resources for the implementation of the plan.

Guidance

The definition of results and cost-efficiency indicators is important to monitoring investments under the plan. The link between the investment plan and result indicators should be clearly established. Building on the discussion in step 6 and the monitoring system described in step 8, task teams should establish the quantitative link among investment, intervention cost, benefits, and results.

The investment plan provides an overview of the plan's expected results in the medium and long terms, taking into consideration the financial resources that would be allocated by the sector. Task teams should present the investment plan to key decision makers, such as the ministries of education, finance, and public works. During these discussions it will be important to review the projected investment scenarios and gather key recommendations from the decision makers to ensure the investment plan is realistic and will have the political support to be formally adopted as part of the overall plan.

This is the opportunity to engage with donors and development partners to leverage the government's efforts. This engagement is particularly relevant in low-income countries, which depend heavily on donor contributions and lending from IFIs. In our experience, the framework offered by the plan allows for contributions from different players to be articulated, which will draw the attention of the international community.

➜ ***The discussion with decision makers is also applicable in post-disaster conditions.*** It is, however, common for the definition of the investment plan to be permanently subject to adjustment rather than being a single-step activity. This is so for two main reasons: on the one hand, access to new information about the impact of the disaster improves over time; on the other, an investment plan is needed early in the emergency phase to fund the recovery activities.

Output

The completion of activities under each module will result in one or more output(s). For post-disaster conditions, the arrow in the chart below highlights the additional information that should be included in the output.

Module	Output(s)
7.1. Plan's structure and cost	- Document for the investment plan: Structure of the investment plan and costing algorithms
7.2. Investment scenarios	- Database: Parameters for each investment scenario, projection of each scenario, and financing mechanisms
7.3. Financing strategy	- Investment plan (for the plan) ➜ Investment plan for the recovery and reconstruction plan

Step 8

Implementation Strategy

Purpose

To define implementation arrangements for the plan in line with the intervention strategy, the investment plan, and the country's institutional and legal framework.

Objectives

In normal conditions

At the end of this step, the team should be able to do the following:

a. Define institutional arrangements and legal framework for implementation

b. Define prioritization criteria and kickoff activities

c. Establish a management information platform

d. Define a monitoring and evaluation system

In post-disaster conditions

At the end of this step, the team should be able to do the following:

a. Define the institutional and legal framework for implementation of reconstruction

b. Define prioritization criteria and kickoff activities

c. Establish a management information platform

d. Define a monitoring and evaluation system

Modules and activities

Module	Activity	
8.1. Implementation framework	8.1.1. Identify specific roles for government agencies and stakeholder capacity-building needs	8.1.1. Identify specific roles for government agencies
	8.1.2. Define the legal framework for implementation	8.1.2. Define the legal framework for implementation
8.2. Initiation activities	8.2.1. Define prioritization criteria	8.2.1. Define prioritization criteria
	8.2.2. Set up implementation units and procedures	8.2.2. Set up implementation units and procedures
	8.2.3. Define the investment and procurement mechanisms for implementation	8.2.3. Define the investment and procurement mechanisms for implementation
	8.2.4. Establish an information management platform	8.2.4. Establish an information management platform
	8.2.5. Establish a communication strategy	8.2.5. Establish a communication strategy
8.3. Monitoring and evaluation	8.3.1. Define a monitoring system and procedures	8.3.1. Define a monitoring system and procedures
	8.3.2. Evaluate needs for project adjustments	8.3.2. Evaluate needs for project adjustments

Local partners and technical expertise

The table below presents a list of suggested local partners and technical expertise required to contribute to or lead the activities of this step.

Key agencies

> Ministry of Education: decision makers
> Ministry of Education: infrastructure manager and planning office

Contributing agencies

> Ministry of Planning and Development (if any)
> Ministry of Finance

Technical expertise

> Senior structural engineer (usually external advisor)
> Senior disaster risk management specialist (usually external advisor)
> Ministry of Education: senior engineers, education, procurement and communication specialists, legal advisors, and specialists with knowledge of the public investment system
> GIS specialist
> Information management specialist in charge of EMIS (if available)

Module 8.1.

Implementation framework

Through this module, task teams will define the institutional arrangement and legal basis for the implementation phase.

Activity 8.1.1.

Identify specific roles for government agencies and stakeholder capacity-building needs

The aim of this activity is to review the specific roles and responsibilities of government agencies (national and local) in advancing the implementation strategy of the plan and identifying any ways in which they need to be strengthened. Under the proposed institutional framework (activity 6.1.3), the roles within the ministry of education and other relevant agencies can range from general coordination and monitoring of the plan's implementation (for example, from the sector level) to overseeing actual interventions at each school facility (from the subnational level). These need to be mapped to identify any gaps in key roles, and their remediation proposed as part of the strategy.

Guidance

A workflow chart or diagram is useful for mapping the different levels of government, their roles, and their interactions in this process. Tracking the sequence of the project cycle in line with the proposed interventions, for example, will help with mapping the involved agencies and identifying their competencies and coordination needs, along with any gaps in the process.

Task teams must define in advance the capacity expected to be required at each level (human resources, IT, equipment, and so on) and compare this with current conditions. The results of this analysis will help determine areas in need of strengthening and capacity building. In our experience, strengthening school infrastructure management is often a challenge for governments with low institutional capacity or limited experience in infrastructure planning. This means the pace of implementation at the beginning of the plan should be based on the existing capacity, but the plan should include an objective related to building this strength over time. Task teams may need at this point to finetune the intervention strategy and investment plan accordingly. We stress the importance of this activity to avoid any major issues and bottlenecks during implementation.

The plan, which will operate within the education sector's existing institutional structure, may require making adjustments or reforms. Overall, the RSRS proposes an infrastructure management approach grounded in a careful diagnosis and planning process. As the implementation of this approach is in itself a change in many developing countries, adjustments or reforms will likely be needed in the education sector and other key relevant agencies. In some cases, for example, governments will need to create dedicated offices to lead the process or transfer functions to other institutions or levels of government. Any reform undertaken as part of this process should be led by a high-level decision maker to ensure adequate political support to move the changes through the approval process.

This activity is politically sensitive. The plan promotes a change in the planning, implementation, and management of school infrastructure to contribute to the improvement of learning environments. Managing school infrastructure in the twenty-first century requires changes to policies, institutional structure, and construction practices, among other areas, which may affect entrenched interests. Furthermore, informality—another key factor—will need to be changed over time, given its deep roots in social and cultural practices. Hence, the changes stemming from the plan's adoption should be communicated and disseminated to key stakeholders, including government, the school community, and civil society. Making available key information about the plan (see module 8.2) will be important in starting to promote a culture of change and accountability in what is often a politically driven environment.

Increasing the capacity of key stakeholders is a medium-term effort. Task teams should define a realistic

capacity-building strategy (including financial resources to implement it) and convene existing key players in the country (for example, universities) and international partners to contribute toward this aim. Based on our experience, developing capacity to manage school infrastructure at subnational levels, such as at the local government level, remains a largely unmet challenge in developing countries.

➜ ***In post-disaster conditions, these definitions and decisions are even more essential to address the needs of the affected area and accelerate the reconstruction process.*** Given the priority to advance reconstruction, extensive sector reforms are unlikely to be pushed over the course of planning it. The purpose of this activity is to stipulate the roles of the key institutional players needed to operate reconstruction investments in an efficient and timely fashion. Any important gaps in roles and responsibilities should, however, be identified and mapped for action at a later time.

Activity 8.1.2.

Define the legal framework for implementation

The purpose of this activity is to define the legal basis for the plan's adoption and implementation. Working with the education sector's legal team, task teams are to review the plan thoroughly to identify the legal instruments and processes that can be used for its formal adoption and make sure the legal mechanisms are in place to move forward on implementation. The adoption of the plan through a formal and binding legal instrument can help ensure continuity and support for the implementation phase and allocation of public resources.

Guidance

The sector's legal team needs to be kept updated throughout the implementation of the RSRS to anticipate any changes that may be required for the plan and to participate when needed. In countries with a planning investment system in place, this can be a straightforward process, as these steps have already been mapped out. For countries with no experience in this area, however, this will be more challenging. The wide array of issues with legal implications that need to be reviewed include land property rights (with respect to school campuses), land use regulation, adjustments to planning and building regulations, and procurement and purchasing provisions, among others.

For any policy reforms that go beyond the sector, the discussions will involve a broader group of stakeholders to reach consensus and move forward the proposed changes. Modifications to the building code, for example, may be needed to enable vulnerability reduction measures in school buildings. In some countries, this will require the participation of the technical commission in charge of reviewing this code, the ministry of education's entity in charge of school infrastructure, and the ministry of public works, among others. The same applies to other areas, such as land use, which requires the participation of planning offices that manage cadaster information. Although they go beyond the formulation of the plan, it is essential for task teams to identify any such needs for reform and include them in the implementation strategy.

➜ ***The implementation framework for the reconstruction plan is usually not complex, as governments can use exceptional legal provisions for emergency situations.*** A government can fast-track the relevant legal decrees or resolutions or even create a new reconstruction agency. The reconstruction plans in the education sector fall into the broader reconstruction legal framework. In that respect, task teams should identify in a timely manner the need of sector's special provisions (if any) for the implementation framework and coordinate with the central government.

Module 8.2.

Initiation activities

Activities under this module focus on identifying kickoff activities that will enable infrastructure managers to begin the implementation phase.

Activity 8.2.1.

Define prioritization criteria

This activity focuses on prioritizing interventions, which is essential to implementation of the plan. Investments in school infrastructure tend to be driven by local demands and influenced by the political environment. The RSRS advocates the use of prioritization criteria, a quantitative and evidence-based approach that is in line with government and sector policy priorities and maximizes benefits for the most children. The set of criteria can be risk-based and cost-efficient and may also include social equity (see below). This approach allows task teams to prioritize investments in a transparent, measurable way and makes possible monitoring and evaluation of progress and results. The definition of prioritization criteria is also at the core of implementing solutions at scale and at the heart of modernizing how school infrastructure is managed.

Guidance

The team formulating the plan must fully understand the rationale behind the intervention strategy and the need for quantitative metrics to measure and track progress. The maximization of benefits is not only based on the use of quantitative analysis; it also includes the application of engineering solutions that can be implemented and scaled up. This combination allows the cost-efficiency ratio of the investments to be maximized.

Risk-based criteria quantify the safety benefits before and after interventions. The safety benefits for each proposed intervention option are estimated using quantitative risk assessment methods (see step 5). Risk integration implicitly raises hazard, vulnerability and exposure considerations. Although they contain sources of uncertainty, these estimates provide an adequate metric in relative terms for a comparative analysis within the school building portfolio.

Cost efficiency criteria refer to the number of students benefitting from a given investment. A per capita cost is used as a metric to compare the monetary investments for each of the intervention options. For two school buildings with the same intervention and investment needs, for example, the ratio of benefit to cost will depend on the number of students in each building. The more students who benefit, the higher the benefit-cost ratio.

Social equity criteria refer to reducing inequality by helping prioritize investments for the most disadvantaged. Existing quantitative socioeconomic indicators, such as poverty levels, can be used to identify vulnerable communities and prioritize investments in these regions.

➜ ***The process to define the prioritization of reconstruction interventions is essential to reduce downtime in disaster-affected areas.*** Reducing the education service downtime in affected school facilities requires optimization of the interventions. The longer the recovery and reconstruction process, the greater the negative impact on children's education and learning.

Activity 8.2.2.

Set up implementation units and procedures

In this activity, the main implementation unit for the plan is defined, in line with the institutional arrangement defined above, the resources requirements are estimated, and the key activities and procedures to begin implementation are identified. The implementation unit refers to the specific office in the government entity in charge of school infrastructure that will lead the plan's implementation. It usually corresponds with the school infrastructure management office in the ministry of education or public works.

Guidance

Task teams should work closely and discuss this process with the relevant decision makers. It will be important to discuss and define the roles and respon-

sibilities of the implementation unit, the required team profiles and expertise, protocols regarding key activities to begin implementation, and coordination mechanisms or focal points at subnational levels, among others.

Having attained a full overview of the implementation unit requirements, task teams should discuss the need for adjustments (if any) to the existing institutional arrangements. Local governments may need support to strengthen capacity at the initial stage of implementation, and assisting them will be another important activity for the implementation unit. Task teams may need to conduct field visits to local offices to discuss the proposed implementation structure and get consensus on initial capacity-building needs.

In countries with no experience in school infrastructure planning, implementation of the plan may take longer to initiate. It is unrealistic to expect the implementation to go smoothly, especially in its early stages. Task teams can identify key activities to have in place to provide the minimum required capacity and the instruments needed for implementation.

➔ ***In post-disaster conditions, the reconstruction process is usually led by the central government.*** The education, health, social, housing, and other sectors operate under their usual structures and have to coordinate with the designated reconstruction agency in charge. In this case, this activity tends to be driven by the specific requirements and coordination mechanisms established by the lead reconstruction agency. As the recovery and reconstruction process is continuous and ongoing, some procedures are usually defined along the way.

Activity 8.2.3.

Define the investment and procurement mechanisms for implementation

In this activity, specific provisions are defined for the investment and procurement mechanisms needed for the implementation of the plan. These provisions are based on the existing legal framework and public investment system in the country. Relevant offices at the ministry of finance or education can provide valuable information and guide task teams in the process. This activity further develops, for each program and line of intervention, the information on financial sources and potential funding mechanisms presented in the investment plan defined under step 7. The teams in charge of project design will operate on the basis of these provisions.

Guidance

Any proposed changes to the procurement of construction services should be explicitly outlined and discussed. This is a complex matter at the core of the toxic construction environment in many developing countries. Overcoming these issues may require several years of legal and institutional involvement. Task teams should ensure decision makers are provided with a solid, evidence-based proposal.

It is important to familiarize key relevant government officers with the plan's expected investments and procurement provisions. Even with no significant shift in the existing investments and procurement mechanisms, a training program should be offered to both national and local governments to familiarize them with the plan's implementation. The plan provides input for project design, which should accelerate the process. Project formulators and procurement teams must know and understand the detailed plan information necessary for the preparation of bidding documentation.

➔ ***Reconstruction requires exceptional investment and procurement mechanisms.*** Normally, decisions are made by the central government, to be applied across the whole reconstruction process. Therefore, the scope of this activity is limited, as sectors should follow the procurement mechanisms established by the central government.

Activity 8.2.4.

Establish an information management platform

This activity relates to the information system required to monitor and track the progress of the plan's implementation. An information system is not only essential as a repository for records of the plan's implementation; it can serve as a tool to monitor and

evaluate progress on result indicators, including interventions and investments. Based on our experience, the lack of a well-defined and articulated information system is often a bottleneck during implementation. In this respect, the activity builds on the progress on the information system over the course of the plan's formulation. Task teams are to evaluate whether it's feasible to have in place an IT solution for the implementation phase or if a temporary solution should be identified until the permanent one is developed.

Guidance

The IT solution needs to be flexible and serve as a tool to inform the decision-making process. The plan is based on the existing school infrastructure portfolio, and all attributes are linked to each school facility, which has a unique geo-referenced location. Thus, the IT solution must be able to represent information spatially at several geographic scales (country, region, municipality, and so on). It should also include the capability to host large data sets in a range of formats, including digital image information, such as pictures, videos, and remote sensing images. iCloud-based solutions can be an alternative for managing large amounts of data. Task teams should discuss the current IT infrastructure and capacity to integrate these solutions with the government or sector IT teams.

Accessibility for a large number of users is another key requirement for the information management platform. A large number of users will be involved directly in the day-to-day use of the system. In addition, the system may need an external interface to make information available to the school communities. While the range of IT solutions in the market is growing, governments tend to prefer customized solutions based on their existing information systems. Task teams should identify the resources required for the IT solution and ensure funds are allocated to address these needs.

Developed countries increasingly are integrating Internet connectivity into their education systems. Task teams should discuss with relevant actors in the ministry of education any opportunities for the plan to take advantage of efforts to expand Internet coverage to rural areas.

➜ ***The Structural Integrity and Damage Assessment (SIDA) is an example of an information system to support reconstruction.*** This web-based platform was developed to manage the reconstruction of around 6,000 school facilities affected by the 2015 earthquake in Nepal. Note that the functionality to organize and manage damage assessment data is particular to this type of platform.

Activity 8.2.5.

Establish a communication strategy

The purpose of this activity is to design a communication strategy to disseminate information about the plan's objectives, programs, timeline, expected results, and outcomes. The strategy will help establish a direct channel of interaction with key stakeholders, including government entities (national and subnational) and school communities, academia, the private sector, IFIs, and development partners, among others. Disseminating pertinent information about the plan is important to ensure continuity and to promote a culture of accountability and transparency after the plan has been formally adopted.

Guidance

The communication strategy should address potential concerns from stakeholders regarding changes triggered by the plan. The plan is a policy reform process to build an enabling environment for interventions at scale that will shake up the school infrastructure status quo and have an impact on groups of interest. Task teams need to uncover in advance the sensitive topics that are sure to arise for school communities for the communication strategy to address. The strategy should "shield" the plan by highlighting its evidence-based rationale and the benefits of the proposed reforms. As is well known, international experience is very useful to elevate the discussion from a local perspective.

Task teams must obtain from the field evidence of the positive changes and community views emanating from the plan's policy reform. The communication strategy should gather evidence and disseminate results and changes to inform communities. In

the Istanbul Safer Schools Program (ISMEP), a website providing up-to-date information on the progress of interventions in school facilities proved effective. Communities should also be provided with direct answers to questions about implementation and/or budgetary delays and any submitted inquiries.

➜ ***Engagement with communities is especially important in post-disaster conditions.*** Since school reconstruction is not a standalone effort, an integrated communication strategy is needed to support the recovery of the education sector. Affected communities demand reliable and timely information. Any gap in communication could thwart the process. To support a resilient recovery, communities need to be engaged actively in discussions and the facilitation of reconstruction efforts. The communication strategy should also include and contribute to the affected community's understanding of the need for and benefits from intervening, not only to repair damage but to reduce vulnerability to future hazard events.

Module 8.3.

Monitoring and evaluation

Through this module, task teams will define monitoring and evaluation mechanisms and provisions for any future adjustments to the plan.

Activity 8.3.1

Define a monitoring system and procedures

This activity defines the procedures and indicators that will be used to monitor and update systematically progress of the plan's implementation. Monitoring refers to the progressive tracking of the plan's implementation through both budget execution and physical interventions. The former tends to be regulated and sometimes integrated into the public investment system in a country, while the latter requires defining result indicators by lines of intervention, aggregated at the level of each school facility. These indicators are to be integrated into the monitoring system, and the procedures to collect and update this information systematically are to be defined. This is especially applicable in decentralized school systems, where the implementation is managed by local authorities. The information system will be the platform to monitor the implementation progress of the plan.

Guidance

In addition to result indicators, outcome indicators to measure the impact of the plan need to be defined. Outcome indicators relate to the ultimate benefits for students, teachers, and school communities of an improved learning environment. Examples include indicators on safety (for instance, the number of students benefiting from safer school facilities) and functionality (such as the number of students benefiting from energy efficiency improvements on energy systems and of those benefiting from water, sanitation, and hygiene—or WASH—improvements).

This activity also covers periodic progress reports and accountability mechanisms. Task teams should identify the progress report requirements from in-

volved agencies and public budget regulation. Annual budget execution reports, for example, are usually prepared to provide information on the sector's fiscal balance. Sector accountability requirements may be imposed in the form of periodic reports to public auditing agencies and legislative bodies, such as the city council, congress, or parliament.

➜ ***Under post-disaster conditions, school communities are particularly concerned with the outcomes of the reconstruction.*** The highest priority among affected communities is having their children go back to school. Thus, task teams should define outcome indicators that allow them to gather this information and inform communities about the progressive recovery of school capacity, either through temporary learning centers (TLCs) or reconstructed or new school facilities.

Activity 8.3.2.
Evaluate needs for project adjustments

Adjustments to the plan will be needed as it moves toward implementation. As the planning process during the RSRS is based on the analysis of average representative school building conditions, proposed interventions will need to be complemented by detailed field inspections. Furthermore, depending on the time it took to formulate the plan and the age of the information used, there may be some differences with the actual school facility conditions. This tends to the case, as interventions in schools are always ongoing. The plan should include a section to address this situation and define key steps to begin implementation.

Guidance

The final intervention at the level of each facility may differ from the plan's proposed interventions for several reasons. The final intervention and required investment amounts for a given school building will be defined by the detailed engineering phase, which includes field visits. In this regard, task teams should anticipate some differences between the proposal of the plan and the final intervention. Issues that may lead to changes in the final intervention required in each school facility include gaps in the baseline information, mistakes in the structural classification of school buildings, and outdated ongoing interventions, among others.

Another typical situation is when new hazard or risk information is generated. If flood and landslide hazard maps at higher resolution become available, for example, the implementation unit leading the plan will need to revisit the intervention needs for school facilities located in these flood- and landslide-prone areas. Any modifications to building codes or land use regulations that were not identified early on in the formulation of the plan may also have an impact on the location or design of the interventions. Since this will always be a dynamic process, adapting and addressing these changes efficiently will be key for the team moving forward.

Output

The completion of activities under each module will result in one or more output(s). For post-disaster conditions, the arrows in the chart below highlight the additional information that should be included in the output.

Module	Output(s)
8.1. Implementation framework	- Document for the plan: Two sections (one per activity) to be part of the main body of the text - Annexes: Details about activities 8.1.1 and 8.1.2
8.2. Initiation activities	- Document for the plan: Five sections (one per activity) to be part of the main body of the text ➜ Document for the recovery and reconstruction plan: Five sections (one per activity) to be part of the main body of the text - Annexes: Details about activities 8.2.1 to 8.5.5
8.3. Monitoring and evaluation	- Document for the plan: Two sections (one per activity) to be part of the main body of the text ➜ Document for the recovery and reconstruction plan: Two sections (one per activity) to be part of the main body of the text

Preparing, Adopting, and Communicating the School Infrastructure Plan

At this point, the formulation of the plan has been finalized. In this section, several activities are proposed to adopt and communicate the plan, as well as to facilitate engagement with key players.

To begin implementation, the plan must be formally adopted. The implementation of the RSRS and the formulation of the plan may leave task teams feeling overwhelmed by the volume of documents, databases, and information generated. The final step in this process is crucial, however, and it requires the team to work together to prepare the formal document (the plan) that will ultimately have to be adopted by key decision makers.

We recommend discussing, for example, the actual structure of the document, including the table of contents and key chapters, and defining how the supporting documents will be organized and presented. We also recommend a specific team be designated to write and integrate all outputs so as to deliver a cohesive document. Doing this will allow task teams to prepare the information, assign writing and reviewing roles, and identify the administrative and legal process and procedures to follow within an agreed timeline.

This task is particularly demanding in countries where governments and sectors are not accustomed to or do not use master plans. In such cases, task teams should anticipate needing additional time to prepare and adopt the plan.

Based on our experience, the formulation of the plan can start after the analysis phase of the RSRS has been completed. At this stage, task teams should have a good understanding of the main needs in terms of condition and capacity of the existing school infrastructure.

Since the plan will be formally approved, and in some cases become a legal document, the structure and content should be in line with the country's regulatory framework for these types of documents. It can be divided into three parts: main document, annexes, and supporting documents.

The main document should present all the key information. Although a standard template is not available, we recommend the following approach to preparing it:

> Prepare an executive summary. It's important to synthetize information for policy makers who often only have time to read this section.

> Follow a two-part structure: the first part presents the policy framework and diagnosis (summarizing results from steps 1 to 5), while the second describes the actual intervention proposals (summarizing results from steps 6 to 8). Each part can be divided into separate chapters, as needed.

> In part 1, clearly describe the policy drivers the plan has identified for school infrastructure improvement, report the diagnosis results (condition, capacity, and management), and discuss the findings. Part 2 can follow the same sequence as the RSRS: intervention strategy, investment plan, financing strategy, and implementation strategy.

> Keep the main document concise and as straightforward as possible. Include a summary box with key figures and messages at the beginning of each chapter for better readability.

Annexes are supplementary to the main document and will usually contain graphs, tables, figures, maps, and so on. The briefer the annexes, the better.

Finally, supporting documents will include the original versions of all the reports, databases, documents, and presentations produced over the course of the implementation.

Even though the implementation of the RSRS promotes the active participation of key stakeholders throughout, a final consultation may be important to secure approval of the plan. Consultation practices vary widely from one country to another. In the case of infrastructure planning at the national level, consultation emphasizes the institutional and political levels rather than the community level. Task teams should understand the context and prepare materials to communicate the plan accordingly, taking into account the target audiences. The following are among the key aspects to highlight:

> The gains for children's learning environment are considerable.

> One must keep a long-term perspective.

- The plan is built on a robust technical foundation.
- The plan is aligned with the government's policies.
- A clear link exists among diagnosis, strategy, and outcomes.
- The financial strategy is strong and the implementation strategy realistic.

Although the topic of safer schools enjoys wide political support globally, some stakeholders may be apprehensive that the plan's recommended policy and investment reforms will go against their traditional approach. We encourage task teams to preempt this situation by means of evidence-based arguments and the presentation of benefits at scale.

The adoption of the plan is the materialization of political will to prioritize and modernize school infrastructure. As stated earlier, the decision to prioritize and make investments at scale in school infrastructure is both a technical and political process. Task teams should inform their management of and systematically discuss with them all findings and proposals generated during the implementation. This interaction allows the team to get feedback from decision makers while inducing them to take ownership of the plan.

The group of political stakeholders in this field goes far beyond the direct decision makers, such as the ministries of education or public works. Ministries of finance, energy, health, and social affairs, local governments, members of parliament, nongovernmental organizations dedicated to improving education, and religious institutions are also highly interested in such policy reforms and investments.

Not only must the plan be formally adopted by a legal instrument, but ancillary administrative actions generally need to be taken to make it conform to existing instruments or systems (such as public investment systems, land use instruments, and development plans). Therefore, task teams should share the details of this process with relevant agencies.

A communications campaign should be launched to announce the formal adoption of the plan and begin implementation. The communication strategy should aim to create an enabling environment for the government to engage with communities and begin to prepare for the implementation phase. The wide dissemination of this information will place an additional layer of pressure on the government to deliver results, so it is important to communicate clearly the plan's objectives, timeline, and expected results and outcomes from the beginning and throughout implementation. Information is power, and a community that is continuously engaged and informed about the process can become an ally to move implementation forward. Citizen ownership is vital to guaranteeing the sustainability of the plan's proposals to advance policy reforms and bring about structural change in how school infrastructure is managed. Civic participation can ensure continuity and foster an environment that promotes transparency and accountability, regardless of changes in government.

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