Roadmap for comprehensive MIS

(Data System, Monitoring and Accountability)
Directorate of Primary Education

Fourth Primary Education Development Program
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Foreword

The Directorate of Primary Education (DPE) is generally responsible for providing basic education to around 17.4 million primary school going students of the country (Annual Primary School Census (APSC) 2018) and thereby builds a strong foundation for them to ensure a better future [1]. These students with expected students will take over the responsibility of taking forward the dreams of the nation to acquire the status of a country of the first world within 2041. In recent times, Information and Communication Technology (ICT) has become the one of the main driving forces for this change. No better progress can be achieved without adaptation of technology. At the same time, technology has proved itself useful in course of providing prompt services to the people in a timely, efficient and transparent manner which is also ensuring hassle free quality services. In this backdrop, this Roadmap for Comprehensive Management Information System (MIS) is prepared by DPE with an intention to provide better services to its clientele population.

I find pleasure in quoting a wise saying by George Bernard Shaw, "The reasonable man adapts himself to the world; the unreasonable man persists in trying to adapt the world to himself. Therefore, all progress depends on the unreasonable man." In Bangladesh, the governments previously followed the view of the reasonable man over the years and considered IT as the way forward to achieve the targeted goals through automation. But the 'Digital Bangladesh' concept has altogether changed the notion and took over a role that is similar to that of an unreasonable man. Now the main focus is on better service delivery to the people with the slogan 'service@doorsteps'. Of course Digital Bangladesh has a secondary focus on automation only when needed to support delivery of services. DPE is determined to improve delivery of its services to the people of the country making good use of ICT.

The Roadmap for Comprehensive MIS is intended to take stock of the DPE's current ICT capacity, review its performance in key areas and make recommendations on how to take it forward more effectively through improved use of Information and Communication Technology.

I acknowledge with gratitude the contributions of all those who were associated with the process of preparation and finalization of this document. Especially, I keep on record the support and assistance provided by the Information Management Division (IMD) in DPE.

Let us hope that this Roadmap document of DPE will help improve and bring better results in the operational performance of DPE and eventually the primary students of the country will have the privilege to get better prepared to face the challenges of the future.

Director General
Directorate of Primary Education

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1.0   Introduction

1.0.1   In recent times, Bangladesh has witnessed dramatic changes in the public service delivery mechanism and the organizational thinking behind it. Technology is helping the government to accelerate its services and development activities more transparently than ever. This is an exemplary case of a developing nation coming to grips with technology and turning it into a life-changing tool for millions of citizens. Being an integral part of the governmental machinery, the Directorate of Primary Education (DPE) has also undertaken several milestone activities dedicated towards achievement of the targets of the government in the primary education sector.

1.0.2   ICT has profoundly changed almost all aspects of the society in Bangladesh. It is now central to how people communicate, interact, make decisions and do work. It plays a key role in social and economic transformation. It makes possible the transformation of governmental services, its operational performance and enables open engagement with communities frequently. Possibilities created by current and emerging technologies have influenced and raised peoples' expectations for dealing with government.

1.0.3   The Government of Bangladesh considers information and communication technology (ICT) as an enabling factor towards achievement of its goal of developing the country in a rapid pace and has clearly stated its intention to expand and diversify the use of such technologies in all spheres of life as the key driver of socio-economic development. This roadmap is expressed in the "Vision 2021" plan that is directed to build "Digital Bangladesh" through creation of a knowledge-based society and facilitating transformation into a middle-income country by the year 2021.

1.0.4   This roadmap of DPE sets the direction for use of ICT in the field of management and operation of primary level educational system in the country.

1.1   Vision
1.1.1   "Enhancement of DPE's capability through use of ICT and managed information system with a view to enabling delivery of more integrated, responsive and targeted information and services, improving functional efficiency and supporting the national goal of becoming a middle-income country within 2021 and our students will take over the responsibility of taking forward the dreams of the nation to acquire the status of a country of the first world within 2041by making a strong base for nation building."

1.2   Purposes
1.2.1   To put it very simply, this Roadmap for Comprehensive MIS has only two main and specific purposes – "Doing things better" and "Doing better things".

1.3   Objectives
1.3.1   In the light of the above, the broad objectives of this Roadmap are briefly mentioned below:

1. **Better delivery of services:** Making efforts to provide simplified and effective integrated services up to the level of expectations of the people taking advantage of technology-enabled opportunities.

2. **Better and improved capability:** Build up human resources, and develop and maintain reliable ICT infrastructure for improving ICT knowledge, skills and capacity across DPE to deliver more prompt and efficient services.

3. **Better access to information:** Creating opportunities for officials (from central to the field level), teachers, students and general people so that they can easily access public information produced and maintained by DPE to enable more active involvement of all stakeholders to build knowledge, spark ideas and facilitate better informed decisions.

4. **Better internal and external communications:** Communicating with the teachers, students, officials and members of the public through frequent use of technology-based communication tools.

5. **Better staff development:** Providing teachers and staff appropriate trainings on computer and internet literacy, both basic and advanced, including sensitization programs, and also using ICTs in the conducting of training courses on other topics.

6. **Better transparency, openness and accountability:** Functioning in a more transparent way as well as strengthening networks, creating partnerships and using a variety of technologies to involve the wider community in developing policy and informing service delivery.

7. **Better administrative and management practices:** Improving the administrative processes with greater use of information technology and thereby speedily delivering the administrative decisions to the officers, teachers and staff, and, at the same time, quickly responding to any queries or complaints from the people.

8. **Better supervision, monitoring and evaluation:** Introducing IT-based online data collection and processing system for effective supervision of performances DPE to school-level, including monitoring and evaluation of developmental and other programs.

9. **Better sustainability of ICT operations:** Achieving greater energy efficiency, useful carbon emission management and sustainable environmental performance in DPE's ICT operations, and also to implement an ICT energy management plan that will facilitate improvements in technology, infrastructure and practice.

10. **Better maintenance, security and privacy:** More innovative and strategic use of ICT to ensure information and network security and privacy for all the users including the teachers and students, in addition to proper arrangements for regular maintenance of the equipment.

1.4   Need for the Roadmap for Comprehensive MIS

1.4.1   Of late, Information System has been playing a crucial role in the transformation of governmental machineries to meet peoples' expectations for better services, and to create a more open Government. The administrative restructuring programs and service delivery with support of ICT have achieved greater integration, responsiveness and transparency.

1.4.2   The internet along with the rapid changes in the technology landscape has changed the way of how people can get access to government services. Such changes have become a continuous and regular phenomenon and have been dramatic and occurred over a very short period of time. This pace of change is expected to continue if not accelerate. Smaller devices, increasingly mobile technologies, technology based on personal preferences, etc. will be influencing delivery of government services. These changes also can profoundly influence the choices for ICT investment and the ways and means of service delivery. The greatest challenge now is to address the need to balance the potential gains from innovation in ICT with the need to provide stable and reliable operations and services.

1.4.3   People expect good quality, easy to use and frequently available services from the government and measure the performance of the government against that of the private sector. The use of ICT-related opportunities is integral to developing the processes of policy making and service delivery. ICT offers new ways to design, develop and deliver services, automate existing services, and more effectively consult and engage with a broader range of stakeholders. DPE intends to make use of the available new technologies to deliver better services and to improve its operational performance and also to make it easier for people to access its services. At the same time, careful consideration will be given to the risks of new technologies in terms of security, privacy and sustainability.

1.4.4   Continuing rapid changes to the technology landscape and greater opportunities to improve government operations and service delivery as mentioned above highlight the need for a new roadmap for development and implementation of ICT by the DPE. Thus this roadmap provides the direction for ICT investment, capability development, and transformation to support and enhance integrated service delivery mechanism and operational performance during the next few years.

1.5   Nature and Scope
1.5.1   Productivity is about achieving outcomes in new or better ways. It is also about simplifying or ceasing processes that are inefficient. Reducing the time people and communities take to interact with government, frees up time for all to contribute to other more productive activities. This document outlines a future where people's interaction with the DPE will occur seamlessly as part of day-to-day life, where people and communities are connected and engaged to provide input to policy formulation and service delivery, and where efficient operations deliver faster and more targeted services.
1.5.2   This roadmap for comprehensive MIS outlines how the DPE will use ICT to transform its operations and services to achieve the policy objectives of the government in the field of primary education. More visibility of ICT design and investment intentions is desirable. Simultaneously, decisions to acquire or upgrade ICT systems should consider the broader implications for government and the people.

1.5.3   This roadmap supports the Government's broader policy objectives and major programs of work, and will sincerely follow the guidelines provided by the government from time to time.

1.6   Platform for transformation
The government has laid the foundation for an enabling environment towards ICT-supported functioning at various levels. The Roadmap for Comprehensive MIS is incorporates 'The ICT

Strategic Vision and Plan' of PEDP-3, DPE along with related policy level latest national documents and studies like National ICT Policy 2018 [2], National Science and Technology Policy[3], ICT Act 2006 [4], Master Plan for ICT in Education [5], Vision 2021, Digital Bangladesh, Open Government Initiative, Seventh Five-Year Plan [6], Public-Private Partnership, ICT Strategic Vision and Plan of DPE [7], Digital Security Act 2018 [8], National Digital Commerce Policy 2018, Bangladesh National Digital Architecture Framework Guideline, Annual Performance Agreement (APA), Recommendations from Study to assess the use of ICT (DPE), and especially Forth Primary Education Development Program (PEDP4) and so on.

2.0   Targeting integrated data systems

2.0.1 Features of Proposed DPE Comprehensive MIS

a. It will work as single-sing-in application role base access control platform; i.e. user will login this system and will get data access of relevant application system or data source.

b. Proposed system will perform as common data platform which will deliver core setup database to other application system; i.e. the application will contain school basic information, school infrastructure information, education thana codes, school codes, school types, educational office information, employee information etc., and MIS application service will deliver such type of data upon API request.

c. Proposed system will have a component to distribute/synchronize data to other application systems once a new data has been added or modified any existing data.

d. The newly developed component will be configured such a way that it will automatically identify the mapping of other system entities.

e. Utilizing emerging technologies like: AI, Blockchain, Machine Learning, IoT, Industry 4.0 etc. for the expected integrated system of DPE will be ensured.

f. National level developed system/services/software/reusable-components will be incorporate to this integrated system with necessary modification or upgradation. For example: Nothi System will be implemented at all offices under DPE. Expected Government Resource Planning (GRP) will be streamlined with the DPE System. Project Tracking System maintained by Bangladesh Computer Council (BCC) can be utilized to monitor and track progress of projects for necessary intervention. GeoDASH which a GIS based platform (maintained by BCC) can be utilized when GIS based system will be developed for DPE. To ensure quality of DPE application system/services, SQTC (Software Quality and Testing Center) service of BCC can be utilized. If any other system/services recommended by government that will also provisioned at DPE.
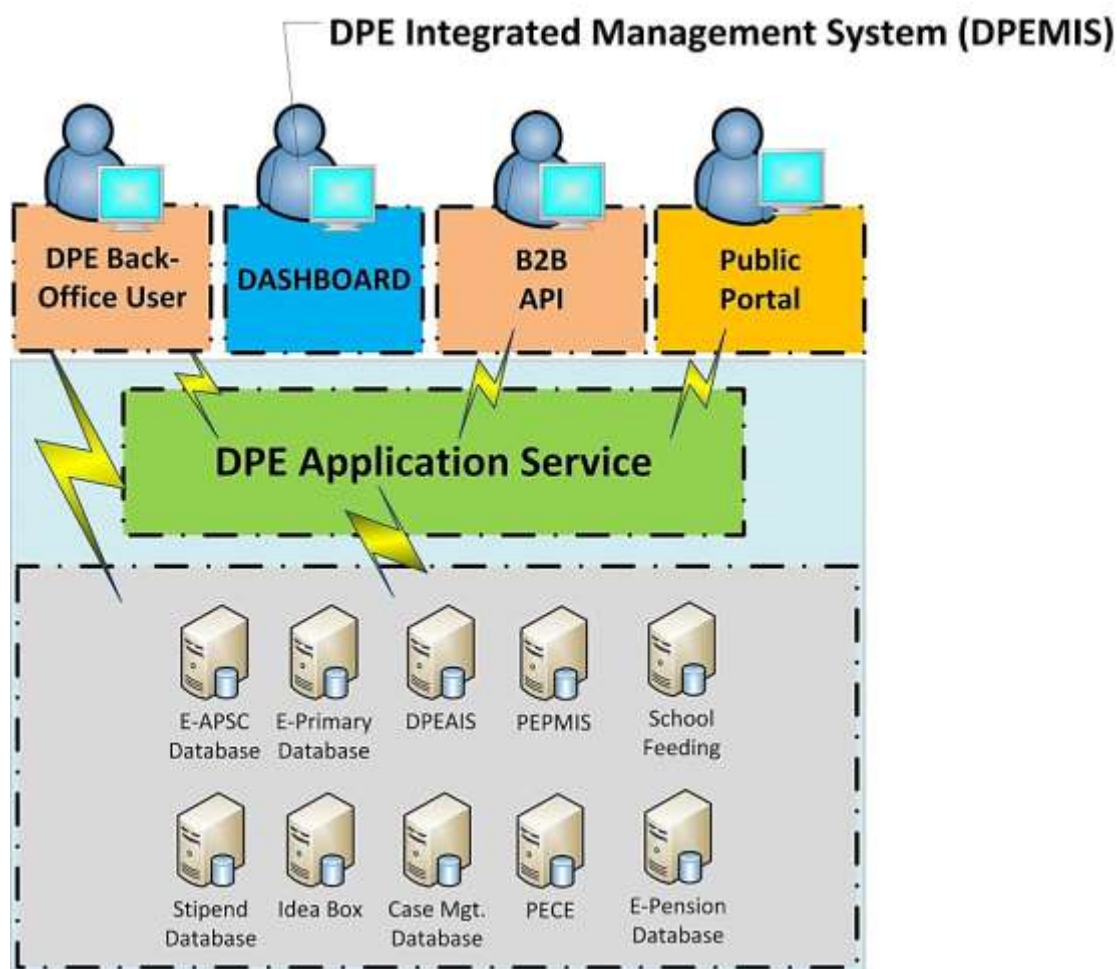
Figure 1: DPE Integrated MIS

2.0.2 Integration policy with Other Applications

Proposed DPE Comprehensive MIS will provide interfaces to trusted servers/applications through HTTPS protocols in on demand basis. In general, interfaces are created via HTTPS protocol or API according to the target applications. Target applications receives data not limited in HTML/XML/JSON format, in some cases, especially excel files (CSV, comma delimitated) which are reliable, simple, and human readable are sent via predefined method by API. API versions are available only from Oracle Applications where the target applications access through Remote Procedure Calls (RPC) or Snapshots by maintaining proper security measures. Read-only interfaces to target applications for data consistency can be an approach. When read/write interfaces are provided, MIS system updates if and only if the incoming data is consistent with other data in MIS database. For internal data interoperability and national level integration, Citizen Core Data Structure (CCDS), Bangladesh National Digital Architecture (BNDA) and Integrated Service Development Platform (ISDP) are the mandatory recommendation by Bangladesh Government will be confirmed.
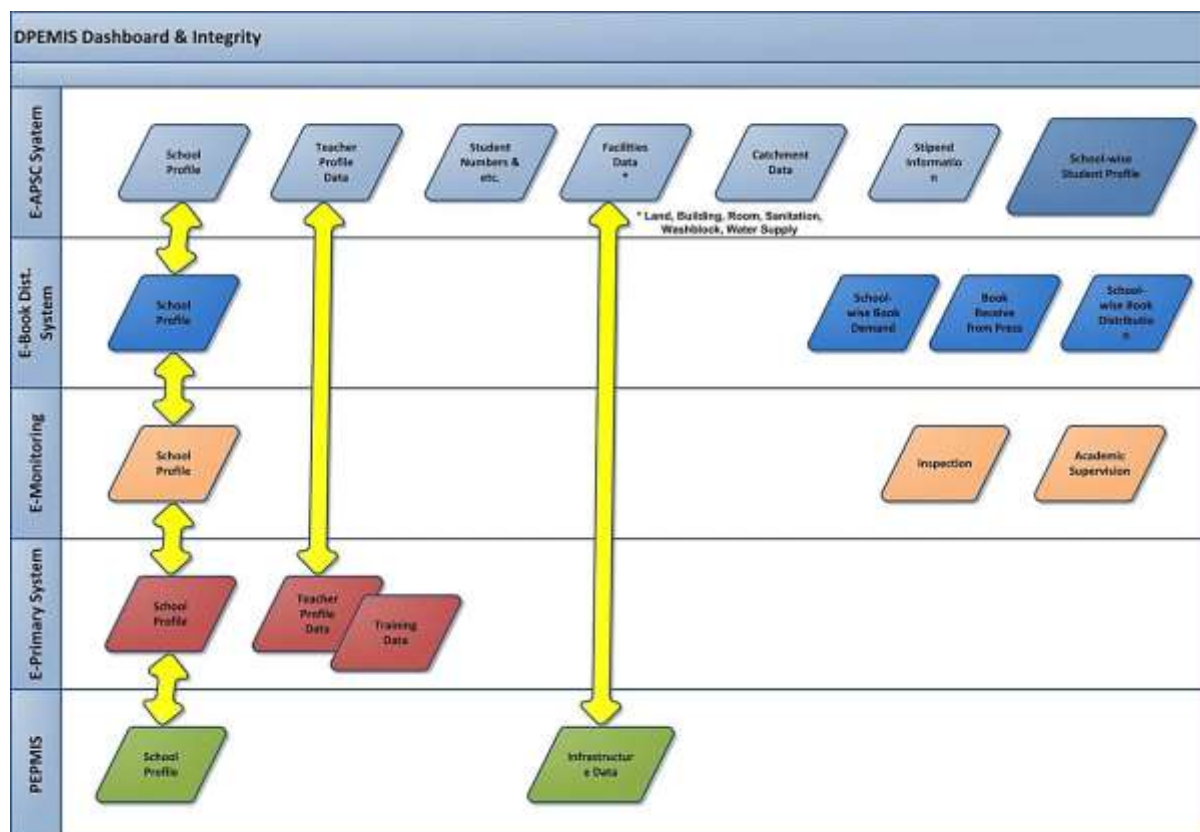
Figure 2: DPEMIS Dashboard and Integrity

2.0.3 Incoming Interfaces

DPE Comprehensive MIS can be designed to pull data from other servers/applications in any format. However, corresponding server/application must provide i) an Interface to connect and query, and ii) format of returned data. System can have data from CSV/Excel/HTML/XML/JSON files or via TCP port or using direct API connection.
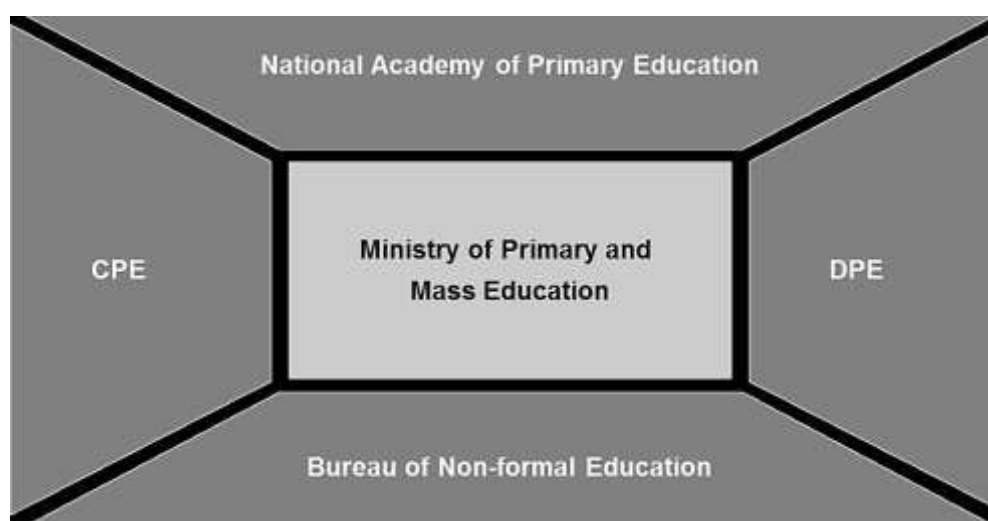
Figure 3: MoPME Offices
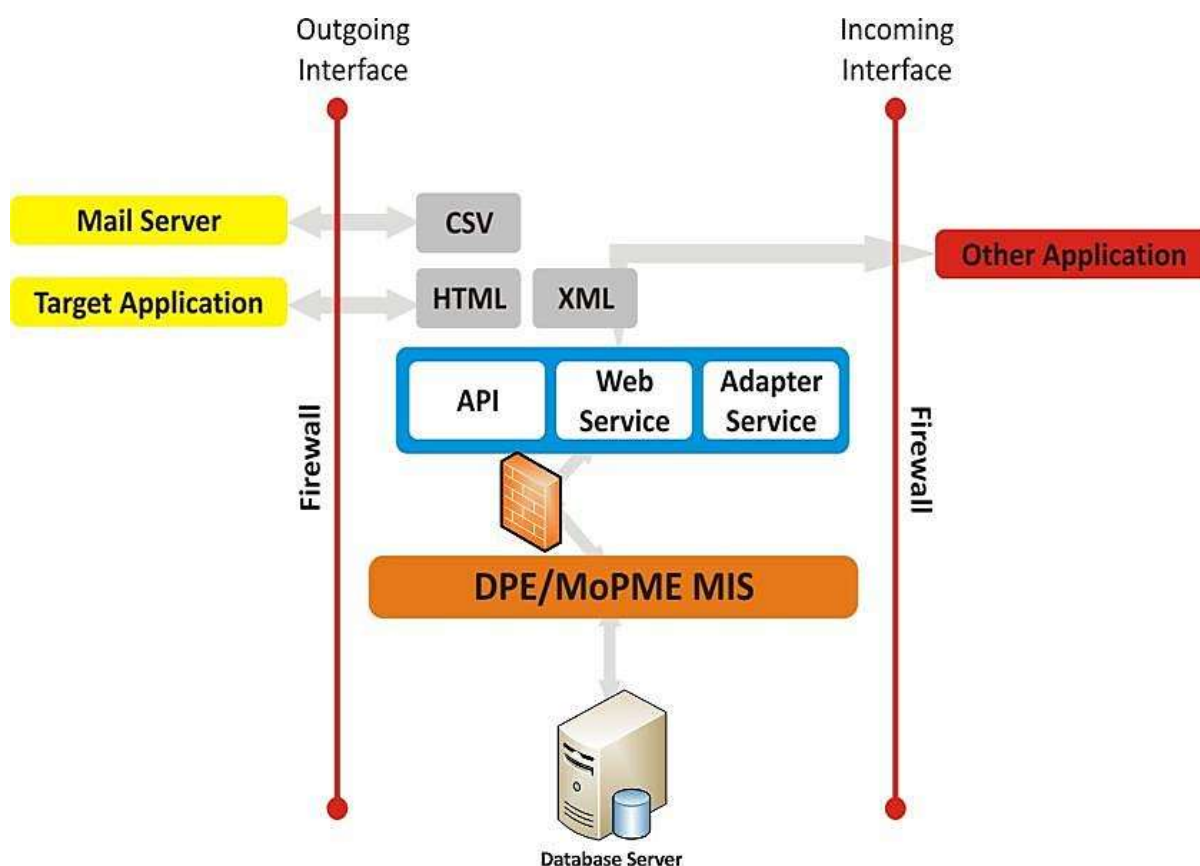
Figure 4: Integration Interfaces

2.0.4 Existing Systems for Integration

Directorate of Primary Education has several information systems which will be integrated during PEDP4 to enable interoperability and produce decision supported database driven holistic reports from this integrated system. The integrated system will contained the existing and upcoming systems and it is presented on the Table 1.

Sl	Name of the System	Module	Platform and Technology
1	e-Primary School System	a) School (Infrastructure)	Web, .NET (C#), Oracle
		b) Teacher	Web, .NET (C#), Oracle
		c) Student	Web, .NET (C#), Oracle
		d) e-Monitoring (Inspection)	Web, Mobile Apps, .NET (C#), Oracle
		e) Training Tracking System	Web, .NET (C#), Oracle
2	Primary School e-Management System	a) e-APSC (Annual Primary School Census)	Web, PHP, Oracle
		b) Online Book Distribution Management System	Web, PHP, Oracle
3	DPE AIS	a) Accounting Information System, b) Personnel Management Information System (PMIS)	Web, .NET (VB), SQL Server

Sl	Name of the System	Module	Platform and Technology
4	PEPMIS	Primary Education Property Management Information System	Web, .NET, SQL Server
5	School Feeding	School Feeding Information System	.NET, Oracle
6	Stipend Distribution	Stipend Distribution IMS	
7	PECE (DR)	Primary Education Completion Examination System	Microsoft Access (Standalone)
8	e-Pension System	Pension Approval, e-Service Book	Java, SQL Server

Table 1: DPE's Existing Systems for Integration

2.1 APSC Data and e-Primary School System

In 2016, with the assistance of the World Bank, the MS Access database storing the APSC data was migrated to Oracle and data entry formats were made available online. The resulting tool is known formally as Primary School eManagement System and one of the modules informally called as eAPSC.

For a number of years prior to this, IMD and Monitoring and Evaluation (M&E) Division piloted a system of school planning and monitoring using data that substantially overlaps and extends that stored in eAPSC on the assumption that, if schools perceive an advantage to themselves of maintaining accurate data systems, they would be more likely to invest the effort required. This system known as ePrimary School System and it has three modules. These are Infrastructure (school profile data), Teacher (teacher profile data) and Student (individual student data piloted in two upazilas).

The ePrimary school system includes a module for school inspection known as eMonitoring. In March 2017, Assistant Upazila Education Officers (AUEOs) and others schools inspecting officers were instructed to install and use eMonitoring software (app) on tablets provided by DPE. It is expected that this will give them some incentive to assure the accuracy of school data as this data is synced with the eMonitoring App prior to school visits.

2.2 Data systems providing evidence based on student assessment

Student assessment results are an important source of data for evidence-based planning and a critical indicator of the quality of teaching and learning. Analysis of results from the National Student Assessment (NSA), indicate marked disparities between regions, school types and social groups in student achievement. Furthermore, regression analysis of the 2011 NSA data indicated that school-related factors accounted for 73 percent of the differences in student performance, i.e. there are larger performance disparities between schools than between students within a school.

Student results from the Primary Education Completion Examination (PECE)/Ebtedayee Education Completion Examination (EECE)is entered to standalone MS Access databases on Upazila Education Office's (UEO) computers, copied on to CDs and sent through to the District Primary Education Officer's (DPEO) office. The DPEO collects all CDs for his/her

District and sends the collection through to IMD. IMD appends all incoming data to tables in their Oracle database.

2.3   Data systems related to textbook supply

The availability of high quality textbooks and teacher guides is an important contributor to an effective teaching learning environment. Textbook delivery has been one of the success factors of PEDP3 with 99.8% of schools receiving textbooks before the beginning of the school year in 2016.

Demand side data for textbook supply is collected online with schools entering their requirements directly to an online data entry format. The system is built on an Oracle database with the front end programmed in PHP making it consistent with the APSC online system. Textbooks are distributed to schools through the UEO's office and the UEO has responsibility to update delivery records on the database. The PEDP-3's MTR attributed success in the timely distribution of textbooks to schools partly to the effectiveness of this textbook database system.

2.4   Data systems related to teacher recruitment, transfer, and training

It is widely recognized that one of the key determinants of an effective learning environment is the presence of a teacher with strong pedagogical competencies and skills and up-to-date subject knowledge. For this reason, many of the eminence initiatives of PEDP-3 focus on the teacher with teachers attending training sessions on a regular basis.

For the design of the training component of the teacher database, IMD has developed a training module in ePrimary school system. The system allows training providers (Upazila Resource Center (URC), Training Division, Policy & Operation Division, and Planning Division) to open a category of training and specify the number of batches to be trained. The local UEO and URC Instructor will then be able to choose individual teachers from the teacher database to attend the training. System reports will include training attended by individual teachers, training offered at the Upazila and expenditure on training by location. The system is currently being working successfully. This design may not be compatible with the approach to Continuous Professional Development (CPD) taken in the PEDP4 but it is essential for ensuring equity of access to CPD by all teachers.

Policy and Operation Division of DPE maintain a teacher recruitment system supported by Bangladesh University of Technology (BUET) which required mainstreaming to DPE system.

At present the DPE processes teacher transfers on the basis of a manual application system where decision makers do not necessarily have access to history data required for cross validation and to follow the ministry terms/regulations/guidelines. There is also no easy way to share data with the result that applications are processed by different stakeholders in isolation. MoPME and DPE decided to develop and implement an efficient online/electronic teacher transfer process which will be module of the integrated system.

Finance Division has developed an accounting system for the whole of DPE with the help of a consultant. This system is linked directly to the iBAS system of the Ministry of Finance (MoF). The consultant also worked on a payroll module for officers and plans to develop a payroll module for teachers and staff in 2018 and ultimately a Personnel Information System

(PMIS). Data for the teacher payroll system planned to store in a SQL Server database to be compatible with the MOF iBAS system. It will use the same unique identifiers for schools and teachers as those currently used in the APSC database so that, in the future, IMD will be able to query teacher profile data (non-financial) from this database. As MoF have a plan to migrate their systems to Oracle, Finance Division will follow suite and move to Oracle. This will make sharing of data between the two systems much easier for IMD to manage.

DPE is also currently working on the development and implementation of e-Pension System which has eService Book module (technical assistance provided by Bangladesh Computer Council (BCC) to maintain live teacher profile and their events and pension approval process digitally. This system has been piloted in two upazilas which Tangail Sadar of Tangail district and ManikganjSadar of Manikganj district.

2.5   Data systems related to the quality of the learning environment

Providing a safe school environment supportive of learning was a key driver under PEDP-3. An important KPI was the percentage of schools meeting composite school-level quality indicators. This KPI tracks the percentage of schools which uphold a set of minimum standards in relation to the physical and teaching-learning environment. The minimum package comprises the following four Primary School Quality Level Indicators (PSQLs): Student per Teacher Ratio (STR), Student per Classroom Ratio (SCR), availability of potable water, and separate functioning toilet for female students. The composite school-level quality indicator measures the proportion of schools which meet at least three of these four standards.

WASH facilities and classroom availability and condition will continue to be closely monitored under the PEDP4. However, with the move to absorb grades 6-8 into the primary system, school buildings will need to be extended, possibly vertically. This will require an engineering assessment; the current assessment of classroom condition by head teachers self-reporting facilities data to the APSC is no longer adequate.

Accordingly, in 2016, MoPME commissioned IT People, a private sector firm, to develop a school infrastructure management information system known as the Primary Education Property Management Information System (PEPMIS). It is intended that Local Government Engineering Division (LGED) engineers working in tandem with AUEO, will make an inventory and assessment of school infrastructure and record data needed for facility planning including number of students, number of teachers, existence of pre-primary classes, need for a boundary wall, capacity of WASH facilities, and GIS coordinates.

PEPMIS data expected to be accessible by DPE and will generate a priority list of building works to guide annual budget allocations. A prioritized list of schools for which needs-based infrastructure development is planned will then be put online as a publicly disclosed "live list". However, at present, PEPMIS system is not functional anymore. Therefore, this system required redesigned and redevelopment for PEDP4.

DPE officers, both in the field and at central office, have been tasked with monitoring the quality of the learning environment in schools. While officers at all levels are encouraged to visit schools, the primary responsibility for school inspections lies with the AUEO. AUEO are mandated to inspect 10 schools every month with UEO and DPEO each required to visit 5 schools every month. Paper reports are sent through to the office of the Divisional Deputy Director (DD) where they are collated and sent through to the M&E Division at DPE.

Last year, data related to the school inspection system is collected digitally in 80 Upazilas where collection of data using eMonitoring software. With the provision of tablets to AUEO and UEO in 2018, DPE has instructed that all school inspections at this level will be done using the eMonitoring App. As well as providing the user with up-to-date school data including enrolment and teacher data, the eMonitoring App retrieves comments recorded in previous inspections into new formats prior to the AUEO departing their office. School inspection data is collected offline and, when a data connection is available, automatically synced with an Oracle database on the IMD servers. The initial pilot of the eMonitoring system ran from April 2015 through to December 2016. The ePrimary School System is built in ASP.NET and Oracle and the App runs only on Android tablets.

However, Ministry of Primary and Mass Education (MoPME) decided to do real-time/live monitoring for immediate action as a tool of e-governance implementation initiatives. Moreover, a number of supplementary database systems are currently being developed, or are planned for development, and in this section, we review the strengths and weaknesses of the online data collection tool for the APSC (eAPSC or eManagement) and opportunities for further enhancing data availability for program monitoring through its integration with other systems.

2.6   Existing data systems and limitations
The PEDP-3 MTR notes that, despite the range of data collected in the APSC and reported in the Annual Sector Performance Report (ASPR):

i.   There is no follow-up on the specific indicators DPE line divisions had identified at program preparation to track the respective *Sub-component* outcomes: More systematic tracking could have helped put the spotlight on lagging areas;

ii.   There are gaps in data needed to sharpen targeting and monitoring mechanisms regarding participation of marginalized groups;

iii. Monitoring of new initiatives and pilots introduced by PEDP-3 is as yet inadequate to track results, to build an evidence base for decision-making, and to improve performance.

To preempt a similar scenario emerging under the PEDP4, an analysis is undertaken here of anticipated monitoring needs for the 16 components areas of the new program and ways in which existing databases can be extended to accommodate these needs or new data sources built.

2.7   Upcoming Data Systems
As noted in previous sections, there are a number of database systems currently being maintained by IMD with other systems in the development pipeline. As IMD has a limited number of Assistant Programmer (2), programmer (3), systems analyst (2), Senior System Analyst (2) positions and Director (IMD). It is imperative to keep the number of database engines and user interface programming languages that they must master to a minimum. Where it is possible to draw on data from functioning systems that have their own checks and balances, this is recommended. A case in point is the ePension application currently being developed by DPE. As it is useful for UEO and DPEO to have an accurate record of which teachers have been applied for PRL, when, and where to, the currency of data in the system is likely to be maintained and to give a more accurate picture of the distribution of teachers in schools than the APSC where there is an incentive for overstaffed schools to underreport.

Accordingly, this section makes a number of recommendations for the integration of existing and planned databases allocated for the conversion of all data systems to a uniform Oracle and PHP standard.

2.7.1 Integrating school inspection databases

The PEDP-3 MTR recommends, 'Linking data collection and analysis to information collected through the school inspection system' and the Joint Annual Review Mission (JARM) in 2015 recommended that the eMonitoring pilot be scaled up. This is a logical recommendation and would give DPE access to information on patterns of attendance (both student and teacher), school use of SLIP funds, seasonal condition of school utilities etc throughout the year rather than only at a single point in time. However, the school inspection system currently includes both administrative data and feedback on academic supervision. For the reasons explained above, these two components would be best separated. So the following are advised for the purposes of linking these two systems:

1. ePrimary School system to be synchronised with eAPSC system and renamed as **DIGITAL PRIMARY EDUCATION INFORMATION MANAGEMENT SYSTEM (DPEMIS)** with backend Oracle database. The eMonitoring system to be reprogrammed to sync with DPEMIS.
2. Reporting from the eMonitoring system to be strengthened by developing a live monitoring on managerial and academic activities to provide M&E Division with reports on action NOT taken by field officers at District and Upazila level rather than all action taken.
3. Reporting from the eMonitoring system to be strengthened to provide DPE with seasonal data including attendance, contact hours, electricity and water supply, construction status on a sample basis.
4. The Academic Supervision checklist to be improved. This format could be developed as a separate App with data feeding into the teacher training database so that training inputs and behaviour change can be correlated.
5. Consistency between the monthly inspection format, the academic supervision checklist and the school grading instrument to be addressed.

2.7.2 Integrating teacher and teacher training databases

Integration is required of the teacher training, transfer or teacher profile database with the main DPEMIS. However, this should be done through the use of redesigned database which allow reports to be generated drawing on both database systems without physically merging the data since:

a. The periodicity of the two database systems are different (the teacher training and teacher profile databases would be updated on almost a weekly basis).
b. Teacher profile data is logically input, updated and checked at field level where responsibility lies for processing teacher payments and effecting teacher service book.

A similar schema would link the Academic Supervision and Teacher Training components of the Teacher database so that training inputs and teacher behavioural change in the classroom can be correlated. Although the system of academic supervision is currently seen only as an extension of mentoring and training systems for teachers, it is envisaged that it will eventually evolve to include a performance appraisal system for validation of teacher skills as part of a career structure based on professional standards. Besides, an online teacher transfer module needs to be developed with high priority to reduce the transfer processing time. This

will need to be built into the teacher database providing District and Upazila level officers with tools to manage teacher promotions.

2.7.3 Integrating facilities databases

Up until now, schools have made self-assessments of the condition of their buildings and WASH facilities as part of APSC data collection. From 2017, school infrastructure data will be more reliably assessed by LGED engineers working collaboratively with AUEO with data to be stored in the PEPMIS database. This will obviate the need to collect infrastructure data as part of the APSC. Unfortunately the PEPMIS database is being developed on a SQL Server engine with the user interface programmed in ASP.NET. Recommendations are made in the costing section for porting the system from SQL Server to Oracle. Thereafter, a database schema should be implemented to integrate the database with the online APSC database for reporting purposes. To ensure fast and accurate data entry during inspections, a mobile data collection tool should be developed for PEPMIS. This system should be integrated with DPEMIS.

2.7.4 SLIP and UPEP databases

While SLIP and UPEP tools are critical to the decentralisation of Result Based Management (RBM), there is not, as yet, a data system to track their usage. However, Planning Division has already formulated guidelines for how SLIP and UPEP planning and expenditure should be monitored. Data systems set up to put this monitoring framework into action should be decentralised with, in the case of SLIPs, data entry by schools and data verification becoming part of the school inspection system. This data system needs to be developed on a workflow model to ensure timely disbursement of funds and approvals.

In the case of UPEPs, data entry will be the responsibility of the UEO with data verification being done based during visits from the DPEO's office. Both systems should be online and developed as a module of DPEMIS in the Oracle plus PHP standard. Once operational, questions related to the SLIP could be cut from the APSC.

2.7.5 Student Data

Under the umbrella of the national CRVS (Civil Registration and Vital Statistics) project, the CRVS Secretariat of Cabinet Division is leading a program to develop database systems which can exchange information across ministries about the youth of Bangladesh. DPE have agreed to collect individual student information based on birth registration number and general profile data by a separate project and this project has been approved by Planning Commission. In the scope of this project, all the student profile will be generated and Student ID/Unique ID (UID) will be distributed within 2021 and this student profile management system initially sustain by PEDP4 year 4 and 5 then it will be mainstreamed.

Student information systems is an important initiative since, once students enter the system with a unique birth registration number, it will be possible to calculate transition rates more accurately and differentiate between students who drop out of school and those who merely transfer to another school. This will, of course, require individual student records to be stored in a central database as well as at the school and will have implications for hardware requirements at DPE. Having a system for digital storage of student data at the school level will support individualised student learning and provide school management with powerful evidence on which to plan SLIP expenditure. Although data entry in the early years will be resource intensive, once profiles for all existing students have been recorded in the system,

there will only be a need thereafter to collect profile data for the new intake and update information related to achievement and health.

Schools which maintain student data on site will need to be equipped with a laptop for administration purpose and have a plan for syncing the data with an online database which will maintain summary student data for tracking and monitoring purposes.

2.7.6   Student assessment data

For a teacher to be able to ensure that each child learns, they need to tailor instruction to the profile of the student revealed by formative assessment. Teachers need the skills to be able to interpret formative and classroom based assessment tools and this is addressed in the assessment.

Summative assessment also has a role in providing feedback to educators about concepts that are poorly understood while, at the same time, providing a measure of school and system health. The National School Assessment (NSA) is one such instrument intended to provide a measure of school and system health in the subject areas that it tests.   NSA results can help a school to benchmark itself against national averages and can indicate to educators at a national level whether students are achieving at the competency levels dictated by the national curriculum. NSA results are not intended to measure achievement for individual students. Summary data based on an assessment of the proficiency band for the student's grade level is most useful.

National Curriculum and Text Board (NCTB) has developed a guideline for continuous assessment of primary school student from grade I to III. While developing a Student Assessment System, Continuous Assessment should be on the top priority and for this the guideline of NCTB should be used. If any changes done on this guideline by NCTB then Continuous Assessment Module should modify to address those changes.

The PECE/EECE is the second and most comprehensive summative assessment tool in use in Bangladeshi primary schools and madrasah. While item analysis of the PECE/EECE will be undertaken by the proposed Assessment and Research Center (ARC), DPE needs to retain a database of individual student scores. Although PECE/EECE results are stored digitally, this database system needs to be upgraded. The PECE/EECE is a high stakes examination and the current system of sending in data on CDs is a security risk. An online system would be an improvement and would also support the proposed decentralisation of the PECE administration. As school and national databases are expanded to include individual student profiles, it will be possible to link PECE/EECE results to unique student IDs rather than roll numbers assigned by the school, as is currently the case, so that achievement data can be transferred between schools and can transition with the student to secondary school. While detailed data about answers to individual questions required for item analysis would be stored at the ARC proposed under the new program, there would be an advantage in storing summary results statistics linked to student and school records in DPE databases. However, until the school adopts unique national student IDs, the data to be linked with the online APSC will only include sex disaggregated summary data.

2.7.7   School catchment data

Each primary school is expected to have a defined catchment area from which it draws students. Teachers of the school are tasked with collecting data on all students age 4 to 15 years in the school's catchment area (whether they attend the school or another school or do

not go to school). Although there are many flaws in the collection of school catchment data, there is no logical substitute for the current system. In the past, one of the main problems has been with parents not enrolling their children in school at the correct age because their age is not precisely known. However, community recognition of the importance of birth registration is growing as government benefits are increasingly being denied to children who are not registered resulting in childrens' ages being known with greater accuracy. Similarly, with community outreach being part of the Diploma in Primary Education (DPEd) program, it can also be hoped that links to the community will grow stronger as more DPEd trained teachers are deployed to schools and that this will also result in more reliable data.

2.7.8   GIS and Remote Sensing

A GIS-based Information system will be developed having the integration of databases, elimination of information duplication, and filling in data gaps. Business Intelligence (BI)-supported geo-spatial information-based planning will be confirmed by the proposed GIS based system. The DPE e-Monitoring system will be fully activated based on the proposed GIS-based system. Moreover, actual GIS coordinate based tracking of schools and field inspections will be ensured through remote sensing. DPE, with the technical support of IMD, will monitor the achievement of PEDP4 objectives, results, and all DLIs, and provide consolidated reports on the implementation progress of the program activities. The DPE line divisions will be benefited from the work that IMD has already commenced to set up data and workflow systems to support more timely and reliable activity/output monitoring. Dashboard data will mainly be sourced from the digital systems of DPE including school monitoring data collected by field offices, and synchronized to the e-Monitoring system to enable real-time monitoring at all field offices. Data systems will be developed to monitor and facilitate SLIPs/UPEPs and their associated financing, PEPMIS, DPE AIS, school feeding system, students' stipend database and so on.

2.8   ICT Infrastructure for Comprehensive MIS Initiatives

During the PEDP-3 period DPE has taken several initiatives to achieve the quality primary education. These ongoing developments have been continuing in present development program which is PEDP4. In PEDP4, from DPE to field offices and school level, supply of adequate ICT infrastructure are targeted. Out of those, remarkable initiative is to establish another one multimedia classroom with internet service to every government primary school. This will empower the ICT based digital class room. Moreover, the improvised ICT setup will facilitate school level access to information as well as extend the present data collection mechanism for the integrated DPE system. In a nutshell, to achieve the SDG, ICT educated human resource will be grown up from the primary education level.

3.0   Design Considerations and Quality Assurance

4.0.1 The design considerations for the development and identification of modules corresponding to the functionality given above are:-

Consideration	Statement
Access	➢ Single window internet & intranet to various stakeholders
Usability	➢ Easy and acceptable UI (user interface) and UX (user experience)
Interoperability	➢ Proposed solution must insure interoperability across other internal

	or external system
Availability	➢ There should not be single point of failure in terms of solution availability
Modular Approach	➢ Layered Architecture ➢ Modular Design ➢ Ensures the re-usability of components
Security	➢ Role Based Access ➢ Physical (Zone based separation), ➢ Log audits ➢ Information Systems Security ➢ Data Security ➢ Data Privacy ➢ Network
Scalability	➢ Scalable to new modules or functions in future ➢ Ensures Vertical and Horizontal Scalability
Data	➢ Government is a Data Trustee ➢ Data is an Asset
Re-usability	➢ Build Once, Use Many Times ➢ Single Source of truth ➢ Ensures the re-usability of components
Vendor-Agnostic	➢ Enterprise Architecture is Technology Independent

Table 2: Design Consideration for Integrated System

3.1 Key Benefits
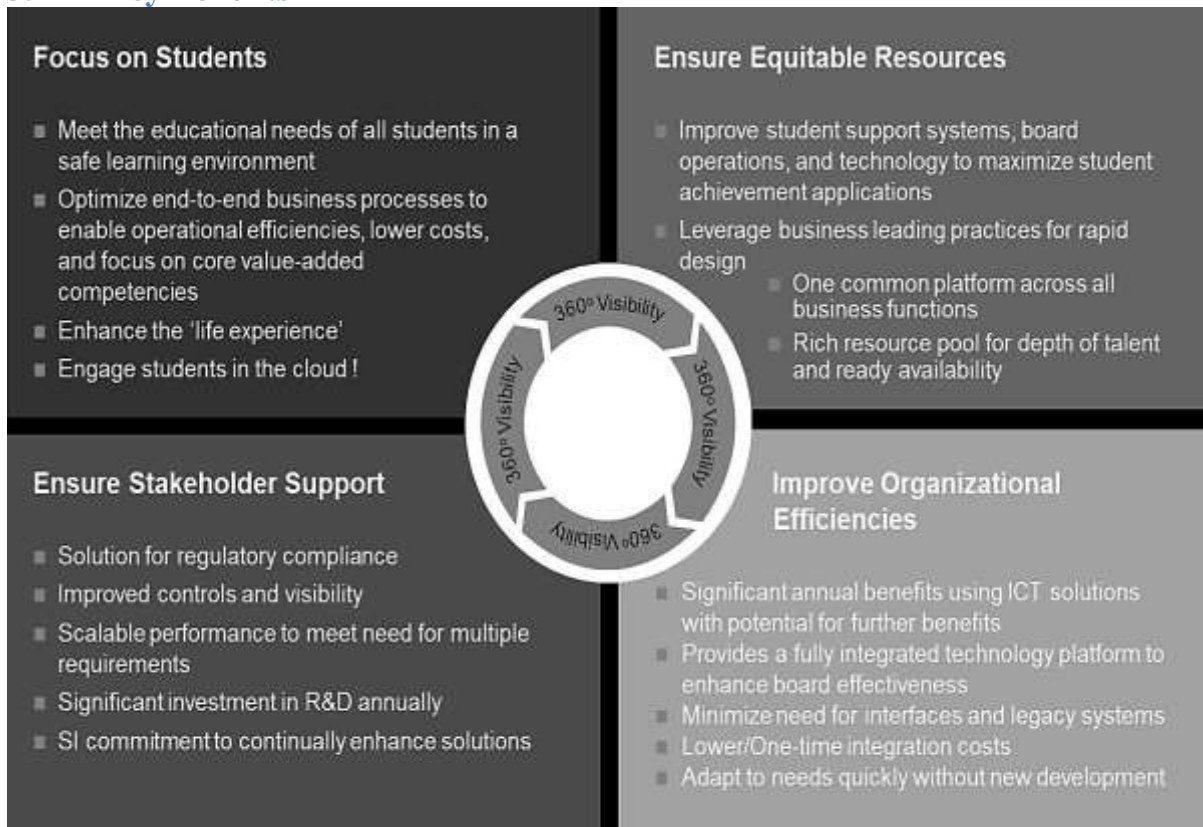
3.2   Feature Highlights

➢ Single Integrated System to support entire primary school business cycle.
➢ Scalable for without loss of performance.
➢ Integrates to various technology options.
➢ Truly global solution.
➢ A "future-proof" application based on configurable processes and open standards that deliver flexibility.

3.3   Risks & Mitigation

No.	Risk	Impact	Probability	Mitigation
1.	Technical risk of the proposed solution architecture not working	High	Low	Proven System Integrator/consultant has already done many projects using the similar Commercial off-the shelf (COTS) products for similar kind of complex solutions.
2.	Delay in Inputs from DPE or some key government stakeholder	High	Low	Governance mechanism being setup in a manner where the project team looks at all activities affecting the project and working with the Government team as a single unit.
3.	Underestimation of the complexity of the requirements by System Integrator/Consultant	Medium	Low	Execution is based on proper design documentation. Hence complexity would be addressed at the design stage itself. Further, as functional requirements are not changing, the risk is lower.
4.	Co-ordination & proper deployment of solution with hardware vendor	High	High	Since hardware may be procured by different vendor it's a high risk in case the deployment architecture and processes are not well defined, client should factor for Enterprise Architect who will ensure the smooth deployment of the application, coordination with hardware vendor is out of scope.
5.	Data quality could be suspect causing delays in data migration and hence rollouts	High	High	This is a strong possibility, due to large number of data and multiple sources. Hence data migration activities are being started in parallel with the development, giving enough time for data cleansing.
6.	Timely sign-off on wireframes & Gap analysis document	High	Medium	DPE or other relevant authority must provide the timely signoff on the SRS document to insure timely delivery.

No.	Risk	Impact	Probability	Mitigation
7.	Frequent Changes in process or functional requirement	High	Medium	Once the Software Requirements Specification (SRS) document is signed off its recommended to not propose any process changes till Go-Live.
8.	Wish list requirement Vs Must have requirement	High	High	While requirement gathering Project Management team must ensure that the features which are asked to be implemented should be practical considering time period and product, wish list should be identified and must be kept separately.

Table 3: Risk and Mitigation

3.4   Generic Modules

Apart from the modules listed above, we are required to capture the generic application software modules which would be required to enable the ancillary functions of a particular organization or department. These would contain, the following:-

- **Email Application:** Email applications are generic office applications which enable the department to distribute and disseminate official memorandum and notifications to all employees.
- **Knowledge Management:** Application which would work as an on-line knowledge repository
- Document Management
- Library Management
- Digital Resource Management
- Asset management
- Exams & result
- Inventory Management
- Biometric/Security Management
- Course Management
- Enquiry & Helpdesk / Grievance Redressal
- Identity & Access Management
- Human Resource Management System
- Analytics
- MIS & Reporting
- Timetable management
- Financial Management System (Finance & Accounts System)
- Grants & Funds Management System
- Purchase Management System
- Facility Management System
- Notes & Assignment System

3.5   Classification of Applications

These applications may then be logically grouped in to Core/Business Function Support, ancillary and enabling functions.

Classification	Module Name
Core Module	- Student Management - Course Management - Attendance Management - Exams & Result Management - School Asset Management - Inventory Management - Vehicle Management - Staff/Teacher Management - Identity & Access Management
Business Function Support	- Finance & Accounts Management - Payroll Management - Grant & Funds Management - Payment Management - Procurement Management
Ancillary Functions	- Facility Management - Alumni Portal / Webpage - Timetable Management - Security / User Rights Management - E-Notice - Notes & Assignments - HRMS - Library Management - Digital Asset Management - Document Management - Analytics - MIS & Reporting
Enabling Functions	- Smart Card Integration - Enquiry/Helpdesk & Grievances - Biometric Security

Table 4: Classification of Modules

3.6 Non-Functional Requirements of Directorate of Primary Education

3.6.1 Scalability Provisions

Sl. No.	Description
1.	Sufficient number of ports for addressing the required bandwidth shall be provided by cloud service provider as per sizing requirements detailed out in.
2.	The system shall provide load balancers at various layers of application deployment, facilitating high availability.
3.	The system shall provide horizontal scalability in such a manner that a new resource can be added (or removed) dynamically, as and when required in future, without disturbing the normal functioning of production system.
4.	The system shall support about 45 Lakhs user's environment seamlessly considering the total number of students, faculty, administrative users and department users.

Table 5: Scalability Provisions

3.6.2 Performance Provisions

Sl. No.	Description
1.	The system shall support 5000 concurrent users on average by considering various types of users in first year of O&M phase and it shall be scalable based on the demand in subsequent years.
2.	Response time shall be on average 3 seconds for 90% of transactions and remaining transactions shall not exceed response time of 10 seconds. Response time is defined as the time between when user sends a service request and when user receives response (output on the screen).
3.	Response time of services shall remain within operational Service Level Agreement (SLA) limit even during peak usage with 2 Mbps link.
4.	The users may perform different kinds of activities on the system, including downloading or uploading large files like images, documents, multimedia etc. The system must have acceptable level of performance even during peak usage.
5.	The system shall respond to user requests within operational SLA limit. This SLA applicable to MIS and analytical reports as well.

Table 6: Performance Provisions

3.6.3 Availability Provisions

Sl. No.	Description
1.	The network level redundancy shall be achieved through procuring leased lines from two different service providers, redundant network devises. Redundant ISP links, as Cloud Provider shall be provided.
2.	Redundancy in security components and load balancers, in high-availability mode, shall be provided to facilitate alternate paths in LAN including all supporting systems.
3.	Redundancy shall be provided to Education Package and all related critical components of architecture including web, application, and database layers. The size of each server/instance and total number of servers/instances in a cluster shall be determined to meet the performance requirements, even if a particular server/instance is unavailable.
4.	The system shall be available 24x7 with 99.5% of uptime on the average and, strictly adhering to these SLAs during working hours of schools and colleges from 8 am to 8 pm.

Table 7: Availability Provisions

3.6.4 Reliability Provisions

Sl. No.	Description
1.	The system shall be a reliable system with consistent and repeatable behaviour in terms of quality, availability, scalability, and performance.
2.	The system shall be robust and tolerant to certain level of faulty use. For example: The entire system should not come down if an user accidently inputs wrong value, or uploads incorrect data.

Table 8: Reliability Provisions

3.6.5 Manageability Provisions

Sl. No.	Description
1.	The system is required to cater to stakeholders across the country accessing it from multiple points and through multiple channels like Desktop, Laptop, Mobile, Tab, etc. Hence the manageability of this system is essential to ensure effective monitoring and timely resolution of any issues surrounding performance, availability and security.

Table 9: Management Provisions

3.6.6 Usability Provisions

Sl. No.	Description
1.	The system shall be made available on all major browsers &mobile platforms and SI shall propose suitable solution.
2.	The application itself shall be user friendly and any new user must be able to easily use functionalities offered by the system.
3.	Error messages or pop ups must be helpful to an extent that user can take next action and does not experience too much discomfort.
4.	User interface must be simple yet user- friendly, and the workflow should be intuitive so that user/student can complete his work with least time and effort.
5.	All the system alerts and error messages shall be available in local languages for understanding of students, etc.

Table 10: Usability Provisions

3.7 Different Architectures of Comprehensive MIS

3.7.1 Functional Architecture

The Government of Bangladesh attaches great significance to the Education Sector. The Functional Architecture consists of multiple applications which work across a number of applications to deliver value to the stakeholders involved in the realm of Primary Education. The core stakeholders are the students and teacher who are supported by the schools and other staff, private businesses providing services and products to the Directorate and other agencies. Planners and administrators desire a reliable set of cross-disciplinary data related to students, faculty, schools and their operational policies. The stakeholders need trust-worthy advice and information related to managing and improving the quality of education from a common platform. When juxtaposed with the tremendous leaps that technology has taken, and its ability to reach a wide section of population, this presents a compelling opportunity for the emergence of a synthesizing platform that could orchestrate structured generation of data, analytics, information, cognitive models and knowledge flow to the demand points. This is sought to be achieved through the integration of applications under the Primary Education Package with Business Intelligence & analytics (such as Big Data reporting tool) under the overall framework. The Business architecture sets out to plan and consolidate all necessary Business application software in a single homologous environment in order to achieve the dream of a successful primary education for the masses.
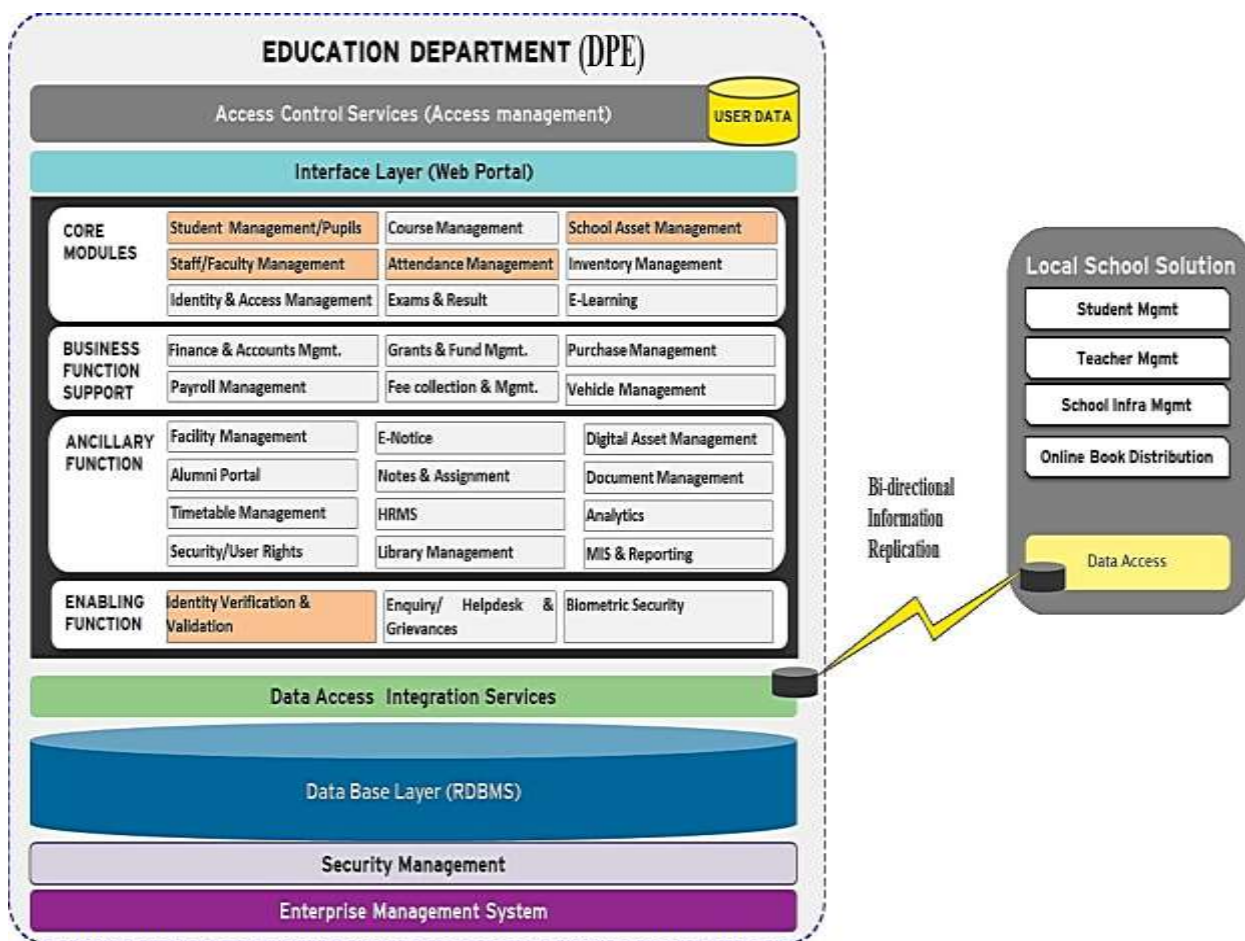
Figure 5: Functional Architecture

3.7.2   Application Architecture

The Business Architecture takes in to account the existing applications in the Directorate of Primary Education such as School Infrastructure Management System, teacher and student data management systems, etc. and other applications which are currently implemented and or in design/conceptualization stage and accommodates these functionalities in the greater scope of ICT automation of the entire directorate. The Business Architecture helps identify and map the corresponding Solution Building Blocks in the form of application software functionality required to enable and empower the underlying Business requirements. It also intends to accommodate the growing needs of a burgeoning and predominantly young population and consequently plans for future integration of more complex ICT systems such as HRMS and Finance & Accounting modules. These would also take in to account the various applications required to handle the core business domain subjects such as Course Management, Attendance Management, Exams & Results Managements, Inventory Management along with the additional generic applications which may be required by the DPE in order to function as a cohesive and collaborative manner, for instance – Email, grievance redressal, Knowledge management, identity and access management, etc. The following diagram provides an indicative overview of the Application Architecture which would enable this ICT automation vision.
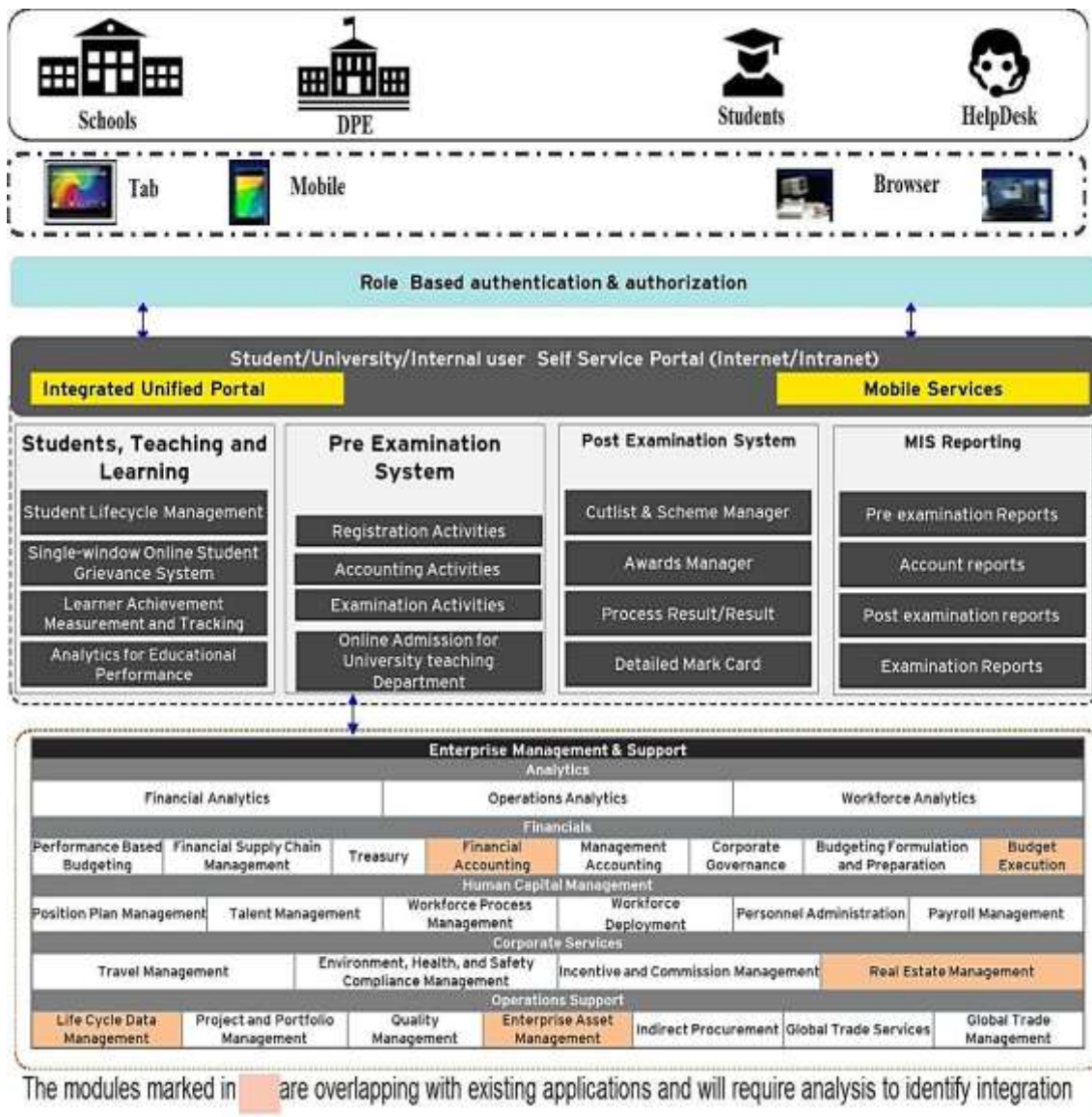
Figure 6: Application Architecture

3.7.3 Data Architecture

The New era of Data Architecture is upon us with real-time methods (event-driven Architecture). BNDA Bus will facilitate near real-time integration. The system will adapt Service Oriented Architecture concepts and provide Data Services for frequently used queries and updates. IT department can propose the technical solution based on the requirements.

Master data represents the business objects which are agreed on and shared across enterprises. Department level master data includes objects that are shared between different applications within a department. State-wide master data are objects that are shared across departments. Common master elements will be captured and made available on Data Hubs. Department specific master data will be captured in department databases. Education sector specific master data has been identified and listed in a separate document.
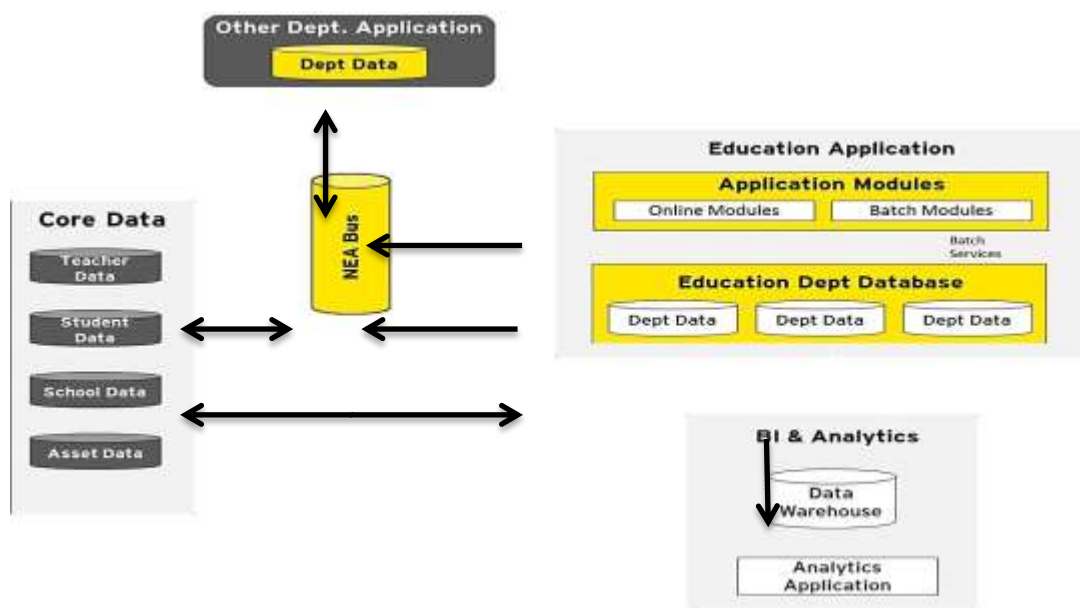
Figure 7: Data Integration Model

3.7.4 Data Migration approach
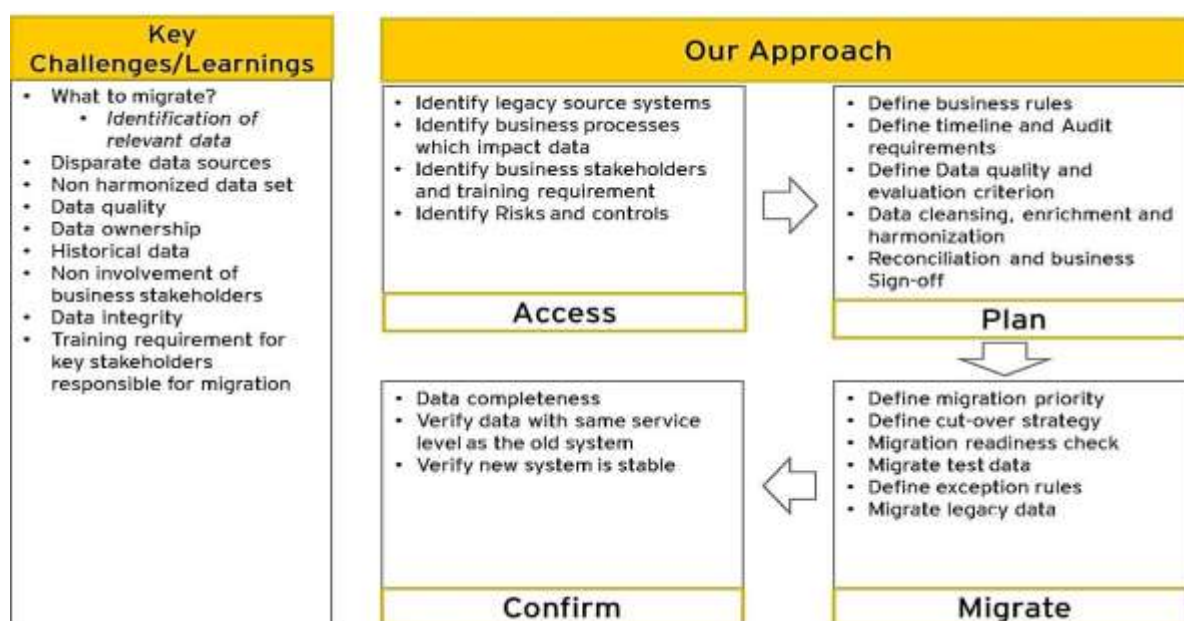
Figure 8: Data Migration Strategy

3.7.5 Data Architecture Compliance Requirements

Sl. No.	Data Architecture Completion Requirements
1.	Standard schemas shall be published for all data entities and accessible through standard SOA services.
2.	Access to a data entity shall be restricted only through a designated single-point-of contact interface.
3.	Data access requirements shall be defined clearly based on role, responsibilities and need to access data.
4.	Providers and consumers for each data entity shall be defined clearly.
5.	Metadata and Data Standards (MDDS) shall be followed. At each domain level,

Sl. No.	Data Architecture Completion Requirements
	metadata and reference data standards shall be used if available, otherwise they shall be defined.
6.	Data quality controls shall be established by ensuring incoming data is of good quality. Invalid data shall be prevented through strict semantic and syntactic checks at run time.
7.	Batch and real-time data integration mechanisms shall be available.
8.	Data lifecycle management plan shall be in place and implemented.
9.	Databases shall be scalable in terms of total space, number of tables, views and users.
10.	Data integration shall be maintained between related entities by defining primary keys and secondary keys relationships.
11.	The Target Application shall ensure that all relevant data specific reference architectures, architecture patterns, best practices and standards from national and global level are followed, wherever they are applicable.

Table 11: Data Architecture Completion Requirements

3.7.6 Technology Architecture

3.7.6.1 High Level Technology Architecture

Technology Deployment Architecture of Education Package assembles the assets and capabilities required for the Education Package Systems deployment. It defines logical and physical view of Education Package Systems identified in Application Architecture.

3.7.6.2 Logical Technology Architecture

The logical technology architecture describes logical components that provide various benefits such as integration of systems using common middleware component, centralized data store and high availability of business system and services.

Technology Component	Requirements
External Security Layer	External Security layer will protect the core system from unwanted traffic and provides easy and seamless access with the help of NAC, Load balancer, and reverse proxy and access gateways. Education Package mobile user requests would be rendered or processed through Gateway.
Web Layer	Web Layer will enable external and internal user to access Education Package system through any web browser from any location. Web access layer provides various web interfaces for different types of users like, Tablet Users, Mobile Users and Standard browser users
Internal Security	All internal traffic would be routed through internal security layer which protect Application layer from unwanted attacks
Application Layer	Application layer will contents the business logic and perform the task required for the proposed system like, School Information Management System, Knowledge Management System, etc.
Database Cluster	All the Education Package system structured data will be saved on Database and for high availability databases should be configured on Cluster environment.
BNDA Bus	NEA Bus will be used to connect with third party system either to pull or push the data.

Technology Component	Requirements
Centralized Security	Proposed solution shall have in Security mechanism as per industry standard and defined in Security Architecture.
Centralized Monitoring System	Centralized Monitoring System would manage and monitor all enterprise systems and IT Infrastructure components. It would provide real time alert/notification & dashboard for analysis and performance management.
Mobile/Table users	Mobile/Table users request would come to NAC and then routed to a specific web server. Post that request will be transferred to Channel Enablement Services and Business Process Service Platform to process user request.
Data Backup System	Data Backup shall be major responsibility of Information Management Division, they have to ensure the data backup should be in place with appropriate SLAs being maintained, data backup should be as per backup policy decided by Government of Bangladesh standard.

Table 12: Technology Components and its Requirements
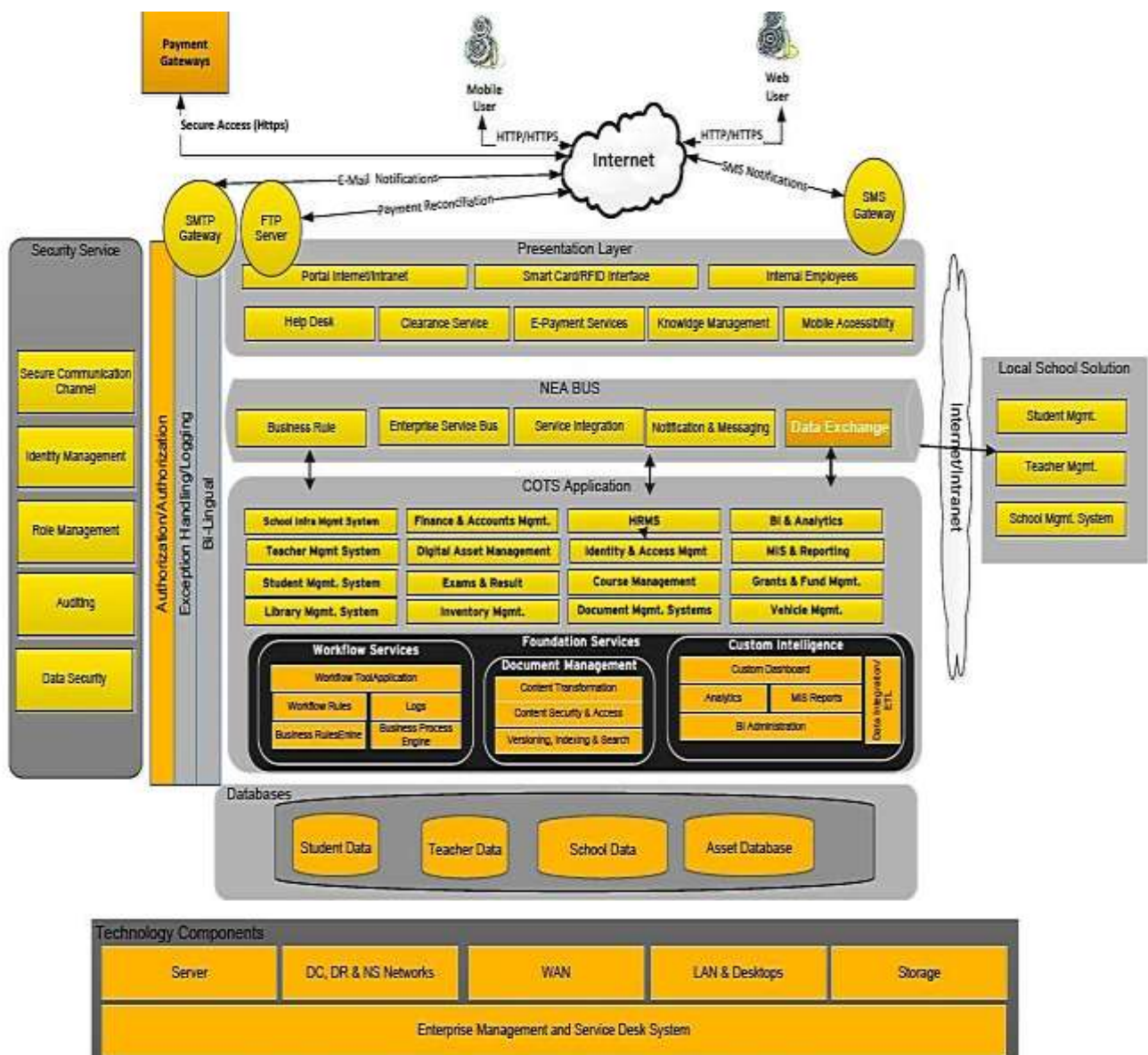
Figure 9: Technology Architecture

3.7.7 Deployment Architecture

This section provides information on the design of a deployment for performance, security, availability and other system qualities. Deployment architecture depicts the mapping of a logical architecture to a physical environment. The physical environment includes the computing nodes in an intranet or Internet environment, CPUs, memory, storage devices, and other hardware and network devices. While designing the deployment an anticipated estimation of the deployment scale is done, in order to determine the physical resources required to meet the system requirements specified in the technology architecture. It may also be decided to optimize resources by analysing the results of sizing the deployment to create a design that provides the best use of resources within business constraints. After a deployment architecture design is complete the actual cost of the deployment is assessed during project approval. Once the project is approved, contracts for completion of the deployment need to be signed and resources to implement the project acquired. A detailed design specification may be drafted at this stage. The detailed design specification is used in the implementation phase to build out the design.
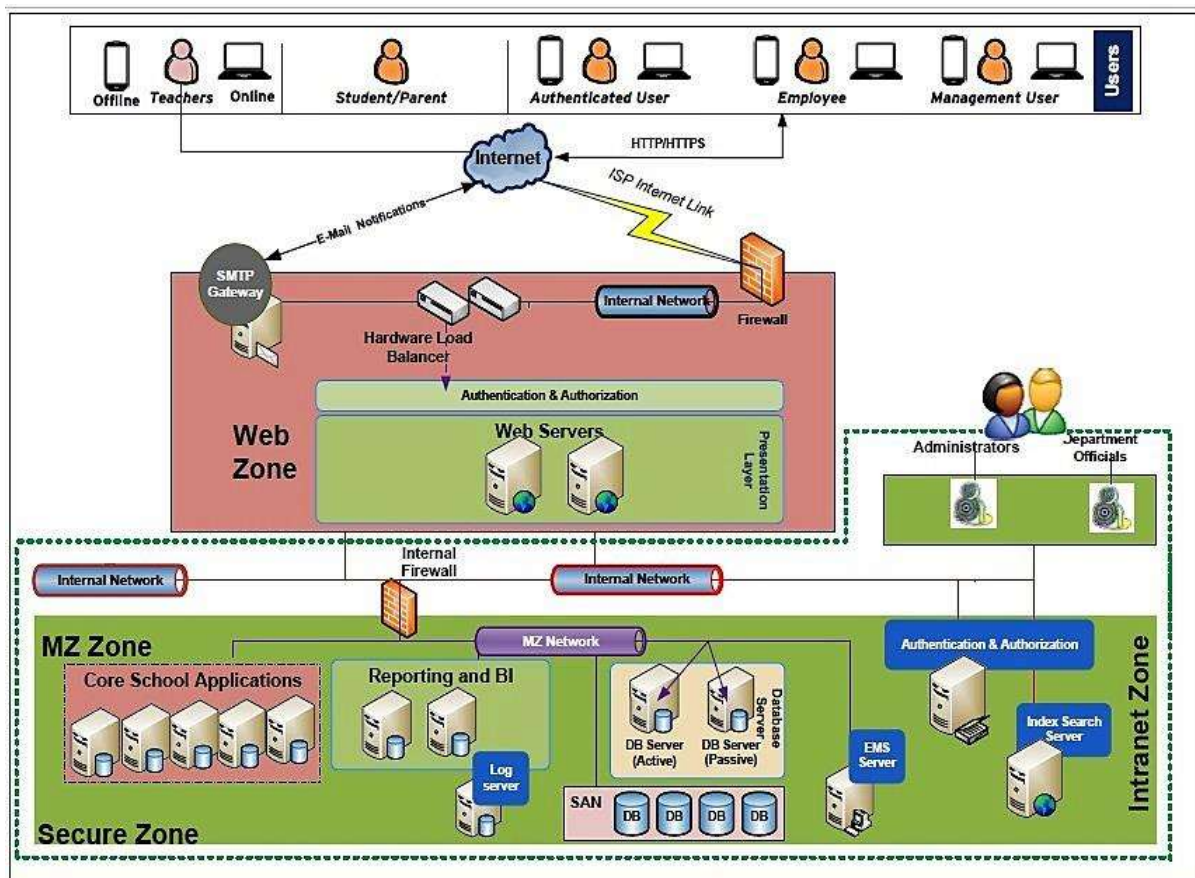
Figure 10: Deployment Architecture

3.8   Software Testing and Quality Assurance

Quality Assurance (QA) being termed as several processes across the organization for every department and group which are matured to different levels over a period of time. The Systems Integrator is expected to follow a meticulous Quality Assurance process as defined by its organizations during all activities and phases of the complete project duration. However, it is mandatory to check the Government of Bangladesh policies, standards, guidelines and specifications that are recommended at all stages always using the latest revisions.

3.8.1 Software Quality Control (SQC)

The developer teams are expected to follow a very systematic approach and use appropriate tools for bidirectional trace-ability including the defect tracking. The tool is expected to provide end-to-end trace-ability from requirements to defects and vice-versa (reverse traceability). As every Business Process is expected to be achieved by composition of services (Orchestration or Choreography) all such services should be mapped to specific requirements. Similarly, it has to be noted that all non-functional requirements have to be mapped to test cases which in turn should help to substantiate the SLAs related to Performance, Scalability, Availability, Security etc. The developed solution should adhere to industry standards and the principles propagated in Bangladesh Nation Digital Architecture (BNDA).

The quality certification for every intermediate, demo or staging release is expected to be given based on detailed analysis and necessary reports substantiating the relevant criterion. Passing or failing requirements based on traceability is mandatory. Every business process, service, module and sub-module has to be certified not only based on the requirements that are passed or failed but also the test cases and the defects still pending.

Different types of testing are anticipated like user interface testing, functional testing, compliance testing, acceptance testing, smoke testing, integration testing, systems integration testing, operational readiness testing, performance testing, load testing, stress testing, pre-production and production testing. All Services and Business Processes have to be tested in a standalone mode and SQTC (Software Quality and Testing Center) service of BCC can be utilized.

Products, Applications (Desktop, Browser or Mobile) and Portals have to be tested for all the user interface requirements in addition to the functional and non-functional requirements as applicable. In all stages and different kinds of testing wherever possible it is required to use appropriate tools.

Sl. No.	Test Type	Description
1.	User Interface Testing	Graphics harmony, usability, navigation and functionality have to be tested using the same traceability approach for the appropriate requirements. For repeated testing of user interface recording, scripts and other techniques and tools are advised. Standards and policies for graphical design have to be followed and the same are expected to be tested.
2.	Functional Testing	As a part of the functional testing all the services (granular web services), business services and business processes are expected to be tested independently in standalone mode using appropriate tools. All messages (request/response) have to be tested for requirements including the compliance, security, performance and other criteria. The products, applications and portals have to be tested for the functional and non-functional requirements.
3.	Integration Testing	The integration testing is the functional testing for integration requirements. All requirements for integration between sub-modules, modules, intra-package and inter-package that are

Sl. No.	Test Type	Description
		identified during the requirements documentation have to be tested in this phase.
4.	Systems Integration Testing	The systems that are alien to the system developed by the system integrator are to be tested in this phase. The systems could be other products like CRM, CMS, ERP, business processes, payment gateways, other government products and other packages. All such requirements have to identified/tagged in the requirements document.
5.	Compliance Testing	All requirements that are cross mapped to specific clauses in a specification, policy or standard have to be tested in this phase. This testing is expected for all the clauses that are relevant in a specification, standard or policy for the services, processes, products, applications and portals. A report on the clauses of the specification with pass or fail results for compliance is mandatory.
6.	Performance Testing	Performance Testing includes but not limited to load, stress, scalability and availability testing requirements and related criteria. To meet specific SLAs or requirements necessary testing tools have to be used to confirm that the results meet the defined criterion.
7.	Security Testing	At different levels from services to products and applications, security has to be tested. Services are to be tested not only for licensing, access, authorization and other aspects but also for penetration and injections for web, application and information tiers. User interfaces have to be tested specific security requirements like URL rewriting, bots and others. Not only the access, authorization, auditing, validating, confidentiality, integrity, availability aspects of an application, service, process, product or portal but also appropriate specifications referred or listed in the requirements document. All security protocols (SSL, HTTPS, etc.), encryptions and other requirements have to be tested in this phase.
8.	Acceptance Testing	This otherwise called User Acceptance Testing is the testing of the product owners/stakeholders who validate all functionalities as per the business. Such a subject matter expert team can also review requirements and can pass or fail using the User Acceptance Test cases that are usually end to end in nature.
9.	Smoke Testing	The application or services are tested after deployment in its environment to ensure the application sanctity. Some basic test cases are identified and run to check this.
10.	Operational Readiness Testing	The production ready infrastructure and the environments are tested for its capacity, size, licenses, upgrades, versions and all other aspects for compatibility including other systems for integration. All scalability, availability in terms of redundancy, performance and all such requirements are ensured. In a cloud the servers and environment procured initially also has to be tested to ensure the requirements compatibility. Necessary loads may have to be generated using tools for Scalability testing in a cloud environment.
11.	Pre-Production Testing	This is otherwise called limited user testing. Before taking a release version to production limited users are identified and rolled out to them to monitor the product or application. Any fixes required are applied before taking to products.

Sl. No.	Test Type	Description
12.	Production Testing	A full release version is tested with full loads by end users for a limited period. This is otherwise called the warranty state or stabilization period. It is recommended for a solution for automated testing and automated test case generation. This ensures complete and appropriate test cases are generated, reducing waste and enhancing application quality, as long as the scope and coverage of test cases and their results are verified and signed off by Project Management Unit (PMU).

Table 13: Tests required for Integrated System

4.0 Implementation

4.0.1 The Government believes that technology is guaranteed to bring prosperity and happiness to the human race with quite a few obvious possibilities. With that end in view, DPE will implement this roadmap under overall guidance of the government. A small and dedicated coordination unit in DPE will provide necessary support to govern the implementation of this roadmap for comprehensive MIS. The unit will play a critical role in working with field offices and institutes to ensure that the Vision is delivered.

4.0.1 National Digital Architecture enabled Roadmap

Different Divisions of DPE may have different needs for IT-services, but a converged roadmap to achieve the common vision along with common processes and a consolidated application landscape would enable IT to act and deliver fast. The implementation process should start by taking stock of the existing applications. At the outset a critical revision/cleaning of the existing master data set should be carried out. This will help determine integration points, data set sizes and other parameters. The IT enabled transformation roadmap has been shown below may need redesign with the approval of bellow mentioned high-level oversight committee.
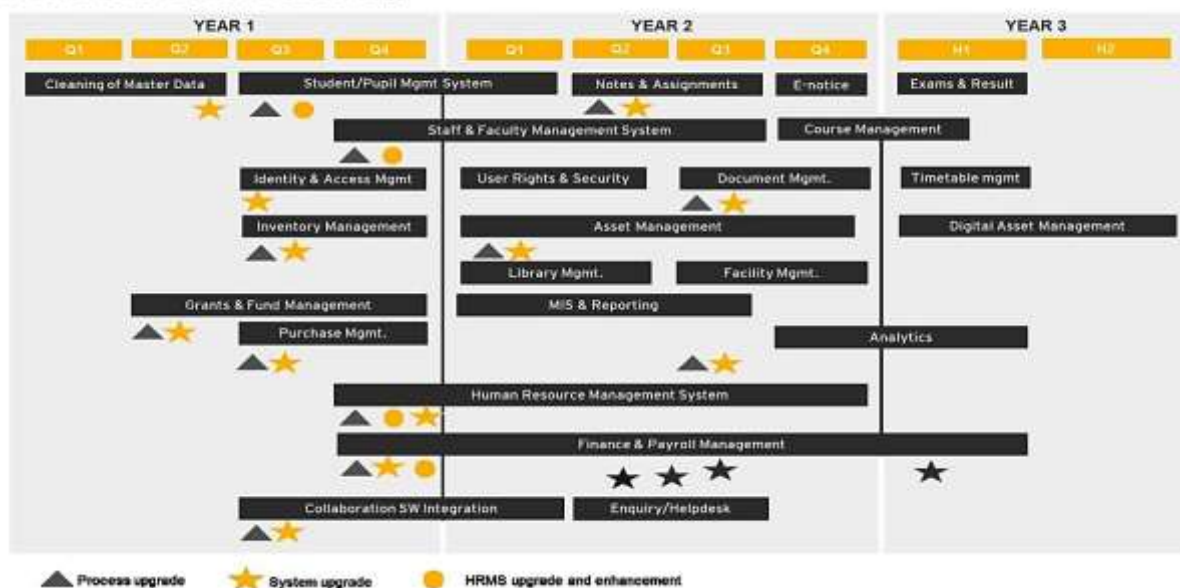

Figure 11: IT Enabled Business Transformation Roadmap

4.1   The Road Map

4.1.1   This Strategy and Plan has 10 strategic objectives which are expected to be achieved within a specific time period. Following is a tentative action plan elaborating specific actions against those objectives to be materialized within the given time limit. Every action item will be implemented within the indicative timeframes, e.g., short-term, mid-term and long-term. Short-term is meant to be within next 3 years or so, i.e., the PEDP4 period, mid-term will be longer than 3 years but not more than 8 years coinciding with the possible PEDP4, while long-term will be longer than 8 years meaning beyond PEDP4 period. In the below table, implementation responsible Divisions of DPE are abbreviated based on their Director. These are A - Administration, IMD - Information Management Division, F - Finance, M&E - Monitoring and Evaluation, Pr - Procurement, P&D - Planning and Development, P&O - Policy and Operation, and T for Training.

Sl. No.	Actions Required	Responsibility	Short -term	Mid- term	Long -term	Remarks
	Strategic Objective 1: Better delivery of services.					
1.	Deliver new and better ICT enabled services	Director (A) & Director (IMD)	√			On-going
2.	Simplify and make consistent processes to enable improved and more standardized approaches (Service Process Simplification and Innovation) to service delivery and ICT capability	Director (A) & Director (IMD)	√			On-going and to continue
3.	Ensure use of multimedia resources in classroom teaching as well as for teacher training	Director (P&O) Director (T)	√			On-going and to continue
4.	Establish another independent multimedia classroom in every school	Director (IMD)	√			
5.	Convert every classroom in every primary school into a multimedia classroom to facilitate use of ICTs	Director (IMD)			√	
6.	Arrange substitute power source, solar or others, to ensure regular supply	Director (IMD)		√		
7.	Supply laptops and multimedia equipment with solar system to schools where grid electricity is not available	Director (IMD)		√		
8.	30% of primary schools to have an ICT laboratory	Director (IMD)			√	
9.	Ensure internet connectivity for all URC and PTIs	Director (IMD)	√			
10.	Establish a Computer Lab in each URC	Director (IMD)		√		
11.	Ensure internet connectivity for all schools	Director (IMD)	√			To continue
12.	Develop digital contents in local languages for teaching-learning in the classrooms	Director (T)	√			To continue
13.	Create provision for outsourcing partners for development of digital contents suitable for child education	Director (T), Director (IMD)	√			
14.	Provide incentives/rewards/testimonial to teachers for e-learning content development	Director (P&O)	√			
15.	Organize regular national competitions amongst the teachers and instructors on digital content development	Director (T), Director (IMD)		√		to continue

#	Task	Responsible				Remarks
16.	Organize annual fair to create opportunity of demonstration of educational materials (digital)	Director (A)		√		
17.	Develop a broad-based strategy to ensure availability of digital contents for educational purposes	Director (A), Director (P&O)	√			
18.	Facilitate orientation of primary school students on computer-related technologies	Director (IMD)	√			to continue
19.	Enable all students to have general knowledge of computers, software and their benefits	Director (A) Director (T), Director (IMD)		√		
20.	Create online services for all students for admission, registration, progress report cards, filling up of exam forms, submission of fees, Stipend Payment etc.	Director (IMD)	√			Student Module
21.	Develop a Model School as an Information Access Centre with ICT facilities for teachers and students in every union	Director (IMD)		√		
22.	Establish one computer lab for each school with at least 20 computer terminals	Director (IMD)			√	
23.	Introduction of digital textbooks in primary schools	Director (A), Director (IMD)		√		
24.	Introduction of digital textbooks for use by the students of primary schools	Director (A), Director (IMD)	√			
25.	Increase use of radio and television for transmission of educational programs for both students and teachers	Director (P&O)	one hour /day	four hours/ day	8 hours/ day	Phase wise
26.	Establish a system of e-learning and distance education	Director (T), Director (IMD)				
27.	Ensure access to education for children with special needs including those in isolated rural communities using ICT tools	Director (P&O)		√		
28.	Ensure access to education using ICT tools for children belonging to ethnic minorities	Director (P&O)		√		

Strategic Objective 2: Better and improved capability.

#	Task	Responsible				Remarks
1.	Ensure ICT training for at least one teacher of every school	Director (T), Director (IMD)	√			
2.	Ensure ICT training for all the primary school teachers	Director (T), Director (IMD)		√		
3.	Organize IT training for all staff working at the Headquarters and the field offices	Director (T), Director (IMD)	√			on-going and to continue
4.	Make provisions for incentives/special loans/performance-based grants to teachers to acquire ICT tools	Director (A), Director (F)	√			
5.	Procurement and installation of necessary equipment for divisional, district and upazila offices	Director (IMD), Director (A), Director(Pr)	√			on-going and to continue

No.	Activity	Responsible					Remarks
6.	Procurement of IT equipment for the DPE Headquarters to enable digitization	Director (A), Director(Pr)	√				on-going and to continue
7.	Prepare a detailed work plan to function digitally in a given time frame	Director (IMD)	√				
8.	Provide necessary IT equipment to the field offices and schools to enable them to work digitally with the Headquarter	Director (IMD)		√			
9.	The library/book corner in each school will have enough books on IT	Director (A)			√		
10.	Build capability across DPE to manage and deliver ICT enabled programs/services	Director (IMD)	√				
11.	Increase awareness and use of existing technology capabilities	Director (IMD)	√				
12.	Build on existing ICT workforce planning approaches to make better use of the ICT skilled workforce across DPE	Director (IMD)	√				
13.	Generate ideas through challenges and competitions to create opportunities for external and internal ICT innovation	Director (IMD), Director (A)	√				

Strategic Objective 3: Better access to information.

No.	Activity	Responsible					Remarks
1.	Develop standards and online system for the use of geo-location-based information (GIS)	Director (IMD), Director (M&E)	√				
2.	Create capability within DPE to capture, share as appropriate, and analyze information so that trends can be identified and used to better inform policy development	Director (IMD), Director (M&E)	√				
3.	Ensure proper maintenance of records relating to teachers, students and the officials	Director (IMD)	√				
4.	Develop online individual student performance tracking system	Director (IMD)	√				Student Module
5.	Create/upgrade information system for all schools and teachers (including personal information) in the same platform	Director (IMD)	√				School module, Teacher Module
6.	Make all public information available to the people through electronic media	Director (IMD)		√			
7.	Develop online System on public examination (PECE)	Director (IMD)	√				
8.	Set up a national library of e-learning contents and make available for use by the primary teachers and students	Director (IMD)		√			
9.	Development of links/APIs with other government database systems	Director (IMD)	√				Nationally Interoperable
10.	Establish/strengthen a central data center with adequate hardware, software, security, sharing and preservation system	Director (IMD)	√				
11.	Publish all publications digitally in Bangla and English using a standard encoding to guarantee portability	Director (A)		√			
12.	Mandate all eligible information to be made accessible through appropriate electronic means including SMS and other channels	Director (A)			√		

13.	Developed and establish an integrated Digital Primary Education Management Information System (DPEMIS)	Director (IMD), Director (M&E)	√				DPEMIS (Portal of all modules)
14.	Build an effective office management system including Personnel Management Information System (PMIS) and Financial Management Information System (FMIS)	Director (F), Director (IMD), Director (A)	√				
15.	Prepare a comprehensive student database in coordination with birth registration and national population database.	Director (IMD), Director (M&E)	√				
16.	Prepare a database of the Head Teachers and Assistant Teachers of the primary schools	Director (IMD), Director (M&E)	√				Teacher Module
17.	Ensure an integrated system which will cover all the DPE system	Director (IMD)	√				Integrity

Strategic Objective 4: Better internal and external communications.

1.	Introduce proper system to communicate with people	Director (A)	√				
2.	Use appropriate tools in a targeted way to engage with people to improve peoples' participation in policy development and better service delivery	Director (A)	√				
3.	Automate processes to improve interactions with the people	Director (A)	√				
4.	Create opportunity for the members of the public to leave their comments and suggestions on school performance and functioning of DPE	Director (A)	√				
5.	Build an online channel of communication with the teachers, students, officials and the members of the public through frequent use of technology-based communication tools	Director (A)	√				
6.	Introduce a mobile communication network involving every school and every officer at the center and the field level	Director (A)	√				
7.	Supply internet service/mobile SIM cards to the schools and officers	Director (IMD)	√				to continue
8.	Continue and improve functioning of blog https://www.facebook.com/pages/প্রাথমিক শিক্ষা ফোরাম/	Director (A)	√				
9.	An online Primary Education Forum with blog facilities and equipped with all information on primary education in Bangladesh will be created	Director (A), Director (IMD)	√				
10.	Introduce an interactive online teachers' platform so that the teachers can easily interact among themselves and directly contact with the top management of DPE	Director (A), Director (IMD)	√				
11.	Introduce an interactive online platform for the field level officers and staff for direct contact with the top management of DPE and interaction between them	Director (A), Director (IMD)	√				

No.	Activity	Responsibility					Remarks
12.	Create an online platform for students to interact with their teachers and fellow students	Director (A), Director (IMD)		√			
13.	Explore partnerships with corporate sector, academia, the community and the third sector to inform policy and deliver services	Director (A), Director (IMD)		√			
14.	Establishment, regular updating and maintaining of a National Education Portal (with blog facilities)	Director (A), Director (IMD)		√			
	Strategic Objective 5: Better staff development.						
1.	Ensure professional development of teachers through ICTs	Director (T)	√				To continue
2.	Include topics relating to ICTs in the curriculum of primary teachers' training	Director (T)	√				
3.	Provision of advanced in-service training on ICT for primary teachers	Director (T)	√				
4.	Supplying books on ICT in easy Bangla language to every school	Director (A)		√			
5.	Develop online course contents/modules for teachers training	Director (T)		√			
6.	Organize online courses for teachers training	Director (T)		√			
7.	Make ICT training a pre-condition for being recruited as an Assistant Teacher	Director (P&O)	√				
8.	Make Diploma in ICT a pre-requisite for being directly recruited as a Head Teacher	Director (P&O)	√				
9.	Recognizing Degree/Diploma in Computer Science as a preferable qualification for appointment as a Head Teacher or Assistant Teacher	Director (P&O)	√				
10.	Organize professional training on ICT for all officers of DPE	Director (T)		√			
11.	Provide basic and advanced computer training to all staff of DPE	Director (A)		√			
12.	Make provisions for future recruitments at the staff level with mandatory provisions of IT literacy	Director (A)	√				
13.	Mandate basic computer and internet literacy for all Class I and II appointments	Director (A)	√				
14.	Ensure no promotion to national pay grade 9 without demonstration of basic computer and internet literacy	Director (A)	√				
15.	Insert new criteria for assessment of basic computer and internet literacy in the ACR of officers as well as staff	Director (A)	√				
	Strategic Objective 6: Better transparency, openness and accountability.						
1.	Sharing of experiences and resources with non-governmental organizations	Director (IMD)	√				
2.	Make PEMIS available online for all interested quarters	Director (P&D), Director(IMD)	√				
3.	Make online software and report facilities on APSC, ASPR, NSA, etc.	Director (M&E)	√				
4.	Make all DPE tenders available online	Director (Pr)	√				
5.	Allow submission of bids online	Director (Pr)	√				

#	Activity	Responsible					Remarks
6.	Introduce e-tendering practices in DPE for all procurements	Director (Pr)	√				
7.	Online publication of results of all public examinations, recruitment examinations, outcomes of tender processes, etc.	Director (IMD)	√				
8.	Introduce e-tendering practices in DPE for all procurement related matters	Director (Pr)		√			
9.	Publish public procurement notices in at least one tender portal operated by the Bangladeshi ITES providers	Director (Pr)		√			
10.	Implement the National Integrity Strategy in DPE	Director (A)	√				
11.	Conduct online opinion polls to assess public opinion on an event organized, or a decision taken, by DPE	Director (A)		√			
12.	Introduce Business Intelligence (BI) Dashboard of the integrated system	Director (IMD)	√				

Strategic Objective 7: Better administrative and management practices

#	Activity	Responsible					Remarks
1.	Allocation of sufficient funds for smooth implementation of this strategy	Director (P)	√				To continue
2.	Ensure recruitment and placement of ICT professionals for IMD	Director (A)	√				
3.	Create Director (IMD) post in revenue budget	Director (A)	√				
4.	Ensure online data collection and processing for Annual Primary School Census, National Student Assessment, annual book distribution monitoring system, etc.	Director (IMD)	√				
5.	Institutionalize IT practices in primary schools including sensitization of teachers and students	Director (IMD)	√				
6.	Institute administrative restructuring programs to promote IT practices	Director (A)	√				
7.	Conduct O&M study to facilitate introduction of IT-enabled practices in offices and schools	Director (A)	√				
8.	Develop institutional buy-in, incentive mechanisms and leadership for leveraging ICTs for service delivery	Director (A)		√			
9.	Institutionalize use of electronic medium for official communications, file processing and exchange of information	Director (A)	√				
10.	Publish all recruitment notices online including the relevant service web portals	Director (A)	√				
11.	Online publication of employment notice for recruitment of officers and staff including receipt of applications, sorting and scrutiny of applications, issuance of admit card and interview card, publication of exam dates, final results, etc.	Director (A)	√				
12.	Provision of online invitation and receipt of applications for teacher recruitment including processing and publication of results with access through mobile phones enabled	Director (P&O)	√				

<table>
<tr><td colspan="6">Strategic Objective 8: Better supervision, monitoring and evaluation.</td></tr>
</table>

1.	Install software-based real-time monitoring system of inspection activities	Director (M&E), Director (IMD)	√			To continue
2.	Deploy computer-based project planning, resource allocation and monitoring system	Director (P&D) Director (P)	√			
3.	Introduce software-based online system for monitoring of textbook production and distribution activities	Director (A)	√			
4.	Install software-based monitoring system for an efficient personnel administration	Director (A)	√			
5.	Install online monitoring system for tracking progress and implementation status of various civil works	Director (P&D)	√			
6.	Introduce electronic tracking system to ensure proper functioning of the schools including teacher and student attendance	Director (P&O)	√			
7.	Online tracking of inspection of schools by the officers at the field level as well as from the headquarters	Director (M&E)	√			
8.	Make and establish online system for SLIP and UPEP	Director (P&D), Director (IMD)	√			

	Strategic Objective 9: Better sustainability of ICT operations.					
1.	Develop a portfolio approach to strategic ICT investments	Director (IMD)	√			
2.	Increase visibility of ICT activities, investments and plans to reduce duplication	Director (IMD)	√			
3.	Target new areas for coordinated ICT procurement to reduce costs and remove duplication	Director (IMD)	√			
4.	Quickly adopt new ICT models through balancing issues of performance, usability, security, privacy and investment.	Director (IMD)	√			
5.	Undertake once in every financial year a market survey to track availability of newer and advanced technology	Director (IMD)	√			
6.	Conduct annual benchmarking analysis of ICT expenditure, based on efficiency and effectiveness metrics	Director (IMD)	√			
7.	Select energy saving and low power consumption ICT devices for procurement	Director (IMD)	√			
8.	Follow governmental directions for safe disposal and recycling of ICT devices	Director (IMD)	√			
9.	Reduce use of paper in offices by increasing electronic communication, file processing, information sharing and archiving	Director (A)	√			
10.	Promote environmental protection through use of ICT tools	Director (A)	√			
11.	Prepare an ICT energy management plan to facilitate improvements in technology, infrastructure and practice	Director (IMD)	√			

#		Responsible					Status
	Strategic Objective 10: Better maintenance, security and privacy						
1.	Every computer will be protected with online-certified, dependable and high quality antivirus software	Director (A) & Director (IMD)	√				On-going
2.	Ensure use of licensed software in every computer and laptop	Director (F) & Director (IMD)	√				On-going
3.	Install appropriate mechanism for protection of children from harmful digital content	Director (IMD)	√				To continue
4.	Include similar knowledge in the curriculum of class IV and V	Director (T)	√				
5.	Undertake a social awareness campaign to train parents on how to filter content harmful to children through websites and TV programs	Director (P), Director (IMD)	√				To continue
6.	Create advocacy programs to create awareness about contents harmful to children	Director (IMD)	√				To continue
7.	Install sustainable arrangements for regular, routine and emergency maintenance of every IT instrument	Director (IMD)	√				
8.	Ensure greater involvement of SMCs and the community as a whole for better maintenance services	Director (P), Director (IMD)		√			
9.	Execute maintenance contracts with capable outsourced technical organization	Director (IMD)		√			
10.	Create Senior Maintenance Engineer post in revenue budget at Head Office (DPE). Employ maintenance Engineers at the district level and Sub-Assistant Maintenance Engineer at the Upazila level	Director (IMD)		√			
11.	Data Center and facilities will have regular backups of data	Director (IMD)		√			
12.	Business Continuity and Disaster Recovery (BCDR) Policy will be prepared to minimize the chances of hardware failure and data loss	Director (IMD)		√			
13.	ICT Policy and Maintenance Policy for DPE, Filed Offices and Schools	Director (IMD)	√				

4.2 Responsibility for Implementation

5.2.1 It is not easy for an organization to make ICT a priority if there is no one within that organization who has been given specific responsibility for it. A named officer or post within the Organization should, therefore, be given responsibility for overseeing ICT. Presently such responsibility is bestowed upon the Director (Information Management Division) who oversees the IMD.

4.2.1 Capacity Building

It is planned to undertake training of manpower before deputing them on job as well as build capacity of Directorate of Primary Education on the proposed solution components. The overall responsibility of the co-ordination and organisation of the capacity building initiative should rest with the nodal officer appointed by the DPE for this specific purpose. However, the individual application software module or training component would be specifically owned by the individual System Integrator and the Specific Point of Contact designated by the DPE for this individual training. The training module may range from 2-3 days to several

weeks depending upon the complexity of the specific training module and the acceptability of the users to the training module. For the purpose of this roadmap document we have considered the capacity development component of the staff of the Directorate of Primary Education at the Headquarters and divisional, district and upazilla level officers of the DPE. The following framework is supposed to be followed:-
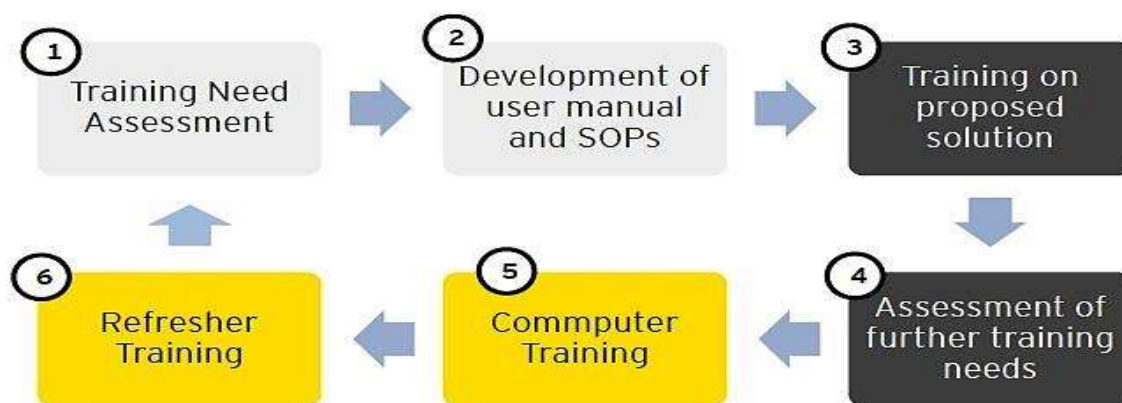

Figure 12: Training Framework

4.3   Financing
5.3.1   The most important aspect of this strategy is that it will be difficult to extract its optimum benefit without allocating required financial resources. The recurring costs to cover internet bills, software and maintenance costs, etc. will gradually account for a sizable amount. Therefore, a sensible and sufficient ICT Budget should be considered as unavoidable in planning every financial year's budget. Nevertheless, allocation of sufficient funds in the regular budget of DPE will be highly critical for proper implementation of this strategy. However, measures will be taken to manipulate adequate budgetary resources in every financial year for preparation and implementation of different initiatives under this roadmap. In addition, efforts will be made to mobilize some extra-ordinary financing outside the budgetary framework especially for implementation of the school-centered interventions. Sources of such financing may include the corporate sector under the CSR activity, the business tycoons and other affluent people in the society, etc.

4.4   Monitoring, Review and Feedback
4.4.1   This ICT Vision and plan will be monitored and coordinated by the Director General, Directorate of Primary Education. In addition, a high-level oversight committee will be responsible to oversee the implementation of this Strategic Vision and Plan. The committee is given below and chairperson of the committee if required can add or drop any member having approval form secretary of MoPME:
   a. Director General   Chairperson
   b. Additional Director General , DPE   Member
   c. Additional Director General (PEDP4), DPE   Member
   d. Director (Administration), DPE   Member
   e. Director (Finance), DPE   Member
   f. Director (Procurement), DPE   Member
   g. Director (Planning & Development), DPE   Member

h.	Director (Monitoring & Evaluation), DPE	Member
i.	Director (Policy and Operation), DPE	Member
j.	Representative of MoPME	Member
k.	Sr. System Analyst, DPE	Member
l.	System Analyst, MoPME	Member
m.	Representative of ICT Division	Member
n.	Representative of Bangladesh Computer Council	Member
o.	Representative of a2i	Member
p.	Representative of BUET	Member
q.	Representative of Dhaka University	Member
r.	Director (IMD), DPE	Member-Secretary

4.4.3 The committees will formulate a modus operandi for monitoring and evaluation of this roadmap, based on which the progress of implementation of this plan will be overseen. It will direct/guide the technical committee for implementation. Moreover, it will meet at least once in every quarter and submit its findings to the Secretary from time to time. It will play a key role in driving the efficiency and effectiveness of DPE's use of ICT including coordinated ICT procurement and ICT investment management. The committee will collect and analyze information to assist in setting future directions. The action plans will be reviewed by the committee on an annual basis to ensure that it continues to target the most crucial priorities and aligns with the Government's Strategic Plan. It will also be reviewed for implementation status checks, necessary reprioritizations and any possible and necessary changes in programs.

4.4.2 Besides the above committee, there will be a technical committee. This committee is mainly responsible to ensure the technical issues like: change management, necessary modification and upgradation of the road map to make it live document. It will meet monthly but reports the development progress quarterly to high-level oversight committee. However, if emergency/immediate intervention required to this roadmap then this committee can recommends the demanded changes to high-level oversight committee and having approval from the oversight committee, this committee will change the roadmap accordingly. Formation of this committee is given below and chairperson of the committee if required can add or drop any member having approval form DG, DPE:

a.	Director (IMD), DPE	Chairperson
b.	Sr. System Analyst, DPE	Member
c.	System Analyst, DPE	Member
d.	System Analyst, MoPME	Member
e.	Maintenance Engineer, DPE	Member
f.	Programmer, MoPME	Member
g.	Representative of Bangladesh Computer Council	Member
h.	Representative of a2i	Member
i.	Representative of BUET	Member
j.	Representative of Dhaka University	Member
k.	Programmer, DPE	Member-Secretary

5.0   Future Scope

It is evidential that during the Mid Term Review (MTR) of PEDP there were always some changes done based on the programme demand. In this situation, if MTR of PEDP4 demands changes than this roadmap must also addressed those related modifications. Moreover, if any national of international intervention demands the upgradation of this roadmap than that must be also reflect in future. This is a living document to achieve the Sustainable Development Goal (SDG) of primary education in Bangladesh. Therefore, the above mentioned committees have the right to change/update at any time to fulfill the national demand.

6.0   Conclusion

The Roadmap for Comprehensive MIS contains DPE's vision and direction for the use of ICT and manages the MIS for rest of PEDP4 period. It will be implemented under the broad guidance of the Government's ICT strategy/policy and work plan. DPE will work closely with stakeholders within and external to implement this roadmap.

7.0 Acronyms

APSC	Annual Primary School Census
ASPR	Annual Sector Performance Report
ARC	Assessment and Research Centre
AUEO	Assistant Upazila Education Officer
BCC	Bangladesh Computer Council
BI	Business Intelligence
BNDA	Bangladesh Nation Digital Architecture
COST	Commercial off-the shelf
CPD	Continuous Professional Development
DD	Divisional Deputy Director
DG	Director General
DLI	Disbursement Linking Indicator
DPEd	Diploma in Primary Education
DPE	Directorate of Primary Education
DPEO	District Primary Education Officer
EECE	Ebtedayee Education Completion Examination
GEP	General Education Project
ICT	Information and Communication Technology
IMD	Information Management Division
JARM	Joint Annual Review Mission
KPI	Key Performance Indicators
LGED	Government Engineering Division
M&E	Monitoring and Evaluation
MoF	Ministry of Finance
MIS	Management Information System
MoPME	Ministry of Primary and Mass Education
MTR	Mid Term Review
NAC	National Assessment Cell
NAPE	Academy for Primary Education
NCTB	National Curriculum and Text Board
NSA	National School Assessment
PECE	Primary Education Completion Exam
PEDP	Primary Education Development Program
PEPMIS	Primary Education Property Management Information System
PMIS	Personnel Information System
PPE	Pre-Primary Education
PSQL	Primary School Quality Level indicators
PTI	Primary Training Institutes
RBM	Results-Based Management
SCR	Student per Classroom Ratio
SLA	Service Level Agreement
SOP	Standard Operating Procedures
SRS	Software Requirements Specification
STR	Student per Teacher Ratio
TBE	Theory Based Evaluations
TPA	Third Party Auditing
TRC	Thana Resource Center

UEO	Upazila Education Officer
UISC	Union Information and Service Centers
URC	Upazila Resource Center

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