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ADB

IT Procurement Plan for Public Debt Management Office

Ministry of Finance, Government of Nepal, April 2014

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Contents

Acronyms

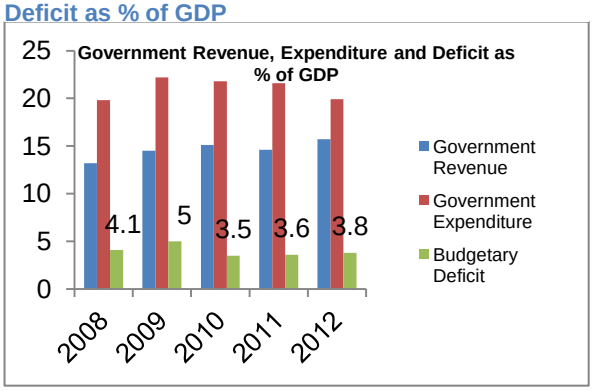
ADB	Asian Development Bank
TMS	Total Management Services
MoF	Ministry of Finance, Government of Nepal
CS-DRMS	Commonwealth Secretariat – Debt Recording & Management System
COTS	Commercial Off the Shelf
CDSCL	Central Depository Settlement & Clearing Ltd.
DfID	Department for International Development
DTTIPL	Deloitte Touche Tohmatsu India Pvt. Ltd.
EAPD	Economic Policy Analysis Division
IOSCO	International Organization of Securities Commission
IECCD	International Economic Cooperation and Coordination Division
FCGO	Financial Controller General Office
IFRS	International Financial Reporting standards
IECCD	International Economic Cooperation Coordination Division
FY	Financial Year
FRL	Fiscal Responsibility Law
NPC	National Planning Commission
NRB	Nepal Rastra Bank
NEPSE	Nepal Stock Exchange
OMOC	Open Market Operations Committee
PDMO	Public Debt Management Office
PDMD	Public Debt Management Department
GDP	Gross Domestic Product
GoN	Government Of Nepal
SEBON	Securities Board of Nepal
SDDS	Special Data Dissemination Standard
QEDS	Quarterly External Debt Statistics
DRS	Debtor Reporting System
EMD	Earnest Money Deposit

1 Project Background, Objectives & Approach

1.1 Project Background & Objectives

The peace process in Nepal after the end of the civil war in 2006 is leading to new demands for government spending in order to generate "peace dividend" in the form of greater ambitious social sector programs and enhanced infrastructure spending. The total expenditure of government has increased from 18.4 per cent of GDP in FY 2006/07 to 19.2 per cent of GDP in FY 2011/12. During the same period the public revenue has increased only from 12.1 per cent to 15.9 per cent. As a result since 1961/62, GON has persistently been relying on both domestic and external borrowings for budget deficit financing. The quantitative dimensions of the Government of Nepal's (GON's) debt inflows and its servicing along with the associated risk features have been widening over the years. However, public debt management in Nepal has not received the priority it deserves as it has been conducted on a traditional manner that lacks comprehensive, specialized, and separate legal, institutional, and operational framework. Further, Nepal's bond market is underdeveloped and dominated by government securities. The overall policies, regulations and institutional arrangements governing the financial markets, banking sector, and government securities are also inadequate for development of a vibrant bond market in Nepal.

Exhibit 1: Government Revenue, Expenditure and Deficit as % of GDP



Source: Nepal Rastra Bank

Currently, there is no unified agency in Nepal which maintains the record of transactions in domestic debt as well as foreign debt in an internationally recognized debt recording system. Moreover, the present system of debt recording and reporting is paper based with no seamless linkages among the various debt agencies for sharing of debt data. Also, the present system of auction of government securities is entirely manual resulting in time consuming and tedious operations. In addition, the government securities are issued as physical certificates in paper based format which introduces further inefficiencies in the system. The procedure is risk-prone, time consuming and costly since sale, purchase and transfer requires physical movement of securities.

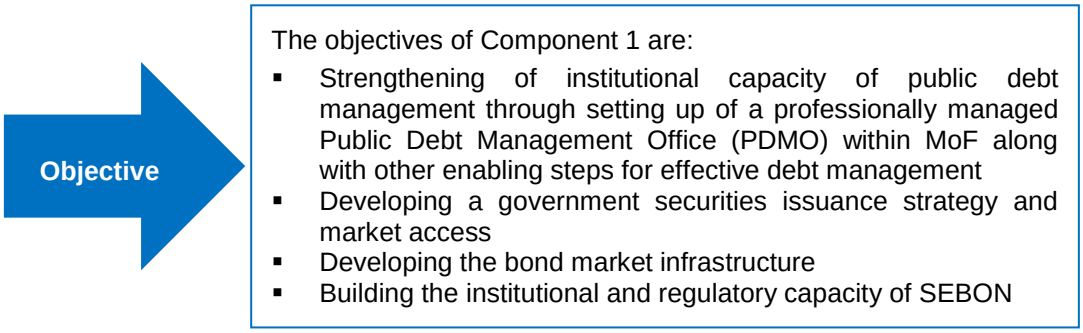
GON recognizes the importance of creating a professionally managed Public Debt Management Office (PDMO) and developing a liquid and deep bond market which will mitigate the potential maturity mismatch of a bank-dominated financial sector and reduce financial sector fragility. Further, to increase the operational efficiency of public debt management and primary and secondary market activities related to government securities market, a modern debt management information system needs to be implemented in the PDMO to carry out its front, middle and back office functions.

It is in the above context, Asian Development Bank is assisting GON through Capital market and Infrastructure Capacity Support Project to create an enabling environment for government securities and efficient management of public debt.

1.2 Project Objectives

The proposed project aims to create an enabling environment for government securities, which in turn will help in setting up the stage for development of corporate debt securities. In particular the project aims to achieve the following key objectives:

Exhibit 2: Project Objectives and Outcome



1.3 Project Scope

We understand that there are inter-linkages between various activities across all the three major reform areas, i.e "Legal and Regulatory", "Institutional" and "Operational" as envisaged under the project are depicted as under:

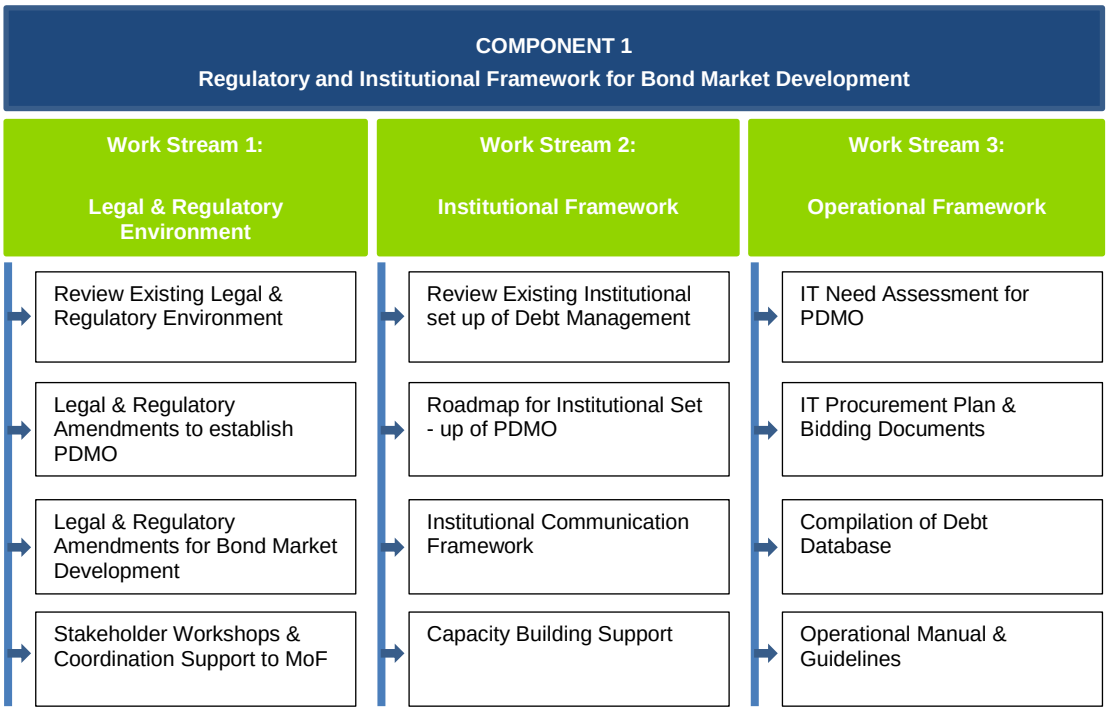


Exhibit 3: Overall Project Scope

1.4 Purpose of this Report

The objective of this report is to present an IT procurement plan for PDMO for modernizing the public debt management functions as well as primary and secondary market activities for Government Securities. This report summarizes the key operational procedures related to public debt management vis-à-vis the requirement for management information system in these operations. The report presents the overall functional contours of the proposed systems along with its overall deployment and technical architecture. In order to assist ADB/MoF in estimating the procurement cost, an indicative cost schedule for key components of the IT procurement including hardware, networking and application software is also provided. As a way forward, this report outlines a tentative procurement schedule which ultimately would depend upon the finalization of the structure and functions of the PDMO by the Government of Nepal.

It is important to highlight that in our 'As Is Assessment and Recommendation Report on Debt Management' we have recommended re-introduction of the latest version of CS-DRMS considering Nepal's prior experience with this software. Accordingly, in our report titled "IT Procurement Plan for PDMO" submitted on 31st March, 2014 we have recommended the procurement of CS-DRMS for debt recording and management system. However, there is one more internationally recognized debt management COTS product available in the market namely Debt Management and Financial Analysis System (DMFAS) developed by United Nations Conference on Trade and Development (UNCTAD) which is covered in this report. Further, this report also provides for bespoke development of the debt recording application.

1.5 Our Approach

We have carried out an IT need assessment of the proposed PDMO in line with our suggestions on the different management information system requirement for performing the debt management operations effectively as provided in our report i.e. ***"As Is Assessment and Recommendation Report on Public Debt Management in Nepal"*** as well as different functions to be performed by the PDMO as mentioned in our report ***i. e "Institutional Structure of Public Debt Management Office in Nepal".*** In this regard, the team had several rounds of meetings and discussions with the officials of PDMD, NRB, and Debt section of Budget Implementation Division of FCGO to study the existing auction procedures, debt recording, accounting and reporting for both external as well as domestic debt. Further, we have carried out a review of the existing IT infrastructure at Ministry of Finance (MOF), Nepal Rashtra Bank (NRB) and Financial Comptroller General Office (FCGO). Based on our study and the requirements of the PDMO, we have identified the IT requirements and have designed an IT procurement plan including the cost estimates. ***It is important to highlight that, in line with GoN's decision; the IT requirement has been prepared considering that all the functions related to public debt management (i.e. external debts as well as primary and secondary market operations related to domestic debt) would be centralized and carried out by the PDMO. Further, as discussed with MoF, some of the public debt functions may be outsourced to other agency if required. Therefore, we have prepared the IT requirement in a modular manner for three key components of the debt management functions. This would facilitate easy implementation/procurement of the IT system for the function which is outsourced to any other agency.***

2 As-Is Assessment

2.1 Debt Recording and Accounting

There is no unified agency in Nepal which maintains the record of transactions of domestic debt as well as external debt in any internationally recognised debt management software. There is also no common linkage between the various debt agencies for sharing of debt data.

The existing arrangement of recording of debt transactions by various debt agencies is as follows:

Till recently, Nepal Rashtra Bank (NRB) has been recording all transactions relating to domestic debt in indigenously developed software, called PubSys. However, recently, NRB has acquired a core banking solution, called the Olympic (GL) system from a Swiss company. This system covers all aspects of banking including public debt, and has been put in operation since mid-April 2013. This system is now being used for recording of the domestic debt transactions. The system is neither linked with the Ministry of Finance nor the FCGO. The NRB does not record the external debt data.

The Ministry of Finance does not by itself maintain any record of either the domestic debt or the external debt. The FCGO maintains the data relating to both domestic and external debt in Excel spreadsheets.

Government of Nepal, in the past has taken several initiatives to enhance the capability of the MoF and its supportive agencies in debt data recording and reporting but could not achieve the desired objectives. A software package namely CS-DRMS developed by the Commonwealth Secretariat was customized and installed in the Ministry of Finance in 1997 under one of the DfID support program. The software was operationalized at three locations, namely, the MOF, FCGO, and the NRB. It was upgraded to its windows version of CS-DRMS 2000+ in 2004. A limited number of in-country training programs for operating the CS-DRMS were also undertaken. The ADB mission in 2001 had recommended shifting the software with its infrastructure to FCGO and, accordingly, the system was subsequently installed and operated at FCGO only.

The CS-DRMS is no longer in use for debt management in Nepal. The software is available on a PC in the office of the FCGO, but not in use. On perusal of the data, it was found that the last entry relates to the domestic debt was entered in 2001. The external debt was last entered in 2008. The transaction details relating to external loans were not entered since 2008, making the entire database obsolete. The data relating to the domestic loans entered in the software has become outdated as all of them have since been repaid.

The main reasons for not using the software system for recording the debt transactions are:

1. Adequate number of staff were not imparted the required trainings
2. The staff trained on the system were subsequently transferred to other Divisions/ Ministries
3. The legacy data entry was not completed before handing over the system to the officials for future operations.

When the officials found it difficult to operate the system owing to lack of training and data, they gave it up and started keeping the record in the Excel spreadsheets.

2.1.1 Weaknesses of the Current System

The present system of debt recording is not sustainable on a long-term basis. It has limitations in the presentation of data and is not capable of being linked with other debt agencies. For policy formulation, the Ministry of Finance obtains the data from the FCGO manually which is a time consuming process. The data is also not fully reliable as there is scope of human errors creeping into the system. It does not also offer the facility of taking out the reports readily.

2.1.2 Measures to overcome the weaknesses of the Current System

We have recommended re-introduction of the latest version of CS-DRMS with all the enhancements along with up gradation of the hardware and software necessary for the installation of the CS-DRMS in our 'As Is Assessment and Recommendation Report on Debt Management'. This would result in overcoming the shortcomings/ limitations of the present debt recording system and also make it in line with the best international practices. CS-DRMS software is capable of recording all the relevant transactions relating to both the domestic and the external debt. It can produce a large variety of reports with required analytics needed by the debt offices including the country-specific reports. It provides a central repository for several categories of public and privately secured external and domestic debt. The CS-DRMS software is currently installed in 54 countries, comprising 44 commonwealth member countries and 10 non-member countries.

CS-DRMS can be installed at the following locations in Nepal:

1. Proposed Public Debt Management Office (PDMO)
2. Financial Controller General's Office
3. Nepal Rastra Bank
4. National Planning Commission

The PDMO could be the primary site where all debt-related transactions can be entered, and will have full access rights whereas the other three sites could be the secondary sites with limited access rights of viewing the data and generating the reports. CS-DRMS may be installed and implemented in client server architecture in respective offices, if the latest version does not support centralized architecture. However, the client server application may be converted into a web based system using tools like Citrix or similar so that the same may be installed in a central location and all the offices can access the application software through appropriate network connectivity

In order to ensure the sustainability of the system, and to avoid the repeat of the past experience, the following has been suggested:

- The consultants should not only install the CS-DRMS and provide the training; they should ensure completion of debt data profile with the help of local officials, revalidate the data and update the system so that the concerned officials have no problem in carrying out their operations thereafter.
- A large number of staff drawn from different units such as PDMO, FCGO, MoF, and NRB say about 20-30 may be trained on the system.
- A few trained staff of PDMO may be available for CS-DRMS in a dedicated manner on a long term basis to ensure its continuity and sustainability.

However, it is important to highlight that there is one more internationally recognized debt management COTS product available in the market namely Debt Management and Financial Analysis System (DMFAS) developed by United Nations Conference on Trade and Development (UNCTAD). The latest version of the software is 6.0. This software is almost similar to the CS- DRMS and records both the external and domestic debt. This is also a proprietary product and is supplied only by the UNCTAD. This system is in use in about 70 countries.

However, we believe that the CS-DRMS would be a more suitable option for Nepal given Nepal's history of using CS-DRMS and the advantages over the DMFAS as mentioned below,:

- It is more user friendly
- Total cost of ownership over a long period is low
- Implementation time required is lesser
- Post implementation support is faster

It is to be noted that both the products are proprietary in nature and has proved to be highly capable debt recording and management system.

We would also like to mention that GoN may also explore the option of bespoke development of the Debt Recording and Management software. In this regard there would be a requirement of bringing on board an IT firm with proven development and implementation capability. The functional requirements for bespoke development of the application would be those as mentioned in Section 3.1.

2.2 Bidding and Auction System

The Development Bonds and the Treasury Bills are sold by NRB through a paper-based auction system. Auctions of Development Bonds are yield-based and those of Treasury Bills are multiple price-based. Under the current dispensation, bidders of Development Bonds and Treasury Bills submit their bids in sealed envelopes within a prescribed time on the auction day. The sealed envelopes containing bids are first required to be recorded in a register kept for this purpose and then dropped in the box kept at the chamber of the Executive Director of the PDMD. The bidders outside Kathmandu valley have to fax the bids to the PDMD on the same day within the specified hours and send the original bids separately.

The envelopes are opened after the expiry of the prescribed time, and the bid details like name of the bidder, the bid amount etc. are entered in a spreadsheet. Bid price is taken as the bid variable for Treasury Bills and yield in the case of Development Bonds.

Entries of non-competitive bidders are maintained separately. The notified amount after deducting the amount allocated for non-competitive bids is allocated to the competitive bidders. The Treasury Bills are allotted to the successful competitive bidders at the prices quoted by them. The Development Bonds are allotted to all the successful bidders at the cut-off yield. Competitive bids are allocated based on respective bid variables till all the available bonds/bills are exhausted. In case some bidders have quoted the same price /cut-off yield, and the available amount is not sufficient to make the full allotment to them, allotment is done proportionately.

The weighted average bid price becomes the applicable price for the non-competitive bidders of Treasury Bills. In the case of Development Bonds, successful bidders are allotted the bonds at the cut-off yield.

The OMOC decides the basis of actual allocation of securities. The bidders are required to pay for the securities allocated to them on the next day following the auction day in the case of Treasury Bills and within two days following the auction day in the case of the Development Bonds.

2.2.1 Weaknesses of the Current System

The present paper-based auction system requires movement of people and movement of papers and involves manual work in the processing of the bids. There is every chance of errors cropping in the bidding process. Besides, the system is time-consuming, especially when the number of bids received at the auctions is very large. Faxing and sending the bids by NRB offices outside the Kathmandu valley also involve risks.

2.2.2 Measures to Overcome the Weaknesses of the Current System

We have recommended setting up of an automated bidding and auction system in the PDMO to overcome the shortcomings of the present manual system and to be in line with the best international practice.

2.3 Clearing and Settlement

The secondary market for government securities in Nepal is under-developed with most of the securities being held to maturity. There is negligible trading in Treasury Bills and Development Bonds.

Treasury Bills are issued in the form of promissory notes which are transferrable by endorsement and delivery. All such transfers are required to be registered with NRB. The new buyer has to take the respective Treasury Bills to the NRB physically. The secondary market transactions in Treasury Bills are not required to be routed through the NEPSE. In the case of Development Bonds, all secondary market transactions are required to be conducted through the NEPSE. Here again, the buyer of the Development Bonds visits the NRB with the physical bond certificate for NRB's endorsement for the transfer of ownership. The fund transfer from the buyer to the seller of the securities takes place before this stage. These two aspects of the transaction are not inter-linked.

2.3.1 Weaknesses of the Current System

One of the biggest procedural impediments to a vibrant secondary market for government securities is the existing paper based trading. This makes the management and transaction of securities a risky and time consuming process. In the absence of a real time system there is little monitoring of transactions pertaining to bills. Even for bonds which are traded at the NEPSE, there is no linkage between actual transaction and transfer of security.

2.3.2 Measures to Overcome Weaknesses of the Current System

GoN has taken an initiative in this regard by establishing The CDS and Clearing Limited (CDSCL) with the objectives of dematerialization of corporate shares, bonds and debentures etc. and the Government securities listed on the NEPSE, and for providing clearing and settlement facilities of these instruments. However, considering the special characteristic of government securities market, to provide complete control of transactions in Government securities to one entity, to ensure speedy settlement of such transactions on T+1 basis and to facilitate hassle-free Delivery versus Payment through Real Time Gross Settlement System, it is suggested that the depository functions, RTA functions, and clearing and settlement functions are centralized at one place in the PDMO.

3 Functional Contours of the Proposed Systems

3.1 Debt Recording and Management

Debt recording and accounting is one of the most critical functions in debt management, therefore it is important that the IT system is robust enough to cater to the government's requirement.
The following section provides the broad functional contours of the Debt Recording and Management Software:

Function	Description
Loan Management	a) Recording of domestic and external loans b) Capturing of loan terms and conditions c) Back-to-back lending: where external or domestic debt instrument is passed on to other agencies with the same or varied terms d) Loan splitting: where one instrument is re-lent to many sub-borrowers as subsidiary loans e) Pooled Loans: funds are pooled from several debt instruments before being on-lent to one or several agencies f) "On-Granting": grants may be passed on to sub-national agencies albeit on concessional terms g) Guaranteed loans: the recording and monitoring of guaranteed loans help towards the tracking of disbursements and debt service payments by the responsible agencies h) Simple government loans: government lending from budgetary resources
Securities Management	a) Recording of domestic and external debt securities b) Types of securities(traded and non-traded) include: i. Treasury bills ii. Bonds iii. Tax/Reserve Certificates iv. Promissory Notes v. Commercial Papers c) Capturing of securities details
Grants Management	a) Recording of Grant Details
Debt Service and Disbursement Management	a) Forecasting of disbursement and debt service flows b) Capturing of actual disbursement and debt service details c) Forecasts stock position and flows
Debt Restructuring	a) Has provisions to restructure loans including: i. Refinancing ii. Write-off iii. Debt conversion including debt relief b) Has provisions to restructure securities including: i. Buyback ii. Split iii. Strips

	iv. Swaps
Project Monitoring	a) Capture projects funded by loans and grants b) Model any type of disbursement method (reimbursement, cash advance, direct payment) c) Track and monitor project expenditures throughout their lifecycle
Customization	a) Maintains exchange and interest rates data b) Capture government chart of accounts and expenditure line items
Debt Assessment and Analysis	a) Generate cash-flow forecasts for any future projection period b) Compare new loan offers c) Assess the cost of new borrowing d) Examine the impact on the debt portfolio in nominal and present value terms of: i. Adding new loans ii. Applying debt restructuring options e) Perform "What if?" analyses on the debt portfolio by investigating the effects in nominal and present value terms of: i. Debt restructuring ii. Carrying out sensitivity testing on interest rates, exchange rates and exogenous economic variables under different scenarios f) Analyse loans in existing debt portfolio to identify 'high' cost loans for prepayment
Debt Reporting	a) Generate operational, analytical and statistical reports b) Reporting on internationally accepted practices such as IMF's Special Data Dissemination Standard (SDDS), Quarterly External Debt Statistics (QEDS) and World Bank's Debtor Reporting System (DRS) c) Produce reports covering the entire period of the instrument (historical as well as forecast) d) Ability to generate reports covering the entire portfolio e) Use of filters to control report content f) View different reports simultaneously g) Report writing tool for developing country specific reports h) Ability to export reports in various formats including excel, csv, xml etc.

3.1.1 Debt Information Exchange

In addition to maintenance of debt data, there would also be requirement of reporting and exchange of debt information with key government agencies. The technical protocol for exchange of information will dependent on the configuration of other system. It can be in various forms like export/import of data using Excel, csv, xml, web services etc. The debt information exchange requirements are presented below:

System	Information Exchange
Online auction system	a) Issue and Bidding calendar b) Bid/Auction data c) Securities allocation data d) Bidder profile and bid information

Clearing and Settlement System	a) Transaction data b) Change of ownership c) Market Scenarios
FCGO System	a) Debt profile b) Debt Service Information c) Debt Restructuring Data d) Disbursement information e) Financial Reports
NRB System	a) Disbursement data b) Debt profile c) Auction data including collection instruction d) Settlements and Clearing data e) Interest rate and exchange rate information f) Settlement Instructions

3.2 Online Bidding and Auction System

The Online Bidding and Auction System would support the PDMO to operationalize and operate auctioning of competitive and non-competitive government securities. The system would effectively manage the entire auctioning process from notice of issue of securities through recording of bids to generation of allotment letters. This would overcome the shortcomings of the present manual bidding system.

The proposed system should support:

- Auction of different types of government security instruments
- Various Auction types - Uniform Price (English Auction method) and Bid Price (Dutch/American Auction method)
- Yield-based or price-based bidding processes
- Competitive and non-competitive bidders
- Underwriting/devolvement
- Recording of payments from successful bidders through electronic transfer or manual entry
- Commission payment to primary dealers
- End-to end workflow management

The broad functional contours of the system should be as per the following:

3.2.1 Bidder Registration

Bidder Registration	
Stakeholders	**Roles**
Prospective Bidders/Applicants	1. Submits registration form through the system with necessary details 2. Receives auto emails from the system on approval/rejection of the registration form 3. Visits the PDMO with hardcopy of the approval email 4. Receives user id and password for accessing the bid submission module from the PDMO
System	1. Alerts the applicants with error messages, if any during the registration submission process 2. Generates unique application number on successful submission of registration form 3. Sends auto emails to the applicants on approval/rejection of the registration form

PDMO User	1. Issues user id and password to successful applicants for accessing the bid submission module
Functional Requirements	The system should facilitate the following: 1. There should be a provision to download the registration form from the website 2. The system should prompt the applicants in case of error, if any in the filled up forms 3. There should be a provision to generate unique application number on successful submission of registration form 4. There should be a provision to send email notification/acknowledgement to the applicants on successful submission of registration form 5. There should be a provision for the applicants to check the status (in process, approved, rejected) of the application from the system. 6. There should be a provision to send email notification to the applicants on approval/rejection of registration form 7. The user id and password should not be mailed to the applicants
Illustrative Reports/ Output	1. Number of requests for registrations 2. Number of successful and unsuccessful registrations

3.2.2 Auction Announcement

Publication of Auction Notice	
Stakeholders	**Roles**
PDMO	1. Uploads approved Auction Notice in the System 2. Publishes the auction notice (Triggers the Bid Submission Process)
System	1. Sends auto emails to the registered bidders communicating the auction notice with all necessary details
Registered Bidders	1. Receives auto emails from the system communicating the auction notice with all necessary details
Functional Requirements	The system should facilitate the following: a) The system should have provision to maintain auction calendar. b) The auction notice should include the following details i. Name of the Security ii. Security Identification Number iii. Maturity iv. Due date and time for Submission of Bids v. Date of Issue vi. Issue Amount vii. Type of Auction: Multiple Price based or Yield based viii. Number of Decimal Places allowed for bid price ix. Minimum Subscription Amount and Step Bid Amount (multiples thereof) for competitive bids x. Minimum Amount allocated for non-competitive bids xi. Bidding Criteria for competitive and non-competitive bids xii. Amount of Earnest Money Deposit required xiii. Bank Account Number for payment of Earnest Money Deposit and

	balance amount for Securities Allotment xiv. Deadline for Payment of Balance Amount for Securities Allotment c) The auction notice should be published before a given number of days prior to the date of bid submission and there should be a provision to change the same d) There should be a provision to send email intimation to registered bidders post the publication of auction notice e) There should be a provision to change and the due date for submission of bids and communicate the same
Illustrative Reports/ Output	1. List of Auction Notices

3.2.3 Bid Submission

Bid Submission	
Stakeholders	**Roles**
Individual Bidders	1. Logs into the bid submission module 2. Downloads the bid forms 3. Uploads the filled up bid forms with necessary details 4. Uploads EMD payment voucher and soft copy/scanned copy of citizenship certificate 5. Receives auto email from the system on successful submission of bid
Institutional Bidders with accounts in NRB	1. Logs into the bid submission module 2. Downloads the bid forms 3. Uploads the filled up bid forms/fills up the bid form online with necessary details 4. Receives auto email from the system on successful submission of bid
Institutional Bidders without accounts in NRB	1. Logs into the bid submission module 2. Downloads the bid forms 3. Uploads the filled up bid forms with necessary details 4. Uploads EMD payment voucher 5. Receives auto email from the system on successful submission of bid
System	1. Alerts the bidders with error messages during uploading/online filling up of bid forms 2. Deactivates the bid submission process after the cut-off time 3. Receives auto email from the system on successful submission of bid
Functional Requirements	The system should facilitate the following: a) There should be a provision to download the bid form b) There should be a provision to upload the filled up bid form into the system c) There should be a provision to upload soft copy/scanned copy of the required EMD d) There should be a provision to upload soft copy/scanned copy of citizenship certificate e) The system should identify the errors in the uploaded bid form/online bid form and display the same on screen

	f) The system should not allow submission of bids until all the errors are addressed by the bidders g) There should be a provision to send email notification after successful submission of bid with time stamp h) The system should not allow the bidders to submit the bids after the cut-of time
Illustrative Reports/ Output	1. Number of bids submitted for Treasury Bill and Development Bond auctions 2. Number of bids submitted for competitive and non-competitive bids

3.2.4 Bid Processing

Bid Processing	
Stakeholders	**Roles**
System	1. Identifies the cut-off price/yield for the auction and prompts the PDMO user for approval of the same 2. Prepares the list of successful and unsuccessful bidders 3. Sends auto emails to unsuccessful bidders having accounts with NRB communicating the auction results 4. Sends auto emails to unsuccessful bidders not having accounts with NRB to visit NRB for refund of EMD 5. Prepares a table with bid amount allotted and payment due from the successful bidders 6. Sends auto alert to successful bidders not having accounts with NRB to visit NRB for payment of the balance amount 7. Sends auto alert to successful bidders having accounts with NRB with details of securities to be allotted and the payment due from the bidders
PDMO User	1. Approves/modifies the cut-off price/yield
Unsuccessful Bidders with accounts in NRB	1. Receives auto emails from the system communicating the auction results
Unsuccessful Bidders without accounts in NRB	1. Receives auto emails from the system communicating the auction results and intimation to visit NRB for refund of EMD
Successful Bidders with accounts in NRB	2. Receives auto emails from the system communicating the auction results with details of securities to be allotted and the payment due from the bidders
Successful Bidders without accounts in NRB	1. Receives auto emails from the system communicating the auction results with intimation to visit NRB for payment of the balance amount
Functional Requirements	The system should facilitate the following: a) The system should prompt the PDMO user for approving the cut-off price/yield b) Provision for manual intervention on the price/ 'Cut-off-yield" for allotment at the auctions c) The available balance after allotment to non-competitive bidders, if any,

	in the limit fixed for non-competitive bids is to be transferred to the limit fixed for competitive bids for allotment to competitive bidders. d) Calculation of weighted average yield/ price e) Calculation of price of security per NPS 100 at the cut-off- yield for each accepted competitive bid vis-a-vis the yield offered f) There should be a provision to send email notification to both successful and unsuccessful bidders with necessary information
Illustrative Reports/ Output	1. List of successful bidders 2. List of unsuccessful bidders 3. Amount of securities issued to and payment due from the successful bidders

3.2.5 Allotment Function

Allotment Procedure in the case of Multiple Price-Based Auctions- The amount against each competitive bid is allotted in full on the basis of the quoted prices arranged in descending order till the auction amount is fully exhausted. In case some bids have offered the same price and the balance amount available for allotment is not sufficient to make full allotment there against, the amount is allotted proportionately against such bids. All successful bidders have to pay the price quoted by them for the quantities allotted to them.

The amount against each non- competitive bid is allotted in full at the weighted average price of all the competitive bids received at the auction, if the aggregate amount of such bids is equal to or less than the limit fixed for non-competitive bids. Where the total amount of non-competitive bids received at the auction exceeds the limit fixed for non-competitive bids; then the amount is allotted proportionately against such non-competitive bids at the weighted average price.

Allotment Procedure in the case of Yield-Based Auctions- The amount against each competitive bid is allotted in full on the basis of the quoted yields arranged in ascending order till the auction amount is fully exhausted. In case some bids have offered the same yield and the balance amount available for allotment is not sufficient to make the full allotment there against, then the amount is allotted proportionately. The highest yield at which the allotment is made should be called as the 'Cut-off yield' and this will be the common coupon rate at which the securities will be issued to all the successful bidders. The difference between the yield offered by the successful bidders on their bids and the 'Cut-off yield' will be adjusted in the price of the security per NPR 100.

The amount against each non-competitive bid is allotted in full at the cut-off yield, if the aggregate amount of such bids is equal to or less than the limit fixed for non-competitive bids. Where the aggregate amount of non- competitive bids received at the auction exceeds the limit fixed for non-competitive bids; then the amount is allotted proportionately against such non-competitive bids at the weighted average yield. However, the difference between the weighted average yield of all the successful competitive bids and the cut-off yield will be adjusted in the price which the non-competitive bidders should pay.

3.2.6 Management Information

Bid Processing	
Stakeholders	**Roles**
PDMO User	a) Use of data for making decisions on ongoing auctions and plan for future auctions

Functional Requirements	a) The system should have the provision for an inbuilt support for deciding allotment cut off values. b) Real-time monitoring of auction process c) Dashboard comparison with previous auction processes
Illustrative Reports/ Output	a) It should support generation of custom reports.

Owing to the sensitive nature of the auction process it is pertinent to highlight that the security of the system should be of utmost important and should be at the highest possible level. There would also be requirement of the exchange of auction related information with different agencies. In this regard, the requirements are presented below:

System	Information Exchange
Debt Management System	a) Issue and Bidding calendar b) Bid/Auction data c) Securities allocation data d) Bidder profile and bid information
NRB System	a) Profile of bidders b) Account information of bidders c) Debit instructions/Collection instructions d) Depository update

3.3 Clearing and Settlement System

The Clearing and Settlement System is being proposed to enable flow of data pertaining to transactions of government securities in the secondary market. While trading of bonds is effected through NEPSE, trading of bills is not routed through the exchange. Hence the proposed system should provide for capturing and settlement of both types of transactions. The broad functional contours of the proposed system are as follows:

3.3.1 Trader Registration

Trader Registration	
Stakeholders	**Roles**
Traders	1. Register on the website with complete profile 2. Furnish details along with linked bank account information 3. Receives auto emails from the system on approval/rejection of the registration form 4. Visits the PDMO with hardcopy of the approval email 5. Receives user id and password for accessing the bid submission module from the PDMO
System	1. Alerts the applicants with error messages, if any during the registration submission process 2. Generates unique application number on successful submission of registration form 3. Sends auto emails to the applicants on approval/rejection of the registration form
PDMO User	1. Issues user id and password to successful applicants for accessing the trade submission module
Functional	The system should facilitate the following:

Requirements	a) The system should be able to map registered traders from the exchange b) The system should prompt the PDMO user for approving registration application c) Registration of traders for non-exchange and exchange traded securities d) Inform registration applicants of their application status and actions to be taken from their end
Illustrative Reports/ Output	1. List of registered traders 2. List of pending applications

3.3.2 Non-Exchange Trade Submission

Non-Exchange Trade Submission	
Stakeholders	**Roles**
Traders	1. Both buyer and seller should be registered on the system 2. Seller posts the transaction information including transaction instruments, instrument quantity and transaction price. 3. Buyer posts the transaction information including transaction instruments, instrument quantity and transaction price.
System	1. Compares data from buyer and seller for discrepancies. 2. Highlights transaction if there is information mismatch.
PDMO User	1. Authenticates transaction based on confirmation from depository and bank and sends for clearance 2. Rejects transactions with data mismatch.
Functional Requirements	a) System should post information of trade initiation to the depository/NRB. b) System should be able to receive confirmation/rejection of securities from the depository/NRB. c) System should be able to post request to banks for checking of availability of funds in sellers' declared account. d) System should be able to receive confirmation/rejection of fund availability from banks. e) System should be able to process data exchange over standard clearing protocols.
Illustrative Reports/ Output	1. Detailed transaction report 2. Summary of rejected/approval transactions during a period

3.3.3 Exchange Trade Submission

Exchange Trade Submission	
Stakeholders	**Roles**
Traders	1. Both buyer and seller should be registered on the system 2. Seller should post the transaction information including transaction instruments, instrument quantity and transaction price.

	3. Buyer should post the transaction information including transaction instruments, instrument quantity and transaction price.
NEPSE	1. Posts transaction clearance to the system 2. Post transaction cancellation to the system
System	1. Record transaction clearance from the exchange 2. Record transaction cancellation from the exchange 3. Cross check clearance with the depository
NRB	1. Send confirmation the transaction to the system
PDMO User	1. Authenticates transaction based on confirmation from depository and exchange.
Functional Requirements	a) System should be able to receive transaction details from exchange. b) System should be able to receive confirmation of transaction details from the depository/NRB. c) System should be able to process data exchange over standard clearing protocols.
Illustrative Reports/ Output	1. Detailed transaction report 2. Summary of rejected/approval transactions during a period

3.3.4 Transaction Clearance

Transaction Clearance	
Stakeholders	**Roles**
Exchange	1. Posts clearance information to the system for each transaction
System	1. Reconcile all transactions (exchange and non-exchange) 2. Highlights all cleared transactions
Depository/NRB	1. Receives cleared transactions and marks the securities for change of ownership
PDMO User	1. Reconciles cleared transactions and sends to the depository
Functional Requirements	a) System should be able to receive clearance information of trade from exchange. b) System should be able to reconcile and highlight cleared transactions c) System should be able to send clearance to the depository/NRB d) System should be able to process data exchange over standard clearing protocols.
Illustrative Reports/ Output	1. Detailed transaction report 2. Summary of rejected/cleared transactions during a period

3.3.5 Transaction Settlement – Exchange Traded

Transaction Settlement – Exchange Traded	
Stakeholders	**Roles**
Exchange	1. Posts settlement/rejection information for all cleared transactions

System	1. Marks all transactions as settled based on information received from the exchange 2. Marks all rejected transactions based on information received from exchange 3. Sends confirmation to the exchange once confirmation of ownership update is received from the depository.
Depository/NRB	1. Receives settlement information the system and updates ownership for all settled transactions 2. Sends confirmation to the system for confirmation of information update
PDMO User	1. Clears settled transactions and send to depository for update.
Functional Requirements	a) System should be able to receive settlement information of trade from exchange. b) System should be able to reconcile and highlight settled transactions c) System should be able to send clearance to the depository/NRB d) System should be able to process data exchange over standard settlement protocols.
Illustrative Reports/ Output	1. Detailed transaction report 2. Summary of rejected/cleared transactions during a period

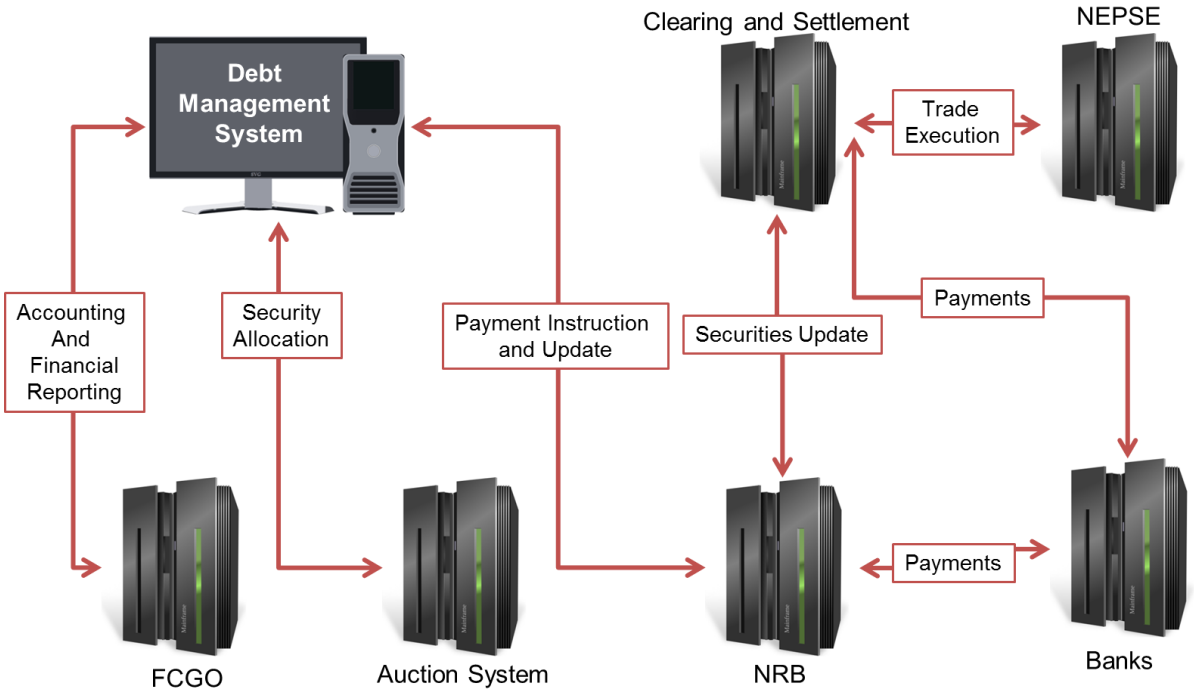
3.3.6 Transaction Settlement – Non-Exchange Traded

Transaction Settlement – Non - Exchange Traded	
Stakeholders	**Roles**
System	1. Collates all cleared transactions for each buyer-seller. 2. Calculated net securities to be traded for each trader. 3. Sends data to depository for confirmation of availability of the securities for trader with the seller. 4. Rejects the transaction in case of unavailability of securities. 5. Calculates net debit – credit for each trader. 6. Sends debit request from buyer account to designated bank in buyer profile for cleared transactions. 7. Send credit request to seller account to designated bank in seller profile for cleared transactions 8. Receives debit-credit confirmation from respective banks. 9. Marks the transaction as settled.
Banks	1. Received debit-credit request for cleared transactions. 2. Send confirmation to system for the fund transfer. 3. Send rejection to system in case of insufficient funds.
Depository/NRB	1. Checks net securities available with the seller as per the request sent by the system. 2. Receives settlement information the system and updates ownership for all settled transactions 3. Updates ownership profile as per all settled transactions. 4. Sends confirmation to the system for confirmation of information update
PDMO User	1. Sends all settled transactions to the depository/NRB. 2. Cancels all unsettled transactions.

Functional Requirements	a) System should be able to collate all cleared transactions for all trader and arrive at net trade. b) System should be able to send credit-debit instruction over all standard banking protocols. c) System should be able to reconcile and highlight settled transactions d) System should be able to send clearance to the depository/NRB e) System should be able to process data exchange over standard settlement protocols.
Illustrative Reports/ Output	1. Detailed transaction report 2. Summary of rejected/cleared transactions during a period

3.4 Information Exchange

The requirement and importance of data exchange between various systems has already been highlighted. The exhibit hereunder, summarizes the data flow between the various systems.

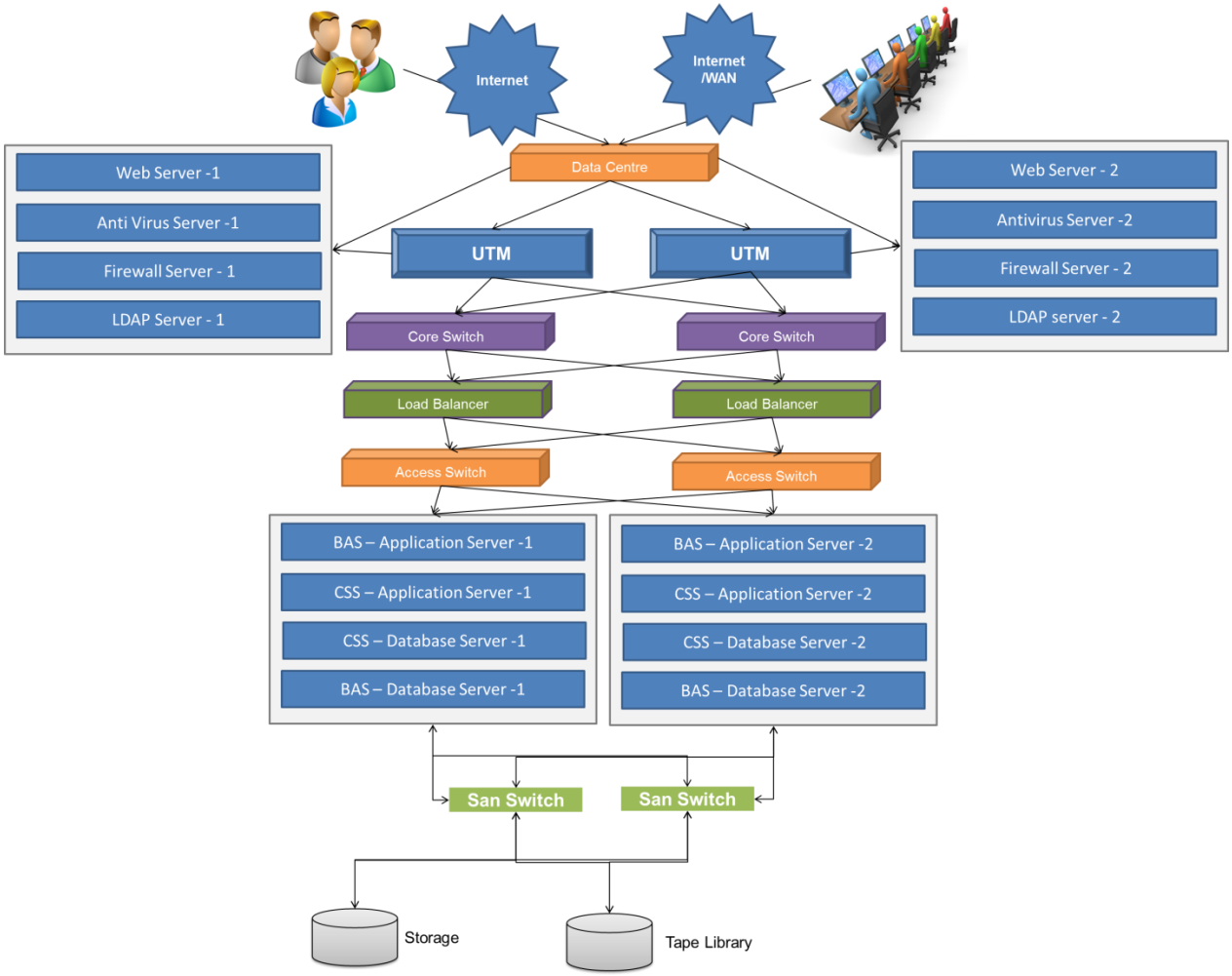


4 Deployment Plan and Technical Requirements

For the Debt Recording System, CS-DRMS shall be procured for the proposed PDMO. It is a client - server 2-tier architecture system which will be setup at the PDMO. Access may be granted to other offices via a VPN connection or by converting the system in browser based by using tools like Citrix.

It is proposed that Bidding and Auction System and the Clearing and Settlement System be web-based to enable access and information exchange over the internet. These two systems may be deployed either at the PDMO premises or at a hosted data center. This can be decided at the time of procurement.

Based on this suggested design, the deployment architecture is highlighted in the exhibit hereunder:



4.1 Assumptions

We have prepared the technical requirements and budget outline based on following assumptions:

- Debt Recording and Management System shall be hosted in PDMO and access shall be provided to all designated users via web or remote access.
- No failover system has been considered for Debt Recording and Management System
- Bandwidth requirement for operationalization of Debt Recording and Management System shall be procured by PDMO. An estimate has been provided for the same.
- The Bidding and Auction System and the Clearing and Settlement System shall be hosted in a Government Data Centre in a single set of hardware with failover system.
- The data Centre shall provide:
  - UPS and power backup
  - Rack space with KVM consoles for server management
  - Redundant internet connection
  - Primary router
  - Temperature and humidity control
  - Preventive maintenance support
  - Failure management system
- No costing has been factored in for the Government Data Centre and its services
- Access for 20 concurrent users has been assumed for Debt Recording and Management System and 200 concurrent users for the other two systems.
- Market prices in India have been considered for arriving at the budget. Vendor discounts, if any, have not been factored into the budget.
- Costs of development/implementation of the software have been assumed based on current market trends.
- For the Bidding and Auction System and the Clearing and Settlement System, server virtualization has been considered instead of procuring individual physical servers.
- The brand or OEM mentioned in the procurement plan in section 4.3 is for costing purpose only and not a recommendation for that brand/OEM.

4.2 Technical Requirements

4.2.1 Requirements for Debt Recording and Management System

The minimum technical requirements for Debt Recording and Management System as internationally recognized are provided below:-

A. Server	
Processor (Number)	Intel Xeon MP 2.2Ghz (4*)
Internal Cache	Min 2 MB
Memory	16 GB DDR SDRAM
DVD-ROM Drive	48X IDE Internal
HD Configuration	Split backplane, HD Controller PERC3-QC, 128MB, 2 Internal & 2 External Channels Add-In Card RAID 1/RAID 5
HD Drives	160 GB 10K RPM Ultra 160 SCSI
Number of HD Drives	5
Tape Drive	1
B. Printers and Scanner	
Printer	LaserJet Printer with stacker (Ethernet ready) Black and white printer recommended because of the operating cost of colour laser printers.

Scanner	Fast colour document scanner for scanning agreement documents and any other related correspondence.
C. Operating Systems	
Server	Microsoft Windows 2000/2003 Server Edition, Linux (as required by the application)
Workstations	Microsoft Windows XP / Vista or above, Linux (as required by the application)
D. Databases	
Option 1: Oracle	Oracle 9i Release 2 or Oracle 10g v10.0.2
Option 2: Microsoft SQL Server	MS SQL Server 2000 (SP3) / MS SQL Server 2005
E. Workstations	
Processor	Pentium® 4 2.66GHz
Bus Speed	533Mhx Front Side Bus
Memory	1GB SDRAM
DVD ROM	48X IDE Internal
HD Drives	80GB Hard Drive
Network Card	10/100mbs
Software	RDBMS Client Application
	Microsoft Office
	Adobe Acrobat Reader
Number of Workstations	20
F. Network	
Network	TCP/IP Network
Speed	10/100mbs
G. Citrix or equivalent (Only for accessing CSDRMS via browser, if is procured)	
Number of Sockets	20
Type of license	Perpetual
OS support	Windows XP/Vista and above

4.2.2 Requirements for Bidding and Auction System and Clearing and Settlement System

It is proposed that the Bidding and Auction System and the Clearing and Settlement System be web-based for ease of access and data exchange with multiple agencies. They can be hosted either at PDMO or at a data centre. To minimise the costs of procurement and maintenance for these systems, it is recommended that they be hosted at the same location enable sharing of hardware. The hardware specifications for both the systems are as hereunder. These specifications are tentative and as per the present recommendations. These should be finalized based on the requirement of the selected solution (Application Software) and deployment option.

A. Server	
It is considered that multiple servers will be setup on individual physical servers through virtualization.	
CPU	8 Processors of X86 Intel Xeon based E5 (Intel E5-2620 or above) with 64 bit Extensions (EM64T). There should be four cores per processor. The Frequency should be minimum 2.66 GHz.

Chipset	Suitable Processor OEM motherboard/chipset
Form factor	Rack form factor
Memory	96 GB minimum 1600MHz ECC DDR3-SDRAM DIMMs
Memory Expandability	Minimum 768 GB
Controllers	Integrated SAS Raid Controller with RAID 0, 1,5 support
Bays	Two 2.5" SAS/SSD Hard Disk bays, scalable to minimum 16 drive bays
Hard Disk Drives	Two 300 GB 2.5" SAS Hard Disk Drive hot swappable system disk with mirroring using integrated RAID 0,1 on internal disks.
Ethernet Adapter	Minimum 4 x Gigabit Ethernet Ports
Host Bus Adapters	2x8GB/s FC Ports for storage connectivity, preferably on separate adapter. MUST BE Qlogic or Emulex
I/O Expansions	Minimum 6 PCI express I/O expansion slot
Power Supply and cooling	Redundant Hot swappable Power Supply and cooling Fan
System Management and Diagnostics	LED lights indicating failing component and on-board diagnostics (via on-board system management processor)
Software	Server Management software with the device drivers
OS Compatibility	Microsoft Windows Server 2008 Standard Edition (32 bit and 64 bit) Microsoft Windows Server 2008 Enterprise Edition (32 bit and 64 bit) Red Hat Enterprise Linux 5.7 (32 bit and 64 bit) Red Hat Enterprise Linux 6.0 (32 bit and 64 bit), Oracle Enterprise Linux, Oracle unbreakable Linux, SUSE LINUX Enterprise Server 11 (32 bit and 64 bit) SUSE LINUX Enterprise Server 10 (32 bit and 64 bit) vSphere 5.1 Standard
Warranty	3 year on site 2 hour response 24x7 support. Pre failure warranty on CPU, RAM Power Supply and Hard disks. On demand Health checks and preventive maintenance to avoid failures.
Server Management	Should help provide proactive notification of actual or impending component failure alerts on critical components like CPU, Memory and HDD. Should support Remote Management, Phone home, Service Request Management features

B. Specifications for Virtualization of the Servers	
Virtualization Licenses	Unlimited enterprise licenses for virtualization (with 24X7 web/phone support) to be provided for all the servers with appropriate number of VMs and for all processor
Operating System Support	Support for wide range of Guest Operating system including RedHat Enterprise Linux, Oracle Enterprise Linux, Windows and Solaris
VCPU	Support for at least 8 vCPUs per Guest machine
High Availability	It should support automated failover of all the VMs onto another available physical server in case one system fails.
Migration	Should allow easy conversion of Physical machine to Virtual Machine, Should support migration of Virtual machines from one physical server to another. For planned downtime, it should be possible to migrate all VMS on one physical server to another without any interruption to the application service.

Management	Should have provision to create, clone, share, configure, boot and migrate Virtual machines from a browser based Management console.

C. SAN Storage	
Storage	iSCSI 6Gbps compatible, 6TB-8TB storage
Operating System & Clustering Support	• The storage array should support industry-leading Operating System platforms – VmWare, Windows and Linux (Redhat, Suse latest versions) • Offered Storage Shall support all above operating systems in Clustering.
Controllers	Dual controllers in active-active mode
Architecture	• The storage array should support dual, redundant, hot-pluggable, active-active array controllers
No Single point of Failure	Offered Storage Array shall be configurable in a No Single Point of configuration including Array Controller card, Cache memory, FAN, Power supply etc. It should have Redundant power supplies, batteries (if provided) and cooling fans and storage controller.
Disk Drive Support	Offered Storage Array shall support 6Gbps dual-ported 300/ 600GB 15000 RPM hot-pluggable Enterprise FC/SAS hard drives, along with SSD drives in the same device shelf.
Cache	• Offered Storage Array shall be given with Minimum of 8GB cache per controller total 16GB Cache • The cache should be mirrored across controllers
Raid Support	• Offered Storage Subsystem shall support Raid 0, 1, 1+0, 5 and Raid 6
Data Protection	• The storage array must have complete cache protection mechanism either by destaging data to SSD/flash or providing complete cache data protection with battery backup for up to 72 hours or more.
Host Ports & Back-end Ports	Offered Storage shall have minimum of 8 No.s of 8 Gbps host ports for connectivity to servers & minimum of 2 device ports for Disk shelf connectivity
Ports Bandwidth	Offered Disks shall be minimum 6 Gbps
Global Hot Spare	• Offered Storage Array shall support distributed Global hot Spare for offered Disk drives • At least 2 Global hot spare drives shall be configured.
Load Balancing and Multi-path	Multipath and Load balancing should be provided
Maintenance	Offered storage shall support online non-disruptive firmware upgrade for both Controller and disk drives.
Business Copy	Shall support Snapshot or any other means to support Business copy. Required licensing should be provided for the entire capacity supported by the Array.
Storage Array Configuration & Management Software	• Storage Array configuration and Management software. Management software should be provided to manage all the servers, O/S, Virtualization and Storage from a single tool. • Should support Remote Management, Phone home, Service Request Management features
Performance Management	Performance management software for Storage Array. It should be possible to identify performance bottlenecks upto the level of a single file or single user causing performance issues.

Software Features	Software Licenses for Thin provisioning and Remote Management must be included for the storage array
	The SAN Array should support data replication in both synchronous & asynchronous modes with consistent copy of replicated volumes at target site.

C. SAN Switch	
Capacity	SAN switch shall be configured with minimum of 16 Ports.
Scalability	To be scalable up to 48 ports
Throughput	Must deliver 8 Gbit/Sec Non-blocking architecture with 1:1 performance for up to 48 ports
Auto sensing	Must protect existing device investments with auto-sensing 1, 2, 4, and 8 Gbit/sec capabilities
Configuration	The switch shall support different port types such as FL_Port, F_Port, M_Port (Mirror Port), and E_Port;
Form Factor	The switch must be rack mountable
Upgrade	Non-disruptive Microcode/ firmware Upgrades
Bandwidth	The switch shall provide Aggregate bandwidth of 768 Gbit/sec: 48 ports × 8 Gbit/sec (data rate) end to end.
Management	Switch shall have support for web based management and must also support CLI.
Interface	The switch must have necessary port/ mechanism for firmware download, support saves, and configuration upload/download.

D. Server Load Balancer	
Specifications	10/100/1000Mbps Ethernet Ports - 4 ports
	Minimum of 2 Gbps throughput upgradeable upto 4 Gbps
	Minimum of 1 Gbps SSL throughput
	Minimum of 5000 SSL connections
Server Load Balancing Mechanism:	Cyclic, Hash, Least numbers of users
	Weighted Cyclic, Least Amount of Traffic
	Customizable Algorithm / Response Time
	Should support IPv4 and IPv6 traffic and should be able to translate between IPv4 and IPv6
	Should be able to natively load balance http, https, and SSL protocol in IPV6 environment.
	Should support bidirectional Network Address Translation (NAT) and Port Address Translation (PAT)
	Supports Active-Active and Active-Standby Redundancy
	Segmentation / Virtualization support along with resource allocation per segment, dedicated access control for each segment
Server Load Balancing Features:	Server and Client process coexist
	UDP Stateless
	Service Failover
	Backup/Overflow
	Direct Server Return

	Client NAT
	Port Multiplexing-Virtual Ports to
	Real Ports Mapping
	DNS Load Balancing
Load Balancing Applications:	Application/ Web Server, Streaming Media
	DNS, FTP- ACTIVE & PASSIVE,REXEC, RSH,
	LDAP, RADIUS
	Content Intelligent SLB
	HTTP Header Super Farm
	URL-Based SLB
	Browser Type Farm
Management Options:	Secure Web Based Management
	SSH
	TELNET
	SNMP v1, 2, 3 Based GUI
	Command Line

E. Switches	
Core Switch:	Should be Chassis based switch with passive backplane
	The chassis should have minimum 10 slots out of which 8 slots should be used for interface modules and the remaining 2 slots used for CP cards
	The switch should have distributed nonblocking architecture and each module should be provisioned with adequate hardware/software to support the same.
	The switch should be provided with redundant CPU and redundant power supply redundancy
	The switch with non-blocking architecture shall offer minimum speed of 1.1 Tbps. The Same Chassis should be scalable upto 2.5Tbps Switching capacity in non-blocking Architecture
	The switch should have a minimum packet processing rate of 800 Mbps or higher and shall be supported for both IPv4 and IPv6. All the Ipv6 features to be provided from day1.
	Shall be capable of minimum 150 Gbps switching capacity per slot.
	Shall support multi-layer switching, Layer 2 (MAC), Layer 3 (IP address) and Layer 4 (TCP UDP port) switching/application classification and redirection
Access Switch:	24/48 port switch, as will be required. • For 24 port Switch: 24 ports 10/100/1000BaseT PoE ports with 4xcombo SFP slots & 4x10G SFP+ slots (GE Sx, Lx/LH modules will be populated in future) • For 48 port Switch: 48 ports 10/100/1000BaseT PoE ports & 4x10G SFP+ slots (GE Sx, Lx/LH modules will be populated in future).
	Support for Redundant Power supply
	Forwarding bandwidth: • 128 Gbps for 24 port Switch

	• 176 Gbps for 48 port Switch
	Forwarding rate • 95 Mpps for 24 port Switch • 130 Mpps for 48 port switch
	Configurable up to 8000 MAC addresses
	Support for Layer-2 Features
	IEEE 802.1Q VLAN encapsulation. Upto 1000 VLANs must be supported. Support for 4000 VLAN IDs.
	Centralized VLAN Management. VLANs created on the Core Switches must be propagated automatically.
	Spanning-tree Enhancements for fast convergence
	IEEE 802.1d, 802.1s, 802.1w, 802.3ad
	Spanning-tree feature to prevent other edge switches becoming the root bridge.
	IGMP snooping v3, IGMP filtering.
	Link Aggregation Protocol (LACP)
	Support for Detection of Unidirectional Links (in case of fiber cut) or equivalent and to disable them to avoid problems such as spanning-tree loops.
	Per-port broadcast, multicast, and storm control to prevent faulty end stations from degrading overall systems performance.
	Local Proxy Address Resolution Protocol (ARP)
	Must support IPv6/IPv4 dual stack
	Support for Layer-3 Features
	Basic IP unicast routing protocols (static, RIPv1, and RIPv2) must be available
	Support for Advanced IP unicast routing protocols (OSPF and BGP), for load balancing and constructing scalable LANs.
	Inter-VLAN IP routing must be supported for Layer 3 routing between two or more VLANs.
	Support for Protocol Independent Multicast (PIM) for IP Multicast routing must be supported, including PIM sparse mode (PIM-SM), PIM dense mode (PIM-DM)
	Must have IPv6 routing protocols like RIPng and future support for OSPFv3
	Network security features
	Support for mechanisms to improve the network's ability to automatically identify, prevent, and respond to security threats and also to enable the switches to collaborate with third-party solutions for security-policy compliance and enforcement before a host is permitted to access the network. Thus preventing the spread of Viruses & worms.
	IEEE 802.1x to allow dynamic, port-based security, providing user authentication.
	Port-based ACLs to allow application of security policies on individual switch ports.
	SSHv2 and SNMPv3 to provide network security by encrypting administrator traffic during Telnet and SNMP sessions.
	Bidirectional data support on the Mirrored port to allow the intrusion detection system (IDS) to take action when an intruder is detected.

	RADIUS authentication to enable centralized control of the switch and restrict unauthorized users from altering the configuration.
	DHCP snooping to allow administrators to ensure consistent mapping of IP to MAC addresses. This can be used to prevent attacks that attempt to poison the DHCP binding database, and to rate-limit the amount of DHCP traffic that enters a switch port.
	Port security to secure the access to an access or trunk port based on MAC address.
	Multilevel security on console access to prevent unauthorized users from altering the switch configuration using local database or through an external AAA Server.
	Spanning tree feature to shut down Spanning Tree Protocol enabled interfaces when BPDU's are received to avoid accidental topology loops
	Quality of Service (QoS) & Control
	Standard 802.1p CoS and DSCP
	QoS ACLs
	Eight egress queues per port to enable differentiated management of up to four traffic types across the stack.
	Weighted tail drop (WTD)/Strict Priority Queuing (SP)/Weighted Round Robin (WRR) or equivalent to provide congestion avoidance
	Strict priority queuing mechanisms
	There must not be any performance penalty for highly granular QoS functions.
	Rate Limiting function must guarantee bandwidth in increments as small as 64Kbps.
	Management
	Superior manageability Features
	Command Line Interface (CLI) support for configuration & troubleshooting purposes.
	For enhanced traffic management, monitoring, and analysis, upto four RMON groups (history, statistics, alarms, and events) must be supported.
	Domain Name System (DNS) support to provide IP address resolution with user-defined device names.
	Trivial File Transfer Protocol (TFTP) to reduce the cost of administering software upgrades by downloading from a centralized location.
	Network Timing Protocol (NTP) to provide an accurate and consistent timestamp to all intranet switches.
	SNMP v1, v2c, and v3 and Telnet interface support delivers comprehensive in-band management, and a CLI-based management console provides detailed out-of-band management.
	RMON I and II standards
	SNMPv1, SNMPv2c, and SNMPv3

F. UTM	
Architecture	Comprehensive Site-to-Site and Remote Access Security
	Web Filtering, AV, AntiSpam, and Intrusion Detection from day one should be present with subscription for three (3) years.
	At least 4 x 10/100/1000BASE-T Interfaces scalable to 8 x 10/100/1000 BaseT or more

Features	Firewall Performance: min 9 Gbps
	Security Zones: Min. 20
	User authentication
	IEEE 802.1Q VLAN support: minimum 1000 VLANs
	Concurrent sessions: minimum 80,000 per sec
	New Sessions/second: minimum 50,000
	IPSec VPN performance (168-bit DES): 1 Gbps or more
	Appliance should have minimum 6 Gbps IPS throughput
	Concurrent IPSec VPN tunnels: 300 or more
	Should have Dynamic routing RIP v1 and 2, OSPF, BGP from day one.
	Should support L3 VPN
	IPv6 routing and multicast
	Redundant Power Supply from day one.
Security Features	Attack prevention: DoS, DDoS, DNS query/SYN/ICMP/UDP/ARP flood, SYN cookie proxy, Layer 7 attacks (SQL injection, XSS, …), IP/MAC binding, IP spoofing detection, ARP reverse query, checking, Management interfaces disabled by default, TCP reassembly for fragmented packet protection
	Keying modes: manual key, IKE-PSK, IKE-X509
	Encryption: DES, 3DES, AES
	Should preferably have integrated support for Web Filtering, Gateway Antivirus and AntiSpam. Otherwise, this can be provided through external appliance(s) where the following parameters need to be met:
	Antivirus Throughput: 1500 Mbps or more
	Web Filtering: For at least 500,000 concurrent sessions
	AntiSpam: For minimum 1000 mailboxes
	Web Browser based VPN client support
	Application layer filtering: Application layer gateway support for FTP, SMTP, HTTP, RTSP,H323 and SIP, User-based Web HTTP URL content filtering, Custom SMTP mail subject/content/attachment filtering, antispam, Java/Active-X detection and blocking
	Deployment modes: NAT, PAT, IPSec NAT Traversal
	IP multicast routing
	IGMP v1, 2 and 3, PIM SM, PIM SSM, PIM DM.

G. Tape Library	
Drives	2 tape drives of LTO-Ultrium-5 or equivalent, FC interface (8Gbps) / SAS2 / iSCSI (10Gbps)
Tapes	60 nos of Ultrium-5, each 1600GB uncompressed, Max. no. of cartridges 24, 2 cleaning cartridges
Features	Encryption, path-fail-over, web based management
Power & Cooling	Dual hot-swap power supply, and fans
Backup sw and licenses	Back-up SW and licenses
Other component / utility /software	Specify & quote , as necessary to achieve solution
RoHS	Compliance and level of compliance

H. RDBMS
Enterprise version of Oracle, MSSQL, DB2 or equivalent

I. Application Server Software
Appropriate version of Web logic, WebSphere or equivalent

J. Backup Management Software	
OS Supported	Backup server to run on Redhat physical machine. Backup clients to be Windows or Linux
Online Backup Support	Necessary licenses for online backup of MSSQL RDBMS (running on 2 virtual servers)
Encryption	Should support backup media encryption both Drive hardware based and software based to protect from data theft
Virtual Server	Should be able to take backup of Virtual Servers from vSphere at the guest level
Licenses	Online backup for Oracle RDBMS (4 servers) LAN based backup for 16 servers

K. Operating System
Redhat Enterprise Linux license with 3 years subscription Premium Support

L. Infrastructure and Application Management (EMS) Software	
Mandatory	Must support multiple OS /Platforms complying Common Criteria EAL-4 and ISO/IEC/IEEE 9945 (POSIX) or ISO/IEC 23360 (LSB), as applicable.
	Proposed application server must have a published benchmark in place preferably on a clustered DB.
	Application server components must be based on open standard.
	The proposed application server must be enterprise ready application platform with built in integrations between components.
	The proposed application server must support high performing JVM's with features for real time performance and java application profiling and management.
	The proposed application server must provide in-house scripting tools.
Manageability and Health Check Monitoring	Proposed Application Server must provide a unified console for configuration and administration, including but not limited to deploy/re-deploy application, data-source configuration, message configuration etc.
	Proposed Application Server Administration Console "Tuning" must provide support to monitor threads and investigate thread dumps.
	GUI based configuration of server resources, prebuilt templates etc.
	Single management console across the tiers.

	Easy to manage multi-domain, multi version enterprise environment.
	The proposed application server must provide manageability support features like proactive management to prevent system failure including alerts, problem diagnostics, service level, configuration and life cycle management.
	The proposed application server must provide support to obtain real-time and historical in-depth JVM diagnostics including garbage collection, thread, and heap analysis without instrumentation overhead.
	The proposed application server must support the automatic detection for dead servers and common alert framework.
Diagnostics	Proposed application server must provide capabilities like session tracking and run it as executable scripts
Clustering and Availability	Support for premium clustering capabilities, automatic failover, replications, whole server migration and additional load balancing schemes.
	The Application Server must support Scalable architecture to support clustering, Fault Tolerance & Load Balancing.
Security	Proposed application server must provide support for certificate management without additional software.
JMX and Messaging	Proposed Application Server must include a Messaging provider without additional license.
	Must support all type of available messaging protocol out of the box and is capable of sending and receiving message of size > 500K.
	Proposed application server must support automatic messaging client failover when a server or network failure occurs.
Distribution, Built and Deployment	Support for iterative and incremental development. Version control of application must be part of the application serve . Single application server supporting multiple JVM versions.
	Support for side-by-side/production redeployment. Newer versions of application can be deployed side-by-side with older version in same JVM.
	Support for automatic retirement - graceful or timeout for older versions of the application.
	A unified development/customization environment for developing the application server components
	A unified comprehensive and development/customization cum deployment environment covering the entire lifecycle of development from scope formation, code generation to testing and deployment to application server.
	The proposed application server must support ordering of deployments and and deployment to multiple targets.
	The proposed application server must support zero downtime production redeployment
Data Sources and Data connectivity	Proposed application server must provide out-of-the-box support in setting JDBC over SSL data source.
Migration and Upgrade	Proposed Application Server must support Migration / Upgradation of current applications / software without any major changes.

	The proposed application server must provide Functionality for **Rolling** Upgrade which allows application of Patch without shutting down the entire cluster

M. Storage	
Operating System & Clustering Support	• The storage array should support industry-leading Operating System platforms – Windows and Linux (Redhat, Suse latest versions) • Offered Storage Shall support all above operating systems in Clustering.
Capacity & Scalability	• The Storage Array shall be offered with 4 TB Usable space using 300 GB SAS2 6 Gbps Disk drive after Raid 5 Implementation. At least two Hot spare Disks must be provided. • Storage shall be scalable to 12 TB Usable space using 300 GB Disk drive after Raid Implementation after Raid Implementation • Storage system must deliver at least 3500 Disk IOPS
Controllers	Dual controllers in active-active mode
Architecture	• The storage array should support dual, redundant, hot-pluggable, active-active array controllers
No Single point of Failure	Offered Storage Array shall be configurable in a No Single Point of configuration including Array Controller card, Cache memory, FAN, Power supply etc. It should have Redundant power supplies, batteries (if provided) and cooling fans and storage controller.
Disk Drive Support	Offered Storage Array shall support 6Gbps dual-ported 300/ 600GB 15000 RPM hot-pluggable Enterprise FC/SAS hard drives, along with SSD drives in the same device shelf.
Cache	• Offered Storage Array shall be given with Minimum of 2GB cache per controller • The cache should be mirrored across controllers
Raid Support	• Offered Storage Subsystem shall support Raid 0, 1, 1+0, 5 and Raid 6
Data Protection	• The storage array must have complete cache protection mechanism either by destaging data from SSD or providing complete cache data protection with battery backup for up to 72 hours or more.
Host Ports & Back-end Ports	Offered Storage shall have minimum of 4 No.s of 8 Gbps host ports for connectivity to servers & minimum of 2 device ports for Disk shelf connectivity
Ports Bandwidth	Offered Disks shall be 6 Gbps
Global Hot Spare	• Offered Storage Array shall support distributed Global hot Spare for offered Disk drives • At least 2 Global hot spare drives shall be configured.

Load Balancing & Multi-path	Multi-path and load balancing software shall be provided,
Maintenance	Offered storage shall support online non-disruptive firmware upgrade for both Controller and disk drives.
Business Copy	Shall support Snapshot or any other means to support Business copy. Required licensing should be provided for the entire capacity supported by the Array.
Storage Array Configuration & Management Software	• Storage Array configuration and Management software. Management software should be provided to manage all the servers, O/S, Virtualization and Storage from a single tool. • Should support Remote Management, Phone home, Service Request Management features
Performance Management	Provision for performance management software for Storage Array. It should be possible to identify performance bottlenecks upto the level of a single file or single user causing performance issues.
Software Features	Software Licenses for Thin provisioning and Remote Management must be included for the storage array
	The SAN Array should support data replication in both synchronous & asynchronous modes with consistent copy of replicated volumes at target site.
Warranty	3 years onsite warranty support.

4.3 Cost Estimates for the IT Requirement

This procurement plan captures tentative bill of material required to implement various application software suggested in this report. However the rate of the items may vary widely depending on actual technical specification of the items that the software implementation vendor may suggest. Moreover, there is further scope of hardware resource optimization which will depend on the technology chosen by the software developer. As per the current budget the total investment for procuring all the application software, hardware and implementation of the same will be around ***USD 2 Million***.

It is important to highlight that, since both CSDRMS and DMFAS are proprietary application, therefore, the cost structure related to license fee and maintenance may vary as also requirement for some specific technical requirements. Further, it is estimated that the option for development of the Debt Recording and Management Application will also have similar investment outlay as required for CS-DRMS or DMFAS implementation, if developed locally.

4.3.1 Debt Recording and Management System

The cost estimates for both CS-DRMS and DMFAS and for local development have been outlined below:-

4.3.1.1 For CS-DRMS

The CS-DRMS is a proprietary product and can only be supplied by the Commonwealth Secretariat, London. The Secretariat supplies the software to its member countries free of charge. It has made arrangements with Crown Agents, London for distribution of the software to the non-commonwealth countries. Nepal not being a member of the Commonwealth can obtain the latest version of the CS-DRMS software from the Crown Agents, London.

Procurement of hardware for CSDRMS can be done separately or along with hardware procurement of other systems. The expected tentative budget for hardware procurement is as hereunder.

S. No.	Components	Quantity	Unit Price (USD)	Total Price (USD)
1	CS-DRMS Server	2	10,000	**20,000**
2	Workstation	20	600	**12,000**
3	Printer	2	400	**800**
4	Scanner	1	250	**250**
5	Server OS	2	1,500	**3,000**
6	Workstation OS	20	100	**2,000**
7	RDBMS (Oracle Standard)	1	20,000	**20,000**
8	Citrix	20	1,250	**25,000**
9	First Year License of CS DRMS	1	50,000	**50,000**
10	Second and third year license of CSDRMS	2	25,000	**50,000**
11	Connectivity	3 Years	25,000	**75,000**
12	Storage	1	15,000	**15,000**
13	Price for implementation and training by Crown Agents (This will depend upon the quotation of Crown Agent and may include the data preparation also)	Lump sum	-	**200,000**
			Total	**473,050**

4.3.1.2 For DMFAS

The tentative cost of various hardware and software components have been arrived at through secondary research and are mentioned hereunder.

Procurement of hardware for DMFAS can be done separately or along with hardware procurement of other systems. The expected tentative budget for hardware procurement is as hereunder.

S. No.	Components	Quantity	Unit Price (USD)	Total Price (USD)
1	DMFAS Server (Quad Core Processor 64 bit)	2	15,000	**30,000**
2	Workstation	20	600	**12,000**
3	Printer	2	400	**800**
4	Scanner	1	250	**250**
5	Server OS	2	1,500	**3,000**
6	Workstation OS	20	100	**2,000**
7	RDBMS (Oracle Standard)	2	20,000	**40,000**
8	Application Server (Oracle)	2	5000	**10,000**
9	Development Fee of DMFAS	1	75,000	**75,000**
10	Maintenance for two years	2	10,000	**20,000**
11	Connectivity	3 Years	25,000	**75,000**
12	Storage	1	15,000	**15,000**

13	Price for implementation and training (This will depend upon the quotation of the agency and may include the data preparation also)	Lump sum	-	**200,000**
Total				**483,050**

Note: DMFAS being a browser based system can also be put together with other application systems mentioned in this report.

4.3.1.3 For Local Development

S. No.	Components	Quantity	Unit Price (USD)	Total Price (USD)
1	Server	2	10,000	**20,000**
2	Workstation	20	600	**12,000**
3	Printer	2	400	**800**
4	Scanner	1	250	**250**
5	Server OS	2	1,500	**3,000**
6	Workstation OS	20	100	**2,000**
7	RDBMS (Oracle Standard)	2	20,000	**40,000**
8	Application Server (Oracle)	2	5000	**10,000**
9	Connectivity	3 Years	25,000	**75,000**
10	Storage	1	15,000	**15,000**
11	Price for Development, implementation and training (This will depend upon the quotation of the agency and may include the data preparation also)	Lump sum	-	**300,000**
Total				**478,050**

Note: The cost may further reduce in this option if the developer chooses to use open source platform (RDBMS and Application server) for system development and implementation.

4.3.2 Bidding and Auction System and Clearing and Settlement System

The application for Bidding and Auction System and for Clearing and Settlement System can be Customized Off-the Shelf Solutions (COTS) or Custom Developed Software. It is recommended that procurement of both the applications be done together to enable compatibility of the systems and ease of implementation and maintenance.

Procurement of the hardware for the same can be either along with the procurement of the application or separately as a hardware procurement package. The expected budget for the same is as hereunder:

S. No.	Components	Quantity	Unit Price (USD)	Total Price (USD)
Server				
1	Server (with installation and 3-Year support)	5	15,000	75,000
Network and Security				
2	Load balancer	2	10,000	20,000
3	Core Switch	2	10,000	20,000
4	Access Switch	2	2,000	4,000
5	UTM	2	10,000	20,000
Storage				
6	SAN Switch	2	10,000	20,000
7	Storage	1	20,000	20,000
8	External Tape Library	1	20,000	20,000
Software				
9	Infrastructure and Application Management (EMS) Software	1	9,000	9,000
10	Anti-Virus	5	10,000	50,000
11	Operating System	2	10,000	20,000
12	RDBMS	5	30,000	150,000
13	Backup Management Software	1	30,000	30,000
14	Virtualization Software	1	30,000	30,000
Application Cost				
15	Development of both systems and 1 Year Maintenance	250 Man Months	4,500	1,125,000
			Total	**1,613,000**

5 Way Forward

The IT system requirement for the proposed PDMO as presented in this report would facilitate ADB/MoF in undertaking the procurement activities in line with the ADB procurement Guidelines. However, it is important to highlight that the timelines for the IT procurement should take into consideration the finalization of the organizational structure and functions of the PDMO prior to the procurement since the proposed IT systems will be ultimately used by the PDMO staff. ***The tentative timelines for the IT procurement post finalization of the organizational structure and functions of the PDMO are suggested as under***:-

IT Procurement Activities	Time Lines		
	Q2, 2014	Q3, 2014	Q4, 2014
Preparation of Functional and Technical Requirement Specifications			
Preparation of IT Infrastructure Sizing and Specifications			
Preparation of Standard Bidding Documents for procurement of: 1. Application and hardware for On Line Bidding & Auction System and Clearing and Settlement System and 2. Hardware for CS-DRMS/DMFAS/Local Development			
Procurement of CS-DRMS Application from Common Wealth Secretariat/DMFAS from UNCTAD or Local Development			
Conducting the Bid Process Management for the IT procurement and selection of Vendor			

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