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NATIONAL ROADMAP

EDUCATION SYSTEM DIGITAL TRANFORMATION IN TAJIKISTAN

CONTENT

List of Abbreviations

Abbreviation	Term in Full
AoE	Academy of Education
BYOD	Bring Your Own Device
DCC-LEG	Development Coordination Council – Local Education Group
DED	District Educational Department
EDI	Institute of Development of Education (under Academy of Education)
EMIS	Education Management Information System
GPE	Global Partnership for Education
Go(R)T	Government of the Republic of Tajikistan
ICT	Information and Communication Technology
ICT-CFT	ICT Competency Framework for Teachers
IsDB	Islamic Development Bank
ITTI	In-service Teacher Training Institute
LAN	Local Area Network
LMS	Learning Management System
M&E	Monitoring and Evaluation
MEDT	Ministry of Economic Development and Trade
MoES	Ministry of Education and Science
MTEAP	Mid-Term Educational Action Plan
NEPRP	National Education COVID-19 Preparedness and Response Plan
NSED	National Strategy for Education Development (2021-2030)
OER	Open Educational Resources
PPP	Public Private Partnership
RED	Regional Educational Department

RTMC	Republican Teaching and Methodological Center
RITTI	Republican In-service Teacher Training Institute
SDG	Sustainable Development Goal
SUE	State Unitary Enterprises
TCO / TBO	Total Cost / Benefits of Ownership
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNICEF	United Nations International Children's Emergency Fund
VPN	Virtual Private Network

INTRODUCTION

This Roadmap aims to guide sustainable implementation of digital transformation in the education sector in the Republic of Tajikistan. It provides a strategic and operational framework to achieve educational objectives with an emphasis on digital solutions and identifies concrete steps towards promoting digital solutions in Tajikistan, while considering regional and global best practices.

The Roadmap is aligned with national digital development strategies and policies, and national planning and monitoring processes in the education sector. It takes up digital elements proposed in the Tajik state programs and embeds these in a specific model directed at creating a digital learning ecosystem. Applying this best practice model, the Roadmap systematically reviews and proposes actions at three levels:

- Creating an environment with *enabling context factors* to achieve scale and sustainability in digital transformation. This includes measures in the areas of governance and policy, data and analytics, financing, partnerships, communication, and advocacy.
- Improving *digital learning enablers* which include the provision of connectivity and infrastructure, devices, digital platforms, access solutions, and planning and development of related digital capacity.
- Achieving *learning outcomes* through a digital approach to pedagogy, educational content, and assessment development.

The Roadmap has been developed under the leadership of the Ministry of Education and Science of the Republic of Tajikistan (MoES) by a Working Group (established under the MoES order No.1077 dated 5 August 2021) consisting of representatives of the key departments and institutions involved in design and implementation of digital transformation in the education sector. The Roadmap development process included in-depth consultations with national and international stakeholders. It was informed by findings from a prior assessment of ICT equipment and connectivity in the institutional landscape of the (primary, basic and general secondary) education sector in Tajikistan, and is linked with substantial investments in the ICT infrastructure. The Roadmap specifically informs how to effectively, efficiently, and sustainably utilize procured equipment and accelerate digital learning in the education sector (and specifically benefitting students from grade 5 to 11). While the Roadmap promotes changes in the digital ecosystem that potentially benefit all levels of education, the activity focus lies on general secondary education, and the transition from primary and basic to secondary level. Eventually, other education levels, and both public and private education providers, will be addressed. The Roadmap shows a perspective for the upcoming years and will be brought to life through the annual operationalization by the Roadmap Working Group, Subgroups and Specialist Teams who implement and monitor the activity plans. These activity plans are included in the Annex and will be fine-tuned along the way. A description of specialist expertise needed to implement Roadmap activities, is also included in the Annex. A detailed resources plan for Roadmap implementation shall be developed by the institutions indicated as responsible (coordinating) institution for a specific activity.

Backing of digital transformation by all governmental bodies is an important precondition for implementing a national Roadmap. It is expressed in the National Strategy for Education Development of the Republic of Tajikistan for the period until 2030 (NSED) and its associated action plan (MTEAP), the National Education COVID-19 Preparedness and Response Plan (NEPRP), and the State Program on Implementation of Information and Communication Technologies in General Educational Institutions of the Republic of Tajikistan (2018 - 2022) and its succeeding program. The broader

concept “The Concept of the Digital Economy in the Republic of Tajikistan” (Approved Government decree Tajikistan from 30 December 2019, No.642) also offers a modern vision on ICT application in among others the education sector. These documents, together with the 2030 Agenda for Sustainable Development, give general direction to develop and adopt a strategy for ICT adoption in schools. The Roadmap is aligned with their objectives and key activities and goes one step further in detailing which approach can contribute most to realizing that vision of making best use of digital means.

From the international perspective, ICT is a crucial accelerator in achieving the Sustainable Development Goals (SDGs). ICT is explicitly included in education (SDG 4), gender equality (SDG 5), infrastructure, industrialization, and innovation (SDG 9) and global partnerships (SDG 17). SDG 9 puts forward general and affordable access to the Internet, while SDG 5 advocates the use of ICT with a view to women's self-determination, and SDG 4 addresses the ICT capacities of schools and the ICT skills of young and adult learners. Across the board, ICT is seen as indispensable for reaching all SDGs faster and more inclusive, and for monitoring them continuously with digital means. While the National Development Strategy of the Republic of Tajikistan outlines the national approach of reaching the SDGs, the NSED is meant to create the environment to meet SDG 4. For the education sector, by 2030, SDG 4 sets the challenge to ensure that all girls and boys complete free, equitable and quality primary and secondary education leading to relevant and effective learning outcomes, and to substantially increase the number of youth and adults who have relevant skills for employment, decent jobs, and entrepreneurship. Digital provisions can significantly increase that access to quality education, and digital competency is rapidly becoming a basic requirement at each workplace. SDG 4 further points out two means of implementing targets, to which Roadmap activities directly contribute: Building and upgrading education facilities that are child, disability and gender sensitive and provide safe, non-violent, inclusive, and effective learning environments for all (4.a); and substantially increasing the supply of qualified teachers (4.c). A well-built ICT infrastructure at school with outreach to other learning settings at home and in the community, can help create a level playing field for more learners. Professional teacher development supported by ICT can effectively fill gaps in training provision.

This is not to say that ICT is the solution to all educational challenges. Internationally, the following understanding of digitalization in learning and teaching offers further guidance:

- Digital tools replace neither teachers nor content.
- Digitalization of schools is not an end in itself.
- Not every lesson needs digital tools.
- Devices cannot replace teaching.

As global best practice, the “Principles for Digital Development” provide an orientation for the process of digital transformation. These principles are also being considered in the Roadmap development,

According to the National Development Strategy of the Republic of Tajikistan for the period until 2030, innovation and involvement of employers in the educational process, participation of parents and society in the educational process, and effective management based on feedback should be the key resources of the education sector, and the main institutional points of growth should be:

- Providing all educational institutions with broad access to online resources and increasing the level of computer equipment in classrooms.
- Providing online content for most subjects and widespread introduction of interactive learning formats using information and communication technologies, including distance learning (online) and creation of educational platforms in the national language.

Activities proposed in the Roadmap correspond directly with NSED objectives and activities in the MTEAP, but do not substitute them. Rather, the Roadmap goes deeper into the digitalization aspects of educational reform, which was made even more important and urgent due to the COVID-19 crises, and may thus deepen and complement the following MTEAP objectives:

- The introduction of new learning and teaching methods and tools in model projects (utilizing mobile devices and platforms), as well as assistive devices for students with special needs, will support the “intermediate outcome 3.1.2: Equitable access to general secondary education is ensured by creating a socially safe and supportive learning environment”.
- As a precondition for introducing digital devices in schools, “intermediate outcome 3.1.1: Equal access to general secondary education is ensured by providing appropriate and quality infrastructure”, shall lay ground with connected and secure buildings.
- The teacher training, that is part of the Roadmap activities, fits into “intermediate outcome 3.2.1: The staffing potential of professional workers of all general secondary educational institutions is strengthened”, especially activities “(15) Develop mechanisms for distance and blended learning, taking into account the infrastructure necessary for their implementation” and “(16) Create the system for teachers' needs assessment and improve the system of training, retraining and their professional development (taking into account innovative forms of advanced training, including distance and blended learning)”.
- Almost all activities of “intermediate outcome 3.2.2: The curriculum based on the competency-based approach in general secondary educational institutions has been improved” correspond with Roadmap activities in the fields of pedagogy and content.
- The “national framework for initial, final and standardized assessment to measure student learning outcomes” developed in 2021 (activity 24 of intermediate outcome 3.2.3) will inform all Roadmap activities in the field of assessment.
- “Intermediate outcome 6.1.1: Per capita (normative) financing is the main mechanism for the distribution of budgetary resources allocated to the education sector” when in use, will guarantee that digital transformation in education will be seen as a continuous task and will be part of school financing. In addition, extra budgetary financing, as defined in “intermediate outcome 6.1.2: A multi-channel financing system is widely used at all levels of the education sector”, will enable educational institutions to move forward. The “analysis of the possibility of using the public-private partnership (PPP) mechanism in the regions” conducted in 2021 (activity 10 of intermediate outcome 6.1.3) may inform this further.
- Some Roadmap activities rely on the re-launch and enhancement of the Education Management Information System (EMIS), as planned under intermediate outcome 6.1.4. All activities under “intermediate outcome 6.1.5: Digital technologies are widely used in education sector management and the national system for assessing the quality of education” directly relate to monitoring and evaluation accompanying the Roadmap, as explained further in the final chapter of this document.

A new State Program on Implementation of ICT in General Educational Institutions will be developed for the period 2023 to 2027. The Roadmap experiences can inform this development, and the new strategic document can in turn orientate the Roadmap further. Throughout the 2022 implementation of Roadmap activities, the responsible actors will continue with planning, monitoring and evaluation of the outlined digital transformation. As the Roadmap is a living document, it is meant to be edited and further developed under auspices of the MoES Roadmap Working Group. New challenges will occur that need to be mastered, new technology and methods will evolve in the next years that need to be considered, and lessons will be learned from the model projects and general Roadmap activities that influence future digitalization efforts of the sector.

1. PRIORITIES

Overarching focus is the added value that information and communication technology brings to the core processes of learning and teaching at school. As a prerequisite, an enabling system must be put in place. Based on the analysis of the Tajik situation, short- and midterm priorities in this digital transformation process are:

- Human and financial resources need to be mobilized to ensure universal access to digital infrastructure, connectivity, and modern learning technologies. This starts with equipping and connecting the 'backbone' of national and decentralized educational departments, institutions, and ICT centers in Tajikistan, which are tasked with transferring new digital policies into their institutional practice and supporting schools in the digital transformation. The regulatory framework needs adjustments to carry the process. This includes the firm establishment of mechanisms for maintenance, repair, and renewal of digital equipment, and clear orientations on security, safety, and privacy in the use of digital technology specifically with young learners.

- Education administrators, managers, trainers of trainers, and teachers need training and support to improve their digital competencies and engage in digital transformation. Capacity building is a key factor to ensure that blended, inclusive, and quality learning takes place.

- Education and training providers need to revise their teaching and learning models to make the best use of digital resources. This goes together with the development of an educational platform in Tajikistan that unifies content and tools and ensures continuous access to such resources. At school level, the use of mobile devices shall be modelled to inform decisions on further investments in digital infrastructure and connectivity that best serve the educational objectives.

In this process, the following mechanisms are critical:

- Continuing to align Roadmap activities with national visions and strategies, and international frameworks and best practices.

- Strengthening partnerships that support the digital transformation in the education sector. A concerted effort by actors from the private sector, intergovernmental financial institutions, global and regional digital education initiatives, government agencies and other stakeholders is needed to reach the ambitious goals.

- Providing a mix of public, external and private funding to ensure sufficient and sustainable financing that overcomes existing barriers. This must be based on a thorough assessment of total costs and benefits of introducing digital approaches in the education system.

- Creating a scientific evidence base for digital transformation with systematic data collection, analysis and dissemination to key stakeholders, and regular feedback among the national and decentralized level to respond to challenges and opportunities in a timely and forward-oriented manner.

2. REGULATORY FRAMEWORK

The importance of digital transformation of the education system and educational process is indicated in many strategic concepts and programs of the Republic of Tajikistan. However, for further successful development, the legal and regulatory framework needs reform. New digital visions in Tajikistan and global developments challenge existing boundaries (e.g., the prohibited use of mobile phones in an educational institution). Laws, regulations, programmes and strategies in Tajikistan regarding education, ICT, security, and data privacy need to be analysed in-depth and harmonised so that they fit the needs of digital transformation in education. This is a long lasting and resource intensive effort, especially, as some fields are not regulated at the moment.

Uniform interpretation of concepts such as "digitalization of the educational process" and "distance education" will need to be introduced in legislative acts, minimum standards set for the digitalization of the educational process and digital practice at educational institutions, and ICT terminology used congruently. Regulations need to address how new technology - such as hand-held personal devices - can be used safely and responsibly in learning and teaching. Currently, there is neither a general cybersecurity policy nor a policy that protects children when they are online. Data protection requirements and mandatory costly certification under Tajik rules might require a solution for educational institutions.

The current State program for the introduction of information and communication technologies in general education establishments in the Republic of Tajikistan for 2018-2022 needs a successor for the years to come, which strategically embeds the key activities put forward in the Roadmap.

There lies a large challenge ahead to update work computers, servers and network installations, and provide reliable Internet connections. The more equipment is used, the more important it becomes to have standardised procedures for commissioning, maintenance, and repair, as infrastructure planning is done on a national basis for efficiency and cost reasons. Implementation, however, needs to be decentralized. This not only prevents nationwide data protection mishaps, but also avoids large-scale outages.

Another substantial challenge is to ensure that educational staff is available, prepared and motivated to accompany the introduction and application of ICTs. Regulations, procedures and incentive schemes will have to be developed to support these human capacity development processes.

Regarding the already planned ‘Unified Portal of Education (and Science)’ that shall give everyone access to digital content and networks, a strict quality assurance system shall be put in place to guide technical behaviour and quality of content that is stored or linked there.

Activities to achieve the objectives include but are not limited to:

- Revision of legislation and preparing amendments to legislation in order to introduce new concepts, harmonise interpretation, set norms and standards for the digital transformation of the education sector.
- Adoption of an action plan to connect district offices and education departments to ICT infrastructure at central level.
- Provision of policy guidance for key educational institutions that need to further develop procedures for the use of ICT in general education (on e.g., professional development or the use and decommissioning of digital technologies).

- Support to the development of a new state program for the introduction of information and communication technologies in general education institutions in the Republic of Tajikistan for 2023 - 2027.
- Development of normative documents for further development of e-learning materials, open educational resources (OER) and educational platforms.
- Development of regulations, a) on security, protection, and privacy in the use of digital technology in general education institutions (including permissions to use one's own digital device in educational settings), b) for the registration of equipment, repairs and their maintenance and repair obligations, c) for renewal, re-use of replaced equipment and spare parts and refurbishment for hardware and software considering End-of-Life/End-of-Support risk, and d) for making available any digital device that exists in schools, also in teacher training facilities, to be used in professional development courses.
- Further support in adopting legislation and applying norms and standards for the use and application of ICT in education.

3. DATA AND ANALYTICS

Data governance is a most relevant and important part of digital transformation in education. Data governance consists of policies, processes and an organizational structure to support data management. The structure of the ministry's data governance provides understanding, security and trust around data that MoES collects or data produced when using digital devices in education. Data becomes increasingly important as it also impacts the workflows and decision-making of various departments and projects. Technical as well as human capacity can be monitored, and progress expressed in numbers. In addition, data analysis informs evidence-based decision making.

A fully functional Education Management and Information System (EMIS) is key to data-driven and evidence-based digital transformation in the education sector. The Tajik EMIS is expected to be relaunched soon with stable and long-term supported technology. With an updated and modernised EMIS, ICT infrastructure and equipment in educational institutions can be continuously monitored, the needs of ICT users surveyed, and results of ICT model projects captured. Such data can reliably inform further procurement of digital devices in collaboration with various stakeholders, strengthening of connectivity, and the development of institutional capacities and individual competencies.

In the model projects proposed in the Roadmap, new equipment (tablets, single board computers, and a Learning Management System) shall get tested. The evaluation data of those modelling activities shall inform replication efforts. The same applies to introducing assistive technologies for inclusive education. Leaving no one behind also means: analyse what helps best.

Channels and modes for transmitting information require further professionaliziation. This includes access to a corporate server and use of corporate email in all structural MoES subdivisions.

Activities to achieve these objectives include but are not limited to:

- Reaching an agreement on EMIS data requirements and data collection processes (including e.g. adaptation of EMIS to include or link to a census on all digital devices in schools and school Internet connectivity mapping).
- Setting up an evaluation system for the model projects, which includes selection, preparation and feedback mechanisms with participants (schools, trainers and teachers, students, parents and community), and jointly conducting M&E of the model projects.
- Developing a system for future studies on e.g., the introduction and effectiveness of ICT in various subjects, the readiness of pre-service teachers to use ICTs in their subjects, and the effectiveness of e-learning materials.
- Developing a system for annually recurrent ICT data collection through EMIS and data analysis (e.g., registration of ICT users or feedback mechanisms integrated in distance learning provisions).

4. FINANCING, PARTNERSHIPS AND COMMUNICATION

A joint effort of government, private sector and international donors is required to finance the digital transformation in the education sector. Structural partnerships are needed as this is a long-term process. Communication with all stakeholders (including at local level, schools, parents and surrounding communities) should inform about the benefits, risks and risk mitigation measures related to applying ICT in education. This goes together with advocacy for a modern vision on ICT in education that is oriented at “The Concept of the Digital Economy in the Republic of Tajikistan” (Approved Government decree Tajikistan from 30 December 2019, No.642) and similar international debates on maximizing Internet access and ICT use for education managers, teachers and learners.

Funding of digital transformation in general education institutions should be sustainable from the state budget within the mechanism of per capita funding. The departments (offices) of education of cities and districts when approving estimates of costs and revenues of general educational institutions shall take into account budgets necessary for schools to introduce and maintain ICT in education. The use of ICT entails the need for additional funds to repair, maintain, renew, and buy spare parts as well as consumables. The more equipment is bought, the more such operational budget is needed in every single institution, for upkeep, technical support and capacity development measures. Establishment of new schemes is needed for registration of equipment, refurbishment, possibly ownership by recipient institutions and their commitment to maintenance and repair.

Stakeholders will need to act in concertation. MoES coordinates and aligns activities and cares for keeping knowledge in the institutions. Descriptive or strategic documents regarding digitalization that are produced in a participative process are still rather rare in schools and other educational institutions. Digitalization plans, vision and mission statements, regulations regarding use of digital devices, and code of conduct for social interaction in the digital space are documents that every educational institution should elaborate in a participative manner. Learners and schools depend on the support of parents and communities. It is important to communicate that ICT is no longer just a subject at school but can foster teaching and learning with new methods in all subject areas and help specific learner groups with assistive technologies.

Activities to achieve these objectives include but are not limited to:

- The revision of public expenditures on ICT at the national, local, and institutional level, to identify where budget is insufficient for the current and projected situation (such as: server and computer maintenance and repair budget, and funding for professional development in digital competencies). Further monitoring and evaluation of funding and expenditures, as input into strategic concept/program developments and as base for ICT provisions in the annual state budgets.
- The revision of the number of IT specialist staff at all levels as well as of the functionalities of ICT Units, to then establish organizational structures and staffing schemes to cover current and projected needs. The most urgent is that staff is available to register, install, maintain and repair newly procured hardware and software (such as servers, LAN networks, or workplace equipment). Other staff will have to take on specialist tasks in the implementation of the Roadmap activities, as part of their regular duties. Where ICT Units are absent in institutions, they need to be created to support the institutional role in the digital transformation (e.g., within RITTI and ITTIs, Academy of Education, Institute for Educational Development, Republican Educational and Methodological Center). Where ICT task descriptions are missing in the job

profiles of educational staff, these should be included, and a system of benefits and incentives developed to encourage application of digital technology in daily work routines.
- Creation of legal and accessible software solutions for schools and users for educational purposes.
- The development and distribution of promotional products regarding access and use of educational platforms and digital technology in schools, among users and the general public.
- The exploration of options for ICT partnerships between public and private actors, holding consultations, and developing and signing of memorandums with committed stakeholders.

Envisioned elements for partnership agreements are:

- Commitment of Tajiktelecom to provide initially an Intranet network (VPN, not connected to the Internet, with reduced rates or free of charge) to REDs, DEDs, ITTIs, selected schools, where EMIS and ICT services (such as resource networks) are operated.
- Commitment of Mobile operators like Tcell, Megaphone and Babilon-M to provide unlimited access to video lessons under existing tariff plans for students.
- Securing partnerships for future realization of Internet access at educational institutions, based on Mapping of Internet connectivity.
- Zero-rating access to platforms with educational content (such as video lessons or self-study materials) for all teachers and learners.
- Promotion of involvement of private enterprises (e.g., partnerships in the fields of maintenance (websites, software, hardware) and repair.
- Community and parent involvement, initially in model projects at schools (participation in development of digitalization regulations and plans, home support of digital learning, practice days).

5. CONNECTIVITY AND INFRASTRUCTURE

Improving the low level of availablity and quality of connectivity in the education system of Tajikistan is considered a key enabler. Most educational institutions in Tajikistan are not or not reliably connected to Internet or Intranet and the network connectivity inside buildings for local area networks is often not in good condition, if available at all. At the subnational and decentralized levels, building conditions are not always conducive to ICT installations and upkeep of devices. If all institutions will hold their data for management and education digitally, storage spaces will need to be upgraded and electrical lines repaired.

The current provision of Intranet and Internet at central education authority level shall be expanded to regional and district education institutions, and eventually to schools. Initial infrastructure investments need to include updates of local area networks and servers, to support such extensions of the existing system. Long-term aim is to connect all educational institutions to servers with learning content and to enable them to communicate online, making use of a good in-house local area network.

Taking into account that Internet prices in the Tajik marketplace are high, the creation of a "state educational intranet system of Tajikistan" can be a short-term solution. Learning platforms (e.g., Maktab Mobile), learning management systems (e.g., Moodle), post-launch EMIS, and digital libraries and other resource platforms that can provide teaching and learning materials, can operate via such an intranet system. Implemented as a Virtual Private Network (VPN) and not connected to the Internet (to minimize costs and maximize safety and security), funding and management options under a partnership agreement with actors such as TARENA, Tajiktelecom, and State Unitary Enterprises (SUEs) shall be explored.

Making use of mobile Internet connectivity for educational purposes is another short-term exploration area. Mobile operators in Tajikistan shall for example be approached to provide access to educational content (such as video tutorials) under existing tariff plans.

In the future, International partnerhips can open pathways to Intranet connectivity at a larger scale in the education sector.

Activities to achieve these objectives include but are not limited to:

- Updating the LAN (Local Area Network) in the Ministry of Education and Science and its subdivisions, and prepare the server room at MoES.
- Updating the ICT Center connection (fiber optic) and preparation of its server room.
- Technical installation of procured equipment for LAN creation in regional education departments.
- Updating/creating LAN in the city/district education departments, and connecting them to Internet/Intranet.
- Updating/creating LAN in the Republican ITTI and its ITTI branches.
- Developing and adopting a plan about connecting selected schools to the Internet/Intranet, and an outline of future connectivity options for schools.

6. DEVICES, DIGITAL PLATFORMS AND ACCESS SOLUTIONS

MoES departments and institutions on national and regional level are confronted with outdated workplace computers, operating systems, servers, and network installations. At the decentralized levels, the ratio staff to up-to-date computers is not sufficient. Schools specifically lack digital devices that support learning outside IT classrooms. There is not yet a central digital platform that makes digital learning and teaching content and tools available to all potential users.

A system shall be put in place that regulates the modalities of maintenance, repair and write-off of devices, and updating of software (especially operating systems, to avoid security risks). Open source software solutions are to be preferred to facilitate efficient and prolonged use of elderly devices. A focus on re-use & repair is necessary. All devices shall be used as long as possible. Maintenance is important for hardware and software. Thus every institution and every school shall gain competency in the daily care for digital devices and ICT Centers supporting schools will gain a deep understanding of how to implement maintenance and repair in a way that is sustainable, resource-effective and environment-friendly.

Education shall be a place of ICT sovereignty. Procurement will consider that educational institutions should not be dependent on vendors for products and services and not be locked in paying for licenses with unforeseeable future costs.

But also new devices are needed for institutions who do not take part in digitalisation yet. The status of ICT equipment provision and needs shall be registered and monitored through the relaunched EMIS. Once new regulations allow the use of own devices by learners and teachers within educational institutions, these can also be leveraged as resources in learning and teaching processes. Computer classrooms will in future not be the only place for digital learning but students will use mobile devices (such as Tablets and Single Board Computers) in other subject areas and learning spaces, too.

A consistency of devices in ITTIs and schools will enable to train teachers well in implementing educational processes with digital means. Only devices that make pedagogical sense shall be purchased. Staff on all levels in the educational institutions need adequate digital devices to do their work.

The planned Unified Portal of Education (and Science) will need technical and content quality criteria that comprise but are not limited to accessibility, data privacy and resource efficiency. Access to this portal and learning and teaching content will be free of charge, and all schools shall be connected. This will enable learners to access high quality and „up to date“ learning content, and teachers to exchange premium teaching materials.

Activities to achieve these objectives include but are not limited to:

- Development of a scheme for updating digital hardware, firmware and computer programs by IT administrators at institutional level (district education departments, ICT Centers, selected schools).
- Analysis of ICT equipment data in order to develop a procurement scheme ensuring that management, administration, supporting and teaching staff at all educational institutions have continuously access to a computer and peripherals, as standard professional tools at the workplace.

- Support of further planning and implementation of quality criteria for the planned new Unified Portal of Education (and Science).
- Installation of an own free video conference server to connect regional and district departments among each other, and use of collaborative software that does not produce a lock-in effect.
- Delivery, installation, and user training of procured equipment (tablets, single board computers, LMS) for the model projects.
- After evaluation of the model projects, development of a procurement plan, standards and parameters for upscaling.

7. PLANNING AND DEVELOPMENT OF DIGITAL CAPACITY

The education system needs digital capacity not only for teacher training, teaching, and learning but also for the administration and management at all levels, from the Ministry in Dushanbe to a small rural school. Most teachers do not yet use digital tools in their work, and there is a lack of training of teachers and school administrators in digital competencies and with digital means.

Capacity development needs shall be assessed in detail, and appropriate plans prepared at network and institutional levels. An initial step is the creation of a Pool of ICT specialists who can function as trainers and multipliers. ICT Centers and (R)ITTIs shall join forces to provide training and coaching, in hybrid formats. Continuous professional development offers to educational staff shall gradually lead to certification and recognition of digital competencies in career paths.

The model projects at schools shall help evaluate the usefulness of different approaches of new technology before they are rolled out across the country. Teachers, managers, and other actors in the school community shall be trained and accompanied in the use of new technologies and respective educational approaches.

Documentation helps spreading information and keeping knowledge and best practices in the institutions. Continuous cross-institutional collaboration will sustain knowledge acquisition. Produced capacity development materials (tangible and intangible) shall be shared among providers.

One cross-cutting aspect to be considered in planning and developing digital capacity, is online safety and security. Data protection is not only a technical issue, but also a social task, as people can help protect their data and awareness is as important as technical protection is.

Activities to achieve these objectives include but are not limited to:

- Compilation of manuals for maintenance and administration of hardware and software, as well as establishment of working processes when using the hardware and software.
- Development of a course plan to improve qualifications for IT specialists of MoES.
- Provision of capacity development to city/district education department staff and school administrators and managers in the use of ICT for administration and management.
- Development of directives and templates that support participative development of digitalization plans, digitalization visions, digitalization mission statements, participative decision making in digitalization, regulations regarding use of digital devices, and code of conduct for social interaction in the digital space, in every department and institution of MoES, and the schools selected for the model projects.
- Adaptation, development and try-out of online/blended professional development courses for teacher trainers and teachers in prioritized topic areas.
- Provision of training and mentoring for teachers at the selected model project schools.
- Introduction of practice days or practical ICT lessons, hardware repair and upcycling at schools as a measure that expands capacity to reuse hardware.

8. DIGITAL SUPPORT OF LEARNING AND TEACHING

ICT improves learning and teaching by introducing new methodological and didactical approaches, by making high quality content widely available, and by facilitating in-depth and real-time assessment. Under the headers *Pedagogy*, *Learning and Teaching Content*, and *Assessment of teachers and students*, the relevant Roadmap activities are explained further below.

The planned model projects with teachers and students will – after evaluation – give further direction for the use of the tested devices in learning and teaching. Basic standards for the model projects will include: All content shall be quality checked. All students, including those with disabilities will learn through nationally adapted and high quality Open Educational Resources. Digital educational content will be aligned with the curricula. The learning platforms shall be safe and protect the students and their data. Students will gain ICT competencies so that they can enter the digital space without risk. They will understand and command ICT as a tool and be able to adapt and maintain it.

Pedagogy

Only if the type and use of electronic media is pedagogically justified, there will be an added value of ICT in education. Thus, an appropriate methodological and didactical approach is necessary.

Good teacher training is the basis for good student education. The ICT Competency Framework for Teachers (ICT-CFT) can be the base for professional development of teachers regarding ICT. Topics to be trained can be identified from the ICT-CFT matrix which comes with curricular goals for teacher training and suggested activities. This also embraces inclusive teaching with specific digital devices.

ICT can be integrated into traditional teaching methods. Still, teachers shall be encouraged to take up alternative learner-centered pedagogies – ideally project- and problem-based methodologies that incorporate cooperation and collaboration. Blended and remote learning do also offer self-paced learning methods that need self-assessment by the students. Those methods need to be taught.

Activities to achieve these objectives include but are not limited to:

- Introduction of the ICT Competency Framework for Teachers (ICT-CFT) as the base of professional development of teachers regarding pedagogical application of ICT.
- Development of pedagogical and methodological guidelines for teacher trainers on how to use and train the use of newly introduced digital devices, tools and content, among school managers and teachers.
- Development of pedagogical and methodological guidelines for teacher trainers and teachers involved in inclusive education (on teaching methods and assistive tools for children with special needs).
- Support of ITTIs in the pedagogical and methodological adapation and provision of online/blended professional development courses.
- Development of instructional videos on the use of learning platforms and specific devices.
- Revision of the curricular program and pedagogical approach to ICT lessons in secondary education, and review of the preparedness of IT teachers to organize teaching and learning processes accordingly.
- Development of an approach to work with parents on home support for digital learning, and in general to engage them in planning digital transformation at school.

Content

Traditional learning and teaching content can be digitalized. Books can be prepared with authoring tools, lessons or instructions can be captured and published as videos and tutorials. A substantial number of video lessons has already been produced in Tajikistan. But there is more potential in digitalization. Materials can come with subtitles, audio-description and scripts, and new content can include games and applications in diverse forms. Open educational resources (OER) are published for free use, often under a creative common license. They can be shared and adapted to the appropriate language and context to fit the curriculum and the cultural environment.

Production of digital learning and teaching materials is done at workplaces, and digitalization in general requires servers. Additional and specialized staff is needed to adapt content to technological evolution and create more digitalized learning and teaching materials. The Unified Portal and its connected servers that are planned to host all content, will need continuous upkeep. It is a challenging engineering task and needs to be well prepared and implemented, as it is not only of high relevance, but also a security risk if not well planned and maintained. Investment in such an infrastructure will produce benefits for a long time.

Not only content for students and teachers, but also content for teacher trainers, IT staff and management can be stored online. As an online platform that is available immediately and adaptable to institutional or group needs, a Learning Management System can be introduced (like Moodle, which is already in use at Tajik universities, and proposed as one of the Roadmap model projects). After evaluation, it can be rolled out to other user groups.

Activities to achieve these objectives include but are not limited to:

- Establishment of a permanent division for digitalized learning and teaching content for all subjects (grade 5 – 11), as well as for ICT subject teaching, to adapt learning content (based on technical development and according to curricula and national competency framework).
- Establishment of a permanent division to continuously ensure the quality of the Unified Portal - technically, as an online medium and regarding content that is hosted or linked - and to adapt the developed quality criteria when needed.
- Development and application of procedures for the quality check of digital learning and teaching materials and learning platforms.
- Development and provision of digital learning and teaching materials for prioritized subjects and grades (through upload in the Unified Portal, and distributed at decentralized levels on tangible media).

Teacher and Learner Assessment

Training of teachers in the application of digital solutions in teaching and learning, will be preceded by an assessment or self-assessment of digital competencies. This can be inspired by the ICT Competency Framework for Teachers (addressing the competency areas: understanding ICT in education policy; curriculum and assessment; pedagogy; application of digital skills; organization and administration; teacher professional learning) and embedded in Tajik human resource development plans.

The utilization of ICT in learning assessments shall be explored. This can include e.g., online (self-) assessment of competencies in learning platform environments, entry and analysis of student test results in a shared database, or upper secondary students taking online exams. Assessment itself can be digitalized and enriched by new methods and tools (such as tutorials, drill-and-practice

exercises, resources to be manipulated and reinterpreted). Learners can establish what they already know, assess their strengths and weaknesses, design a learning pathway, stay on task, track their own progress, build on successes, and adjust to failures, and be part of a peer-learning community.

Activities to achieve these objectives include but are not limited to:

- Analysis of prior needs assessment and additional assessment of ICT teacher competencies to inform capacity development plans
- Creation of a mechanism for evaluating the quality of usage of digital resources and technology in the learning process at school
- Analysis of opportunities for digital student testing and reporting processes and development of a system for evaluating educational outcomes using digital technology.

9. MONITORING AND EVALUATION ACCOMPANYING THE ROADMAP

Roadmap implementation goes hand in hand with monitoring and evaluation activities. They include:

- Monitoring and evaluation of model projects with schools that are being initiated under the Roadmap (and will inform rollout design and future procurement of equipment for schools)
- Monitoring and evaluation of the implementation of the Roadmap (assessing progress indicators, per activity line set out in each Roadmap chapter)
- Contributions to monitoring and evaluation of the overall digital transformation in the Tajik education sector, along relevant indicators of the National 2030 Agenda and the NSED Results Framework.

The Roadmap foresees modeling advanced teaching and learning with ICT, in learner groups that will be provided with tablets to assess how these support learning in specific subject areas from grades 5 to 11, and in learner groups using small single board computers in IT subject classes. This shall take place in selected schools (that already initiated digital teaching and learning, have an IT administrator, and can count on IT support from parents, enterprises, and/or the community). Ongoing assessment of progress and results of these model classes is critical before deciding on future rollout, to prevent any repetition of errors or replication of less successful intervention elements. A third model project introduces a learning environment/collaboration platform for user groups such as teachers, which also requires assessment of progress and results before upscaling the platform use.

In each Roadmap chapter, per activity line, milestones are set. These require monitoring by the institution in charge of implementation and of reporting to the Roadmap Working Group. Any deviations will be discussed, and appropriate measures taken to finetune and reach objectives.

Reporting shall also feed into the annual monitoring, evaluation, and planning processes in the Tajik education sector. This includes e.g., reporting towards ICT indicators in the National 2030 Agenda and the NSED Results Framework. Tajikistan has planned to conduct an independent assessment of the quality of education in the framework of the national strategy for development of education 2030, which includes the following ICT indicators:

4.4.1 Young people and adults with ICT skills
4.a.1 Schools with access to [...] b) Internet for educational purposes; c) Computers for educational purposes [...]
5.b.1 Mobile phone owners
9.c.1 Population covered by a cellular network
17.6.2 Broadband contracts
17.8.1 Internet users.

For General Secondary Education, items to be measured in the NSED framework are:

- Proportion of schools offering basic services, by type of service (in %): Internet access for pedagogical purposes, computers for pedagogical purposes; as well as elements that include ICT: adapted infrastructure (scientific and laboratory equipment and materials), accessible learning materials (e.g., learning literature, including textbooks), adapted materials (e.g., for students with disabilities, such as computer programs, audio-visual materials, etc.). Baseline 2019/20 No data.
- The share of educational institutions using digital learning platforms and solutions (in %). Baseline: No data. Target 2021-2023 20%

- Mechanisms and necessary infrastructure for distance and blended learning are developed and digital solutions are provided to support teachers' pedagogical skills and improve students' learning outcomes.
  Baseline: None. Target 2021-2023 „Mechanisms are developed, taking into account infrastructure needs".

Furthermore, while digital aspects are not yet specified for the following NSED items, they could play an important role in accelerating progress towards education objectives:

- The presence of a concept and instruments for formative, summative and standardized assessment of learning.
  Baseline: outdated or not existent. Target 2021-2023: "An action plan is formulated for development of the framework and instruments".
- The share of teachers of general secondary educational institutions who have completed advanced training and retraining courses, i.e., professional development courses (in %).
  20% per year, baseline, and target.

Regarding part 6 of the NSED Framework, on Governance and Financing, relevant items are:

- Average financing normative per child, pupil or student / and per institution. (Which currently includes only fixed phone lines, and no other digital elements such as an amount for monthly Internet fees in the annual school operational budget).
- The EMIS has been upgraded (such as to accommodate online functions) and expanded in line with additional reporting requirements for the NSED/NDS(MTDP) and SDG indicators. Baseline: EMIS is functionally limited and has not been upgraded. Target 2021-2023: EMIS expanded, and its enhancement roadmap is developed and agreed upon with partners.
- Intermediate outcome 6.1.5: Digital technologies are widely used in education sector management and the national system for assessing the quality of education (at all levels of education).

Roadmap activities to achieve M&E objectives include but are not limited to:

- Definition of objective and success / evaluation criteria for the three model projects "tablets in class", "single board computers in class", "learning management system"
- Monitoring and evaluation of model projects, provision of quarterly and final reports, with recommendations for decisions on further roll-out, and discussion of results at strategic level with the participation of key stakeholders (on the three model projects, and also others such as Mobile school, Digital library, e-Knowledge)
- Development, adjustment and/or adoption of indicators (with baseline, targets and measuring tools) to monitor the development of digitalization of education at all levels (school, district, region, MoES)
- Development of a system to provide reports on digitalization of education at all levels (related to EMIS and possibly beyond, such as a Dashboard acccesible also for the decentralized levels).

ANNEX I: ROADMAP ACTIVITY PLANS

Roadmap activity plan: Regulatory Framework

Activity	Progress indicator / Milestone	Responsible Institution	Support
1.1 Review legislation and prepare amendments to legislative acts to introduce new concepts, harmonize interpretation, set norms and standards for digital transformation of the education sector.	Legislative ICT gaps resolved By fourth quarter 2022	MoES/Specialist Team	Ministry of Justice Parliament of Tajikistan Specialist Team (Regulation and policy)
1.2 Develop and adopt a plan to connect district education departments with the central level ICT infrastructure	ICT decentralization plan adopted Second quarter 2022	Department of preschool and general secondary education	ICT Center
1.3 Provide orientations to key education institutions (such as (R)ITTI, DEDs) that need to develop institutional procedures for the use of ICTs in general education (on professional development, use and decommissioning of digital technology, etc.)	Institutional procedures for ICT use prepared Third quarter 2022	MoES/ Specialist Team	ICT Center Specialist Team (Regulation and policy, Digitalization process document)
1.4 Develop state program for the introduction of information and communication technologies in general education establishments in the Republic of Tajikistan for 2023-2027 (including clarifications of concepts and terminology of digital education in Tajikistan)	New sectoral ICT strategy adopted First quarter 2023	MoES/ Specialist Team	Ministry of Justice Parliament of Tajikistan
1.5 Develop regulatory documents on security, safety, and privacy in the use of digital technology in secondary schools (including BYOD orientations)	Regulatory documents on ICT security/safety/privacy adopted First quarter 2023	MoES/ Specialist Team	ICT Center, RTMC, Academy of Education, Institute of development of education

			Specialist Team (Regulation and policy, Digitalization process document)
1.6 Develop regulatory documents on the processing of e-learning materials, OER, and educational platforms	Regulatory documents on OER/Platforms adopted Second quarter 2022 (related to development process of Unified Portal)	RTMC	Institute of Education Development and Academy of Education of Tajikistan Specialist Team (Regulation and policy, Digitalization process document, Unified Portal content and quality, OER)
1.7 Develop a regulation on the registration of equipment, repairs and their maintenance and repair obligations	Regulatory documents on equipment registration/maintenance/repair adopted Second quarter 2022 (before delivery of ICT devices procured in 2022)	ICT Center	Academy of Education, RTMC, RITTI, Legal Department, Department of Economics, Planning in Education and Science EMIS Specialist Team
1.8 Design at national level regulations for renewal, re-use of replaced equipment and spare parts and refurbishment for hardware and software considering End-of-Life/End-of-Support risk (including special regulation for educational institutions that they can use equipment as long as it lasts, not bound by 5-year write off; and including recycling scheme)	Regulatory documents on renewal/re-use/refurbishment adopted First quarter 2023 (before new procurement of ICT devices for schools)	ICT Center	Department of Budgeting and Educational Planning, Department of international relations, Department of Legal Support, external ICT experts, experts of the Regulations and Policy Specialist Team
1.9 Design authorization/promotion/loan scheme for “bring your own device” (BYOD) for the purpose of learning and teaching in schools	BYOD scheme adopted First quarter 2023 (before new procurement of ICT devices for schools)	Department of Legal Support	Regulations and Policy Specialist Team, Department of Economics, Planning in Education and Science, Department of International

			Relations, Specialist Team (Regulations and Policy)
1.10 Develop regulation that ensures that any device in schools, also exists for training purposes in teacher training facilities	Availability of ICT devices in (R)ITTIs regulated First quarter 2023 (before new procurement of ICT devices for schools)	Department of Economics, Planning in Education and Science	Department of Legal Support, Supported by experts of the Regulations and Policy Specialist Team
1.11 Support process of adopting legislation and applying norms and standards for the use and application of ICTs in education	Ongoing support system for processing and applying new regulations in place Third quarter 2022 (after production of regulation drafts)	ICT Center	Institute of Education Development and Academy of Education of Tajikistan

Roadmap activity plan: Data and analytics

Activity	Progress indicator / Milestone	Responsible Institution	Support
2.1 Agree on EMIS data requirements and data collection processes (including adaptation of EMIS to include census on all digital devices in schools, EMIS linkages with Giga Internet Connectivity Mapping, etc.)	ICT data collection mechanisms agreed First quarter 2022	EMIS Department	MoES Department of International Relations, Department of IT, Supported by EMIS Specialist team and external ICT experts IsDB / GPE, UNICEF
2.2 Set up the evaluation system for the model projects (LMS, Tablets, Single board computers), including selection, preparation, and feedback mechanisms with participants (schools, trainers and teachers, students, parents, and community)	M&E system for model projects in place Before delivery of ICT equipment mid-2022	RTMC	Department of preschool and general school education, Specialist Team (Tablet model, Single board computer model, Unified portal content and quality)
2.3 Conduct monitoring and evaluation of model projects	M&E of model projects reported upon On a quarterly base	RTMC	Department of preschool and general secondary education, Specialist Team, EMIS Department, Specialist Team (Tablet model, Single board computer model, Unified portal content and quality, EMIS)
2.4 Develop a system for future studies on e.g., the introduction and effectiveness of ICT in various subjects, the readiness of pre-service teachers to use ICTs in their subjects, the effectiveness of e-learning materials, etc.	Systematic ICT studies planned By end of 2023, and implemented further on annual basis	RTMC	Department of preschool and general school education, RITTI and its branches, EMIS department

2.5 Develop a system for annually recurrent ICT data collection through EMIS and data analysis, e.g., registration of ICT users, feedback mechanisms integrated in distance learning, etc.	ICT data collection and analysis system developed By third quarter 2022 planned, and then implemented at least once per year	RTMC	Department of preschool and general school education, EMIS department, RITTI and branches, Academy of Education RT, DPGSE Compact project

Roadmap activity plan: Financing, Partnerships, and Communication

Activity	Progress indicator / Milestone	Responsible Institution	Support
3.1 Revise public expenditures on ICT at the national, local, and institutional level and identify where budget is insufficient for the current and projected situation (such as: server and computer maintenance and repair budget, funding for professional development in digital competencies, etc.)	Roadmap budget plan completed First quarter 2022, and updated on an annual basis	Department of Economics, planning in education and science	Ministry of Finance, Ministry of Economy and State Committee on Investments
3.2 Revise number of ICT staff at all levels as well as functionalities of ICT Units/Departments, and recommend establishment of organizational structures and staffing schemes to cover current and projected needs (with priority for 2022: hire staff to register, install, maintain and repair procured hardware and software (servers, LAN networks, connectivity and workplace equipment, etc.); assign Roadmap support tasks to members of Specialist Teams; and create units that support ICT application in education, where they are absent, e.g., within RITTI and ITTIs, Academy of Education, Institute for Educational Development, Republican Educational and Methodological Center.	Roadmap human resources plan completed First quarter 2022, and updated on an annual basis	HR department	Ministry of Finance, ICT staff in MoES
3.3 Conduct an audit in model schools on ICT sources of funding and expenditures (at institutional and community level) and use analysis	Audits in selected schools conducted	Internal Audit Department	ICT Center

of results for further planning of financing arrangements and monitoring of model project budget control and spending	During model project implementation mid-2022 to mid-2023		Specialist Team (Tablet model, Single board computer model, Unified portal content and quality)
3.4 Develop a funding plan for the digitalization of the education sector in Tajikistan (Corresponding to the new ICT state program)	Digitalization funding plan developed On time for consideration in the 2023 state budget	Department of Economics, Planning in education and science	Ministry of Finance, Ministry of Economy and State Committee on Investments
3.5 Develop a system of benefits and incentives for educational staff who use digital technology in education, based on ICT integration in job profiles and professional development	Benefits and incentives for ICT adoption by education staff established. By end of 2023	MoES / Department of Economics, Planning in education and science	Ministry of Finance, ICT Center, AoE, EDI
3.6 Explore options for ICT partnership memorandums between state actors and support institutions (e.g., on zero rating for access of students and schools to learning and teaching content on defined servers)	Public private partnership options explored First quarter 2022	MoES / ICT Center	DCC-LEG, Donors, GIGA Connectivity Specialist Team
3.7 Organize consultations/meetings with mobile operators to reach agreements on provision of unlimited free access to video lessons for students and institutions of general education, as well as access to platforms with educational content	Public private consultations conducted Second quarter 2022	ICT Center	MoES, ICT Council Connectivity Specialist Team
3.8 Develop and sign memorandums with mobile operators / providers on access to educational content	Public private MoUs signed By fourth quarter 2022	MoES / ICT Center	Mobile operators, Donors Connectivity Specialist Team
3.9 Monitor and evaluate funding and expenditures, as input into the new state program and as base for ICT provisions in the 2024 state budget	ICT funding and expenditures reviewed	Department of Economics, Planning in education and science	Ministry of Finance, MEDT and State Committee on Investments

	On time for consideration in the 2024 state budget		
3.10 Create legal and accessible software solutions for schools and users for educational purposes	Legal and affordable software available for users in education By end of 2023	ICT Center	Specialist Team (OER, translation) Department of Economics, Planning in education and science, RTMC
3.11 Develop and distribute promotional products regarding purpose, access and use of educational platforms and digital technology in schools, among users and general public	PR regarding digital activities implemented Before roll-out to broader user group in 2023	ICT Center	Media, Non-Governmental Organizations, Substructures of the Ministry of Education and Science

Roadmap activity plan: Connectivity and Infrastructure

Activity	Progress indicator / Milestone	Responsible Institution	Support
4.1 Update the LAN (Local Area Network) in the Ministry of Education and Science and its subdivisions, and prepare the server room at MoES	LAN and Server Room MoES ready Second quarter 2022	IT Department	ICT Center, ISP
4.2 Update the ICT Center connection (fiber optic) and prepare its server room	Connection and Server Room of ICT Center ready Second quarter 2022	ICT Center	ISP
4.3 Technical installation of procured equipment for LAN creation in regional education departments	Equipment (for LAN) installed in REDs Third quarter 2022	ICT Center	IT Department, ISP
4.4 Update/create LAN in the district education departments + Internet/Intranet connection (in two phases)	LAN created in DEDs Second to Fourth quarter 2022	ICT Center	IT Department, ISP
4.5 Develop and adopt a plan about connecting selected (model project) schools to the Internet/Intranet, and outline future connectivity options for all schools	School connectivity plan (model stage) adopted Second quarter 2022	Department of preschool and general school education	IT Department, EMIS Department, ICT Center Connectivity Specialist Team
4.6 Update/create LAN in schools in Dushanbe and connect them to Internet/Intranet	Dushanbe schools' LAN created and connected Third quarter 2022	ICT Center in Dushanbe	ICT Center IT Department
4.7 Develop and adopt a plan to gradually connect all schools to the Internet/Intranet	School connectivity plan (roll-out stage) adopted 2023	Department of preschool and general school education	IT Department, ICT Center Connectivity Specialist Team
4.8 Update/create LAN in the Republican ITTI	LAN ready in RITTI	IT Department	ICT Center

	Third quarter 2022		
4.9 Update/create LAN in the branches of the ITTI	LAN ready in ITTIs Fourth quarter 2022	IT Department	ICT Center

Roadmap activity plan: Devices, digital platforms, and access solutions

Activity	Progress indicator / Milestone	Responsible Institution	Support
5.1 Develop at institutional level (education districts, ICT centers, model project schools) a scheme for updating digital hardware, firmware, and computer programs by IT administrators	IT upkeep scheme in place in prioritized educational institutions Second quarter 2022	Department of Economics, Planning in Education and Science	ICT Center and external ICT experts
5.2 Analyze ICT equipment data to develop a procurement scheme ensuring that management, administration, supporting and teaching staff on all levels of the educational institutions have continuously access to a computer, as standard professional tool at the workplace, and peripherals	Broader procurement scheme (equipment at support level) developed Third quarter 2022	Department of Economics, Planning in Education and Science	Republican ICT Center Supported by external ICT experts, Donors
5.3 Accompany the further planning and implementation of quality criteria for the new Unified Portal of Education (and Science)	Quality assurance of Unified Portal in place Third quarter 2022	IT department, ICT Center	Experts of the Specialist Teams (Unified Portal content and quality, OER, Translation)
5.4 Support the installation of an own free video conference server to connect regional and district departments among each other, and to use collaborative software that does not produce a lock-in effect	Video conference server installed Fourth quarter 2022	ICT Center	Experts of ICT Centers nation-wide, and by external ICT experts
5.5 Implement introduction (delivery, installation, user training) of procured equipment (tablets, single board computers, Moodle LMS) in the model project schools	Model project schools ready to use new equipment Third quarter 2022	ICT Center, ICT Center of Dushanbe	MoES, UNICEF Specialist Team (Tablet model, Single board computer model, Moodle model)
5.6 Develop procurement plan for devices (such as tablets, single board computers, Moodle/LMS) after positive evaluation of model projects	Broader procurement plan (equipment in schools) developed	Department of Science and Innovation	ICT Center and external ICT experts, MoES department of international relations, Donors

	Fourth quarter 2022		
5.7 Implement LMS Platform model project(s) (Moodle, Maktab)	LMS implementation started Third quarter 2022	ICT Center of Dushanbe	ICT Center, IT Specialists, RITTI Specialist Team (Moodle model, Unified Portal content and quality)
5.8 Development of standards and parameters for ICT devices to be procured in the future	Descriptors developed for items to be procured in 2023 Fourth quarter 2022	ICT Center	EMIS (ICT data collection)

Roadmap activity plan: Planning and development of related digital capacity

Activity	Progress indicator / Milestone	Responsible Institution	Support
6.1 Compile manuals for maintenance and administration of hardware and software, as well as working processes established when using the hardware and software	Manuals and processes for IT maintenance and administration in place Second quarter 2022	Republican ICT Center	Experts of ICT centers nation-wide, and by external ICT experts
6.2 Develop a course plan to improve qualifications for IT specialists of the Ministry of Education and Science	Capacity development plan IT staff approved Second quarter 2022, directly followed by implementation throughout 2022 - 2023	MoES	Donors
6.3 Provide capacity development to district education department staff and school administrators and managers in the use of ICT for administration and management	Capacity development of decentralized staff in using ICT for administration and management implemented From third quarter 2022	RITTI	Assisted by experts of ICT centers nation-wide, and by external ICT experts
6.4 Develop directives and templates that support participative development of digitalization plan/vision/mission statement, participative decision making in digitalization, regulations regarding use of digital devices, and code of conduct for social interaction in the digital space, in every department and institution of MoES	Support materials for digital guidelines development provided to education departments and institutes Second quarter 2022	Department of Science and Innovation	Experts of the Specialist Teams (Digitalization process documents)
6.5 Support selected schools in defining their own digitalization plans, digitalization visions, digitalization mission statements, participative decision-making policies, regulations regarding use of digital devices, and codes of conduct for social interaction in the digital space	Support materials for digital guidelines development provided to selected schools Third quarter 2022	Department of Science and Innovation	Experts of the Specialist Teams (Digitalization process documents)

6.6 Provide training and coaching for teachers and other actors at schools selected for model projects	School actors prepared to implement model projects Second quarter 2022, with continued guidance throughout model project duration	RITTI, RTMC	Experts of the Specialist Teams (Tablet model, Single board computer model, Unified portal content and quality)
6.7 Adapt, develop, and try out online/blended professional development courses in prioritized topic areas	Relevant Online/Blended professional development courses offered From fourth quarter 2022	RITTI	ITTIs and Methodologists
6.8 Support the introduction of practice days or practical ICT lessons, hardware repair and upcycling (as a measure to reuse hardware; can be a community activity, a teaching activity or even a sponsoring by enterprises, competition of creative ideas)	IT hardware repair/upcycling capacity strengthened in schools From first quarter 2023	ICT Center	RTMC, assisted by methodologists and experts of ICT centers nation-wide, and parents as well as enterprises

Roadmap activity plan: Pedagogy

Activity	Progress indicator / Milestone	Responsible Institution	Support
7.1 Introduce the ICT Competency Framework for Teachers (ICT-CFT) as the base for professional development of teachers regarding pedagogical application of ICT	ICT-CFT in use for ICT teacher training design Third quarter 2022	RITTI	Methodologists and experts of ICT Centers External experts
7.2 Revise the curricular program and pedagogical approach to I(C)T lessons in secondary education, and review the preparedness of IT teachers to organize teaching and learning processes accordingly (including solutions to: limited IT classroom time, ratio computers to student, change of programming language across education level, etc.)	Approach to I(C)T teaching in schools modernized Phased approach from third quarter 2022 onwards (try-out in model projects) to roll-out in 2023	RTMC	MoES, Universities
7.3 Develop pedagogical and methodological guidelines for teacher trainers (on how to use and train use of newly introduced digital devices, tools, and content, among school managers and teachers of different subject areas)	Teacher trainers prepared to train teachers in ICT application Phased approach from third quarter 2022 onwards (prioritized subject areas in model projects) to 2024	RITTI	Methodologists and experts of ICT Centers
7.4 Develop pedagogical and methodological guidelines for teacher trainers and teachers involved in inclusive education (on teaching methods and assistive tools for children with special needs)	Teachers at special needs schools prepared to apply digital tools Third quarter 2022	RITTI	Methodologists and experts of ICT centers
7.5 Support ITTIs in the pedagogical and methodological adaptation and provision of online/blended professional development courses	Online/blended course modalities offered Phased approach from fourth quarter 2022 onwards (prioritized subject areas) to 2024	RITTI	ITTIs and methodologists

7.6 Develop instructional videos on the use of learning platforms and specific devices	Tutorials supporting use of platforms and devices ready Second quarter 2023 (before end of model projects and start of roll-out)	RITTI	ITTIs and methodologists
7.7 Develop an approach to work with parents on home support for digital learning, and in general engage them in planning digitalization at school	Home support of digital learning strengthened Phased approach from third quarter 2022 onwards (try-out in model projects) to roll-out in 2023	ICT Center	Model project schools, Specialist Teams (Digitalization process documents, Tablet model, Single board computer model, Unified portal content and quality)
7.8 Develop an approach to strengthen, validate, and certify student ICT competencies across education levels (facilitating transitions and meeting entry expectations)	Prior Student ICT learning recognized First quarter 2024	ICT Center	Experts from Polytechnics, Universities

Roadmap activity plan: Content

Activity	Progress indicator / Milestone	Responsible Institution	Support
8.1 Establish a permanent division for digitalized learning and teaching content for all subjects (grade 5 – 11), as well as for ICT subject teaching, to adapt learning content (based on technical development and according to curricula and national competency framework)	Support structure for content creation established Second quarter 2022	MoES	ICT Center, assisted by Specialist Teams (OER, Translation)
8.2 Establish a permanent division to continuously ensure the quality of the Unified Portal (technically, as an online medium and regarding content that is hosted or linked) and adapt the developed quality criteria when needed	Quality assurance system for content of Unified Portal in place Third quarter 2022	MoES	Experts of the Specialist Teams (Unified Portal content and quality; OER; Translation)
8.3 Develop and apply procedures for the quality check of digital learning and teaching materials and learning platforms	Quality check procedures for materials and platforms being applied From third quarter 2022 onwards	RTMC	Specialists Team
8.4 Develop and provide (online) digital learning and teaching materials for prioritized subjects and grades	Learning and teaching materials for prioritized subjects and grades available (online) Phased approach from third quarter 2022 onwards	RTMC	AoE, EDI Specialist Team (Unified Portal content and quality; OER; Translation)
8.5 Design a district distribution scheme for produced learning and teaching materials on tangible media	Distribution (offline) of produced materials at district level planned Fourth quarter 2022 (for distribution from 2023 onwards, related to new procurement)	ICT Center, RTMC	Experts of ICT Centers nation wide

Roadmap activity plan: Assessment

Activity	Progress indicator / Milestone	Responsible Institution	Support
9.1 Analyze prior needs assessment and conduct additional assessment of teacher and school manager ICT competencies to inform capacity development plans	Needs assessment ICT competencies completed Second quarter 2022	RITTI	AoE, EDI of AoE
9.2 Create a mechanism for evaluating the quality of usage of digital resources and technology in the learning process	Evaluation mechanism for ICT application in the classroom created Second quarter 2022 (for try-out in model projects, further adjustments for rollout in 2023)	Department of Quality of Education	State Agency for Educational Supervision
9.3 Analyze opportunities for digital student testing and reporting processes and develop a system for evaluating educational outcomes using digital technology	Potential use of ICT in student assessments outlined Second quarter 2023	RTMC	Department of Quality of Education

Roadmap activity plan: Monitoring and Evaluation

Activity	Progress indicator / Milestone	Responsible Institution	Support
10.1 Define objective and success / evaluation criteria for the three model projects “tablets in class”, “single board computers in class”, “learning management system (LMS)”	Success criteria for model projects defined Second quarter 2022	RTMC	ICT Center, assisted by experts of Specialist Teams (Digitalization process documents, Tablet model, Single board computer model, Unified portal content and quality), and external ICT experts
10.2 Monitor and evaluate model projects, provide quarterly and final reports, with recommendations for decisions on further roll-out, and a discussion of results at the level of the MoES with the participation of key stakeholders (on the three model projects, and possibly including also other initiatives such as Maktab-Mobile, Digital library, etc.)	M&E of model projects started Third quarter 2022	RTMC	EDI, AoE of RT, ICT Center, Department of preschool and general secondary education, Information and Analytical center of Dushanbe Specialist Team (Tablet model, Single board computer model, Unified portal content and quality)
10.3 Develop, adjust and/or adopt indicators (with baseline, targets and measuring tools) to monitor the development of digitalization of education at all levels (school, district, region, MoES)	ICT indicators adopted Fourth quarter 2022	MoES	EDI, AoE, ICT Center
10.4 Develop a system to provide reports on digitalization of education at all levels (related to EMIS and possibly beyond, such as a Dashboard accessible also for the decentralized levels)	ICT reporting system in place First quarter 2023	MoES	EMIS

ANNEX II: GLOSSARY

Term in English	Common use, if applicable, in		Explanation
	Russian	Tajik	
BYOD	ПССУ	Таҷҳизоту худро биёр	Bring Your Own Device. Being allowed to use one's personally owned device as a student or teacher, rather than being required to use an officially provided device.
Digital Divide (digital gap)	Цифровой разрыв	Нобаробарии рақамӣ	Differences in access to and use of ICTs, in particular the Internet, that affect opportunities for social and economic development.
Digital Literacy	Цифровая грамотность	Саводи рақамӣ	The ability of a person to use digital devices, applications, and services in an appropriate way.
Digital Readiness	Цифровая готовность	Омодагии рақамӣ	Degree to which an organization is prepared for ICT use.
Digital Transformation	Цифровая трансформация	Табдилдиҳии рақамӣ	An ongoing process of change that has been initiated and made possible by digital technologies.
Digitalization	Цифровизация	Рақамикунонӣ	In the closest sense, the conversion of analogue to digital data. Also: Global social change through the increasing use of digital devices, software, services, etc. in all areas of daily life and the economy.
E-Learning	Электронное обучение	Омӯзиши рақамӣ	Learning processes that are supported by digital media and tools.
End-of-Life/End-of-Support Risk	Риск Конца срока службы\поддержки	Таҳдиди охири мӯҳлати хизматрасонӣ/ дастгирӣ	i) End-of-Life Risk: for all conventional hardware that is not explicitly built to last long (and thus comes with a long-term spare parts guarantee), repair may be impossible due to a lack of spare parts or even drivers; and ii) End-of-Support Risk: for all proprietary software after the vendor announced the date of end of support, updates and patches are not provided so that the software is a security risk in itself.
Flipped Classroom	Ускоренный класс		Teaching method in which students acquire the learning content in advance (e.g., through video lessons), and then clarify and apply it in class, accompanied by the teacher.

Gamification	Геймификация		Transferring elements of computer games to motivate participants in other 'serious' contexts (such as education). Examples are gaining points, progress bars, badges, and rankings.
ICT	ИКТ	ТИК	Information and Communication Technology. Generic term for communication instruments and applications (including mobile phones, computer and Internet hardware and software) and related services.
ICT-CFT	ИКТ-РКУ	Доираи салоҳияти омӯзгорон оид ба ТИК	ICT Competency Framework for Teachers. A set of competencies that teachers need to integrate ICT into their practice and professional development to advance student learning.
Learning Management System (LMS)	Система управления обучением	Низоми идораи омӯзиш	A software application for the administration, documentation, tracking, reporting, automation and delivery of educational courses, training programs, or learning and development programs.
Lock-in effect	Эффект блокировки	Асари бастагӣ	Effect that makes a customer dependent on a vendor for products and services, unable to use another vendor without substantial switching costs. Lock-in costs that create barriers to market entry may result in antitrust action against a monopoly.
Open Educational Resources (OER)	Открытые образовательные ресурсы	Захираҳои кушодаи таълимӣ	Teaching, learning, and research materials that are either (a) in the public domain or (b) licensed in a manner that provides everyone with free and perpetual permission to engage in the 5R activities: Retain – make, own, and control a copy of the resource; Reuse – use your original, revised, or remixed copy of the resource publicly; Revise – edit, adapt, and modify your copy of the resource; Remix – combine your original or revised copy of the resource with other existing material to create something new; Redistribute – share copies of your original, revised, or remixed copy of the resource with others.
Open Source	Открытый источник	Маҳзани кушод	Material (software, hardware, methods, techniques) that can be publicly viewed, modified, and used (usually free of charge) by third parties under an open-source license.
Realtime	В реальном времени	Вақти ҳақиқӣ	Digital systems that instantly show the results of processing the data entered.
Single Board Computer	Одноплатный ПК	Компютери яктахтагӣ	A complete computer built on a single circuit board, with microprocessor(s), memory, input/output and other features required of a functional computer.
Tablet	Планшет	Планшет	A mobile device, typically with a mobile operating system and touchscreen display processing circuitry, and a rechargeable battery in a single, thin, and flat package.

Wiki	Вики	Вики	Hypertext publication collaboratively edited and managed by its own audience directly using a web browser. A typical wiki contains multiple pages for the subjects or scope of the project and could be either open to the public or limited to use within an organization for maintaining its internal knowledge base.

ANNEX III: SPECIALIST SUPPORT

The following national Specialist Teams may be established by the Roadmap Working Group respectively the Technical Subgroups. To make the transition from steering Roadmap developments to incorporating Roadmap tasks into daily routines of the involved ministerial departments, the development tasks should become part of job profiles and task descriptions of the assigned staff members. Team members may also be practitioners in their field. They should technically support all areas covered of the Roadmap:

A – general legal and regulatory environment
B – enabling context factors
C – digital learning enablers
D – learning outcomes

Ideally, the following Specialist Teams should be formed (in parenthesis, to which Roadmap area each belongs).

1. Connectivity specialist team (C)
2. Regulations and policy specialist team (A)
3. Digitalization process documents specialist team (B)
4. Tablet model specialist team (B)
5. Single board computer model specialist team (B)
6. Moodle model specialist team (B)
7. Unified Portal content and quality specialist team (D)
8. Open Educational Resources, OER, specialist team (D)
9. Translation specialist team (D)
10. EMIS specialist team (B)

Envisaged interrelationships and mutual support between Specialist Teams:

- Connectivity specialist team may inform regulations and policy specialist team about necessary regulations regarding the connectivity and digital devices in schools and access from home (security measures).
- Regulations and policy specialist team may include findings from the model specialist teams (tablets, single board computers, Moodle) especially regarding data protection and privacy.
- Model specialist teams (tablets, single board computers, LMS) may meet at least once to see if there are key findings they share and can evaluate mutually.
- Regulations and policy specialist team may include key issues from digitalization process documents specialist team and vice versa.
- Digitalization process documents specialist team may work together with regulations and policy specialist team regarding consistency of regulations and laws on national level with policies and other papers on all levels.
- Translation specialist team may work together with the LMS specialist team and the OER specialist team to identify content to be translated and to test the translations in the field with informed test-users.
- LMS model specialist team may work together with Unified Portal content and quality specialist team regarding learning and teaching content.
- Unified Portal content and quality specialist team may collaborate with the model specialist team (tablets, single board computers, LMS) to test the quality criteria in a real-world environment.
- OER and translation specialist team may collaborate with the model specialist team (tablets,

single board computers, LMS) to adapt and use content for tablets and single board computers first.

- EMIS specialist team may work together with LMS specialist team to define data requirements (teacher and student data) for the re-launched EMIS solution.

Detailed description per Specialist Team:

Connectivity specialist team

Purpose

The connectivity specialist team may foster and steer the process of connecting all schools to the Internet or intranet. It may also decide on whether an Internet or intranet connectivity is suitable. The specialist team may advise on feasible technical solutions, if necessary.
The specialist team may also agree on students' free access to learning content on dedicated and defined servers from home.

Timeline

The connectivity specialist team may start its work after the first procurement is published and may continue until all schools are connected, and beyond.

Outcome / output

Advice and decisions regarding technical matters of connectivity.
Zero rating agreements.

Members

Representatives of the following areas: UNICEF Giga initiative, MoES ICT Centers, Tojiktelekom, other Internet access providers.

Regulations and policy specialist team

Purpose

In the light of UN's "general comment No. 25 (2021) on children's rights in relation to the digital environment", the regulations specialist team may work on general cyber security policy, especially a policy that protects children and young adults from cyber bullying, and general cybersecurity laws and regulations (like "bring your own device").

Timeline

The regulations specialist team may start working in 2021 and may meet regularly to sustain and adapt protective regulations.

Outcome / output

Regulations that protect students from cyber bullying and regulations regarding the use of digital devices in schools. Regulations regarding data protection and privacy in education. Regular adaption of the regulations.

Members

Representatives of the following areas: GoRT laws and regulations, MoES ICT, MoES education.

Digitalization process documents specialist team

Purpose

The specialist team may develop, suggest, distribute, and maintain digitalization plans, digitalization visions, digitalization mission statements, participative decision-making policies, regulations regarding use of digital devices, and codes of conduct for social interaction in the digital space, and help institutions to develop their own documents and processes.

Timeline

The specialist team may start working immediately and continue until all educational institutions have adopted the respective instruments, and beyond.

Outcome / output

Templates, how-to's and guidelines for digitalization documents.
Schools, ITTIs and other institutions are enabled to develop their own digitalization processes and documents.

Members

Interested teachers and principals, MoES staff in charge of digitalization matters, students and parents from schools that have a digital agenda or documents about digitalization already.

Tablet model specialist team

Purpose

The specialist team may accompany the model project of using tablets in different schools and for several purposes (including learning of students with special needs) and subjects.

Timeline

The specialist team may start working during the first procurement and continue until a decision on a national roll-out is taken, and beyond if the roll-out will take place.

Outcome / output

According to the success criteria defined, the model project is evaluated for evidence-based decision making regarding a national roll-out. Lessons learned and good practices during the model are put into writing to enable future projects to learn from it.

Members

Interested teachers, ITTI staff, students, parents.

Single board computer model specialist team

Purpose

The specialist team may accompany the model project of using single board computers in different schools for ICT and related teaching and learning.

Timeline

The specialist team may start working during the first procurement and continue until a decision on a national roll-out is taken, and beyond if the roll-out will take place.

Outcome / output

According to the success criteria defined, the model project is evaluated for evidence-based decision making regarding a national roll-out. Lessons learned and good practices during the model are put into writing to enable future projects to learn from it.

Members

Interested teachers, ITTI staff, students, parents.

LMS model specialist team

Purpose

The specialist team may lead and document installation and use of an LMS server for general education, and care for knowledge transfer and collaboration on the modelling project.

Timeline

The specialist team may start working during the first procurement and continue until a decision on a national roll-out is taken, and beyond if the roll-out will take place.

Outcome / output

Am LMS server is running and documented. Model schools and/or training institutes are using it and put lessons learned to writing.

Members

ICT centers and LMS practitioners from universities (to setup and maintain the server) and model schools as users (teachers, students); specialist team may cooperate with EMIS staff

to transfer enrolment data of students.

Unified Portal content and quality specialist team

Purpose

The specialist team may decide on content to be linked within or stored on the Unified Portal and care for the continuous adaption of the quality criteria that must be met to become part of the national digital education resource network.

Timeline

The specialist team may start working immediately, as content is developed already, and may become a permanent specialist team.

Outcome / output

Quality criteria for digital learning and teaching materials.

Digital learning and teaching materials are evaluated before they are published under the MoES.

Members

Specialists in the field of ICT, online content, inclusion, accessibility, and education.

Open Educational Resources (OER) specialist team

Purpose

The specialist team may identify OER in Tajik/Russian language and suggest OER in other languages for translation, they also may conduct a quality control of (translated and adapted) materials. Focus is on copyright and license matters.

Timeline

The specialist team may start working immediately and may become a permanent specialist team.

Outcome / output

Educational resources, learning and teaching materials are available under an open-source license or public domain or as creative commons.

Members

Interested teachers, methodologists at all levels, specialists in licensing.

Translation specialist team

Purpose

The specialist team may translate learning software, educational games and other learning and teaching content, may it be OER or under a copyright license.

Translation means translate not only text but also graphics, pictures, names, symbols, clothing or posture, and appearance.

Focus is on translation and local adaption.

Timeline

The specialist team may start working immediately and may become a permanent specialist team.

Outcome / output

Legally translated and locally adapted learning and teaching materials.

Members

Digital learning material specialists, interpreters.

EMIS specialist team

Purpose

The specialist team may compile user requirements for a back-office solution for school

administration that seamlessly feeds into the future re-launched EMIS.

Timeline

The specialist team may start working immediately and can be dissolved after the requirements are defined.

Outcome / output

Backlog of user requirements (e.g., in form of business use cases and user stories).

Members

Interested teachers, school administrators and managers, as well as ICT and EMIS experts.

In addition, on district and / or school level teams for the following purposes can be established with the support of the MoES:

1 Hardware repairing and refurbishing teams: repair and refurbish computers and peripherals (students, teachers, private companies, Linux user groups, etc.)
2 Digitalization readiness team: develop and maintain digitalization plan, digitalization vision, digitalization mission statement, participative decision making in digitalization, regulations regarding use of digital devices, and code of conduct for social interaction in the digital space on school level
(teachers, school staff, students, parents)
3 Model teams: actively analyze the modelling process they conduct (tablets, single board computers, LMS)
(students, teachers, parents)