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1.1.1 Introduction of Mandis Trade

The proposed e-NAM application is a centralized web based application designed to be accessed by all the users (Farmers, Farmer Groups, Business community and Government etc) across the Nation. Internal users can access portal and application modules of e-NAM through an enterprise wide secured interface/portal. Farmers, business community and other registered public users can access portal through internet.

In the first stage, farmers bring the commodities for sale in the market yard through different means of transport like trucks, carts, tractors. An electronic entry pass is generated which has relevant details about the farmer and the commodity details farmer has brought for sale. These details include name and address of the farmer, name of the commodity with approximate weight, name of the commission agent (CA) or firm name where the commodity will be displayed for the sale. The entry pass also carries a LOT number to facilitate local trade and a unique ID number for inter-market trade.

The farmer takes the commodity to the assigned commission agent or for direct sale. The commodities displayed through the assigned commission agent will be inspected by the interested traders or their representatives for physical examination to assess its quality parameters like variety, grade and LOT size. Since trade in most of the traditional markets does not take place on the basis of grades and standards, physical examination of the commodity is vital in taking decisions on the trade transactions.

Since some markets have started grading and testing/assaying of the produce, the relevant information will be updated against the LOT number on e-NAM application to facilitate traders in taking trade decisions. On the basis of physical examination, the interested traders may quote their prices through the computer system or by logging in to the application in mobile that is available in the shops or through the computers available in the market yard. Since the facility is internet based, the quotation by the registered traders may be made from anywhere by accessing their account using internet within the time

prescribed for e-quotation by the APMC for that particular commodity. In this way the rates quoted by different traders for different commodities will be collected.

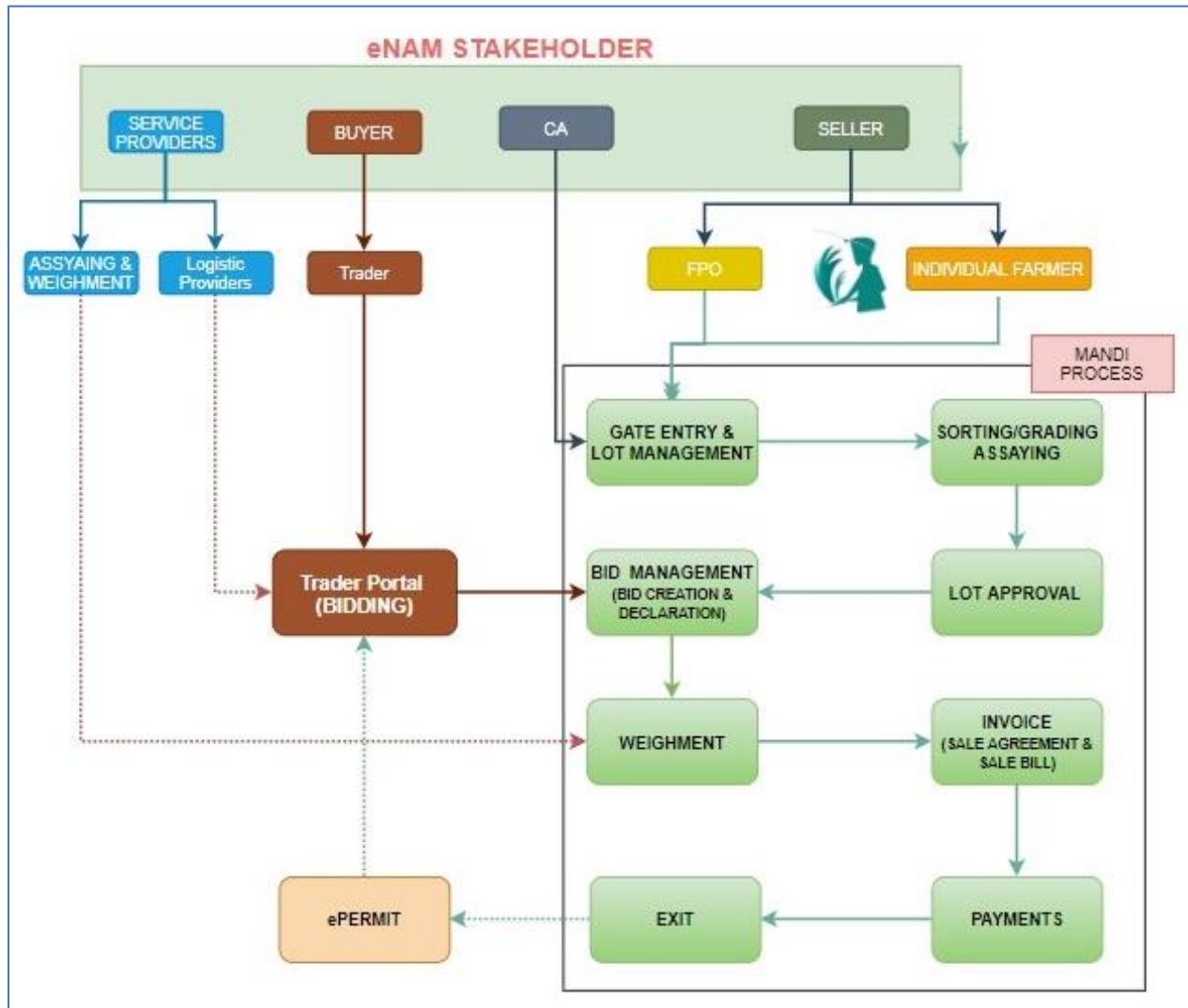
The quotes of different traders are finally submitted which may be evaluated and if successful, the traders will have to honor the final quote.

At any prescribed time the software will display the probable successful quotation i.e. highest price quoted for different LOTS of commodities will appear on the monitor. If multiple quotes with same price for a particular lot are received then they will go through manual selection as per APMC rules. The print out of selected information is taken and displayed on the electronic display board. The same is circulated through SMS, e-mail among all the farmers and traders. This information can also be accessed from anywhere by the registered user.

After receiving the quote, the farmer will decide whether to sell his commodity or not. If the farmer is not willing to offer his produce for sale at the bid value, he is given facility to reject it within the stipulated time or else it will be deemed accepted at the bid value and the trade procedure will move forward. The actual weight of the commodity will be recorded and entered into the system. On receiving the final weight and confirmation, the primary sale invoice will be generated. The farmers can get his sale proceeds immediately. The trader who purchases the commodity takes delivery of the commodity.

The trader will transfer the agreed transaction value to escrow account by using online payment. From escrow account, the total amount will be disbursed to all the beneficiaries involved in the particular transaction. This calculation is done automatically by the system as per predefined fee category masters.

PROCESS FLOW chart of eNAM MANDI:



Introduction

The actual flow of activities in Mandi Trade has been illustrated in the flow chart above. The bidding process and weighment takes place after the LOT has been assigned to the farmers' produce by the APMC official. Provision for quality assessment and recording of the same is also provided at this stage to enable both buyer and seller obtain better value in the transaction.

The users (buyer & seller) can use the analytics based on the previous bids to evaluate the bid price and quality standards of the same item for better quality and value.

Users may use the information available in the portal regarding assaying standards/ parameters for any specific produce. That will also help the farmers to produce better quality products by understanding the requirement of matching the parameters of quality testing. This will also lead the farmers to collaborate with other beneficial schemes running by Govt. of India like improving the knowledge base / providing quality seeds by National Agriculture universities.

The web application can have the knowledge base/case studies/problems/solution of agricultural issues etc. provided by Agricultural institutes to help the farmers. Schemes of similar fashion are being executed at several states with minimum performance. As e-NAM is being executed on ground and users are directly interacting with the platform, the e-NAM platform can also be used to make most of the features of farmers benefiting schemes' which are actually either not in the reach of the farmers or couldn't be executed because of ground reasons.

The various sub-sections of this process such as;

- ❖ Arrival recording (gate entry & Lot Management)
- ❖ Sampling / Assaying
- ❖ Weighment Management
- ❖ eTrade (Bid creation & Declaration)
- ❖ Trader Portal (Rate entry)
- ❖ Invoice Generation & Payment Settlement
- ❖ Exit Management

Detailed description about each subsection follows:

Arrival Management

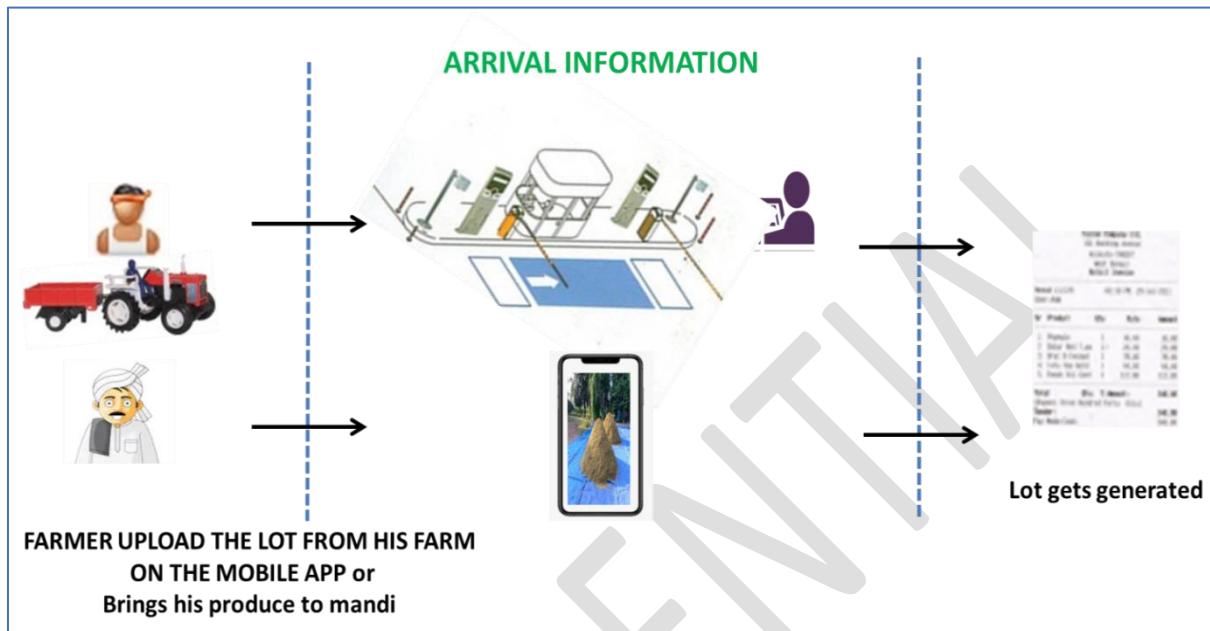
Arrival Management contains Gate entry module & Lot Management Module. Details are given below in the illustrative diagram.

Gate Entry Module

Gate Entry module related to information of seller type and lot type to generate Lot code at Mandi.

The information regarding type of the commodity, the quantity of the commodity, the name of commission agent etc. will be entered in the system through Desktop/Mobile device as input terminal. A print out will be provided to the farmer at this stage with details such as LOT number,

commodity variety, no. of bags etc. The printout will have a QR code for ease of information capture at later stages in the trading process.



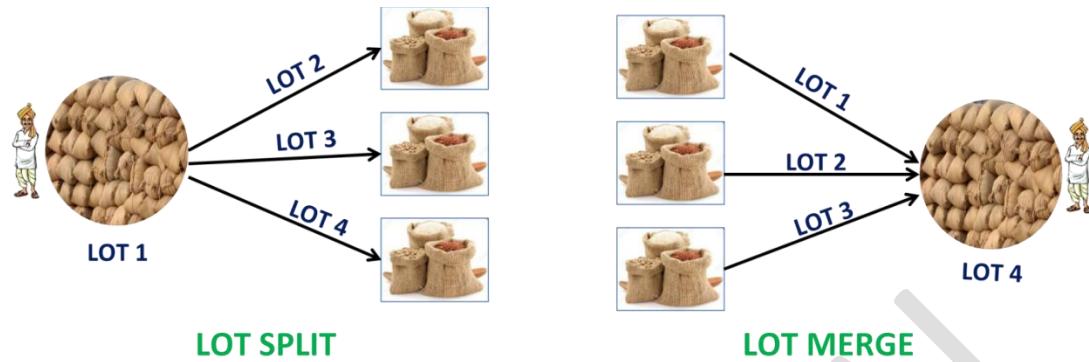
Gate entry will facilitate following features:

- ❖ In order to reduce the crowd at the entry gate Mandi /APMC officials are allotted respective locations (Zones) in the market yard to generate Lot ID based on the registered farmers.
- ❖ Farmers/users may use the mobile application for slot/appointment booking to reduce the crowd. Mobile app can be helpful to use the data available with farmer with document/image upload facility to save extra efforts. Automatic lot ID can be generated and allotted at the same moment. This can be verified using UIDAI services to authenticate the farmer/user either by OTP or by biometric at the entry gate.
- ❖ To reduce crowd, same type of grains/produces can also be clubbed together time slot wise. The mobile app can have the QR code allocated with appointment request that can be validated while entering the yard.
- ❖ Gate pass is generated on the basis of this information with LOT number as unique ID through Mobile Device/Desktop. Either the farmer can come to the entry counter or the operator can go to the farmer with mobile device.

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- ❖ Audio messages will be broadcasted through the public address system requesting farmers to obtain mandatory arrival slips and LOT allocation without which their produce will not be traded. This also prevents congestion at the entry counters.
 - ❖ Printout with QR Code is given to the farmer and the respective slip is tagged on the commodity once the unique LOT ID is generated. This unique ID will be used throughout the process till settlement etc.
 - ❖ The mobile app will show the progress and current stage/required action with necessary notifications. That can be helpful for new users.
 - ❖ Temporary lot feature can be created at the time of gate entry and later it can be converted to normal lot.
 - ❖ Quick farmer registration feature is available at Gate entry.
 - ❖ Farmers/users may request their registration from web/mobile by self-authentication using proper documentation. An automated approval workflow shall be facilitated to the authorities for verifying and approving the registration request.
 - ❖ Farmer through his registered login ID can create his own lot ID through Gate entry form in Farm gate module (Mobile APP).
 - ❖ Advance gate entry option is available for Farmer / Trader
 - ❖ Stakeholders involved in gate entry module are
 - Farmer: Act as a seller for primary Trade.
 - Farmer: Can create lot through farmgate module
 - Trader: Act as a seller in secondary trade.
 - Mandi Staff: Available in Mandi to generate LOT IDs through Gate entry module

Lot Management

Lot ID for a particular seller can be split or merge through this Module.



Lot management module will facilitate following features

- ❖ If the farmer requires sorting and grading of their produce, APMC may provide such facilities.
- ❖ Once sorting and grading is done, farmer gets a system generated unique lot number along with QR Code.
- ❖ This lot number will be pasted on the bags that contain the commodities.
- ❖ The LOT number is used for displaying the quotes in the market by the traders.
- ❖ Same farmer LOTS can be merged or split.
- ❖ Farmer has facility to split the LOT into multiples.
- ❖ Farmer has facility to merge his own LOTS into single LOT.
- ❖ Provision to allocate CA to particular LOT
- ❖ Stakeholders involved in this module are
 - Farmers
 - Mandi Staff
 - Commission Agent

Sampling and Assaying

Assaying is the process where the collected sample is tested using lab equipments. Assaying will be done based on Commodity and associated assaying parameters. After completion of assaying, results are entered against the lot and saved.



Sampling/Assaying module will facilitate following features

- ❖ Sorting and grading has to be carried out prior to assaying.
- ❖ The platform can capture the credentials of the official responsible for collection and testing and shall authenticate the official while submitting the testing report for each lot. This shall mitigate the loophole of biased testing and can also be supportive for the audit/RTI/farmers grievance redressal regarding testing of their produce.
- ❖ Each commodity and variety is mapped with the DMI approved assaying quality parameters and based on the same parameters, assaying will be carried and recorded.
- ❖ Farmer will get the produce assayed at the APMC testing lab or any APMC authorized testing lab. Lab technicians will collect samples of the commodity and details are updated to mandi trade application. Lot wise sample slip details will be generated from the report. Lab technicians have facility to upload the testing results and linking it to the LOT number of the produce.
- ❖ Facility to upload third party assaying certificates.
- ❖ All updated / uploaded assaying certificates can be viewed in trader portal.
- ❖ Uniform parameters for capturing of the test results per commodity (Max 30 parameters per commodity).
- ❖ Provision to Integrate third party assayers with mandi trade platform
- ❖ Stakeholders involved in this module are
 - Lab Technician
 - Farmers
 - Third party assaying agent
 - APMC / Staff

E-Trading

E-Trading is considered as the most crucial task among all the mandi management processes. It contains Bid creation & Bid Declaration. Once the lot arrives it has to be validated by APMC officials before allowing for bidding. After allowing, the details of LOT will be visible for all users across the Mandi Trade Application. Bidding for these lots will be as per the prevalent conditions in the APMC, which could be closed or open trade. Bidding will be permitted for a specified period in a day and price declaration will be done accordingly.



E-Trading module will facilitate following features

- ❖ Lot must be approved by APMC officials for bid creation.
- ❖ To make a healthy and strong bidding practice, operator can choose the minimum number of participants on the Lot as Mandatory to declare the bid.
- ❖ Operator can configure the Minimum Selling Price (MSP) for the lots so that traders cannot quote below that price. Through this, seller can be guaranteed to get the best price than the market price.
- ❖ Minimum selling price (MSP) can be derived by simple analysis of all the previous bids for any specific produce and can be confirmed by the concerned official. Bid starting, ending and declaration timings can be configured and the same are notified to the trader during the bidding process.
- ❖ Mobile app can have the reminder facility regarding important tenders such as date, time and other important schedules
- ❖ Open Bid Type: An open bid is an unsealed bid where bids of other traders are also visible.
- ❖ Close Bid Type: A close bid is a bid where bids of other traders are not visible.
- ❖ Option of commodity-wise auto bid creation is available.
- ❖ Application can declare the winners automatically without any manual intervention.
- ❖ In bid declaration, application has provision to declare / reject / extend the lots.
- ❖ Application has feature to declare the lots which are less than the minimum bidders after intimating higher authority.
- ❖ Stakeholders involved in this module are

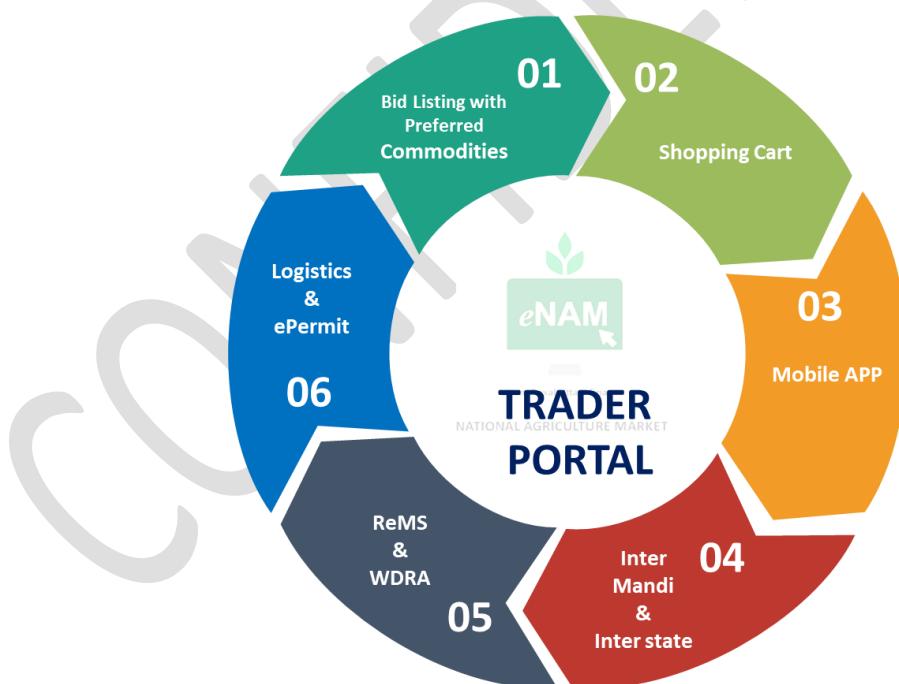
- APMC Staff
- Commission Agent
- Farmer

Trader Portal

Trader will be provided with the dedicated mobile app with specialized features for the bidding. Trader web portal contains different modules which are explained as below:

Trader Portal module will facilitate following features

- ❖ **Bid listing** is the module where the actual bidding is taken place. Trader will select the state and APMC to trade the lots. There will be specific filters to get the lots such as commodity, seller, state and place (APMC).
- ❖ By selecting **FPO** lot filter, a trader can able to trade FPO lots
- ❖ **Inter mandi and Interstate Lots** are the features where the trader is allowed to trade the lots with in the state and out of the state also. Trader need to accept the terms and conditions to do these trades.



- ❖ **Preferred commodities** where trader can choose the preferred commodities of his choice and can add to his favorites for bidding.

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- ❖ **Shopping Cart** is the feature used by the traders to select the lots and add to the cart for further trading. Through this feature trader can select preferred lots only for the trading.
 - ❖ **Logistics** is also a new feature available in the trader modules through which trader can get the details of the logistics service providers nearby or on the other state to move the produce.
 - ❖ **This shall also have the standard and approved rates of logistics**
 - ❖ **Online Payments** provision is available on the trader portal through which trader can do the online payments for single / multiple Invoices he has won. Based on the date range selection, trader can select the invoices for the online payments processing. Part payment and incentives can also be availed through this feature.
 - ❖ **e-permit is** available in trade portal and it will allow the trader to raise the request for e-permit and upon approval by concerned operator, trader can check his permit approval and can also download the same, which will be used for the commodity transport outside Mandi in synchronization with state permit requirements if any.
 - ❖ **Reports and Dashboard** is another feature available in the trader portal through which trader can download the reports and invoices. Trader can also track the bidding history and payments history. Through the dashboard, trader can see the trend of the trade and price comparisons in the selected state and APMC.
 - ❖ **Advance demand** is the feature available where the trader can post his commodity requirement in terms of quantity and quality so that the sellers can respond on the same for the trade.

Traders required specific produces in specific frequency, may create an auto advance demand request which shall populate to all the sellers in fixed frequency.

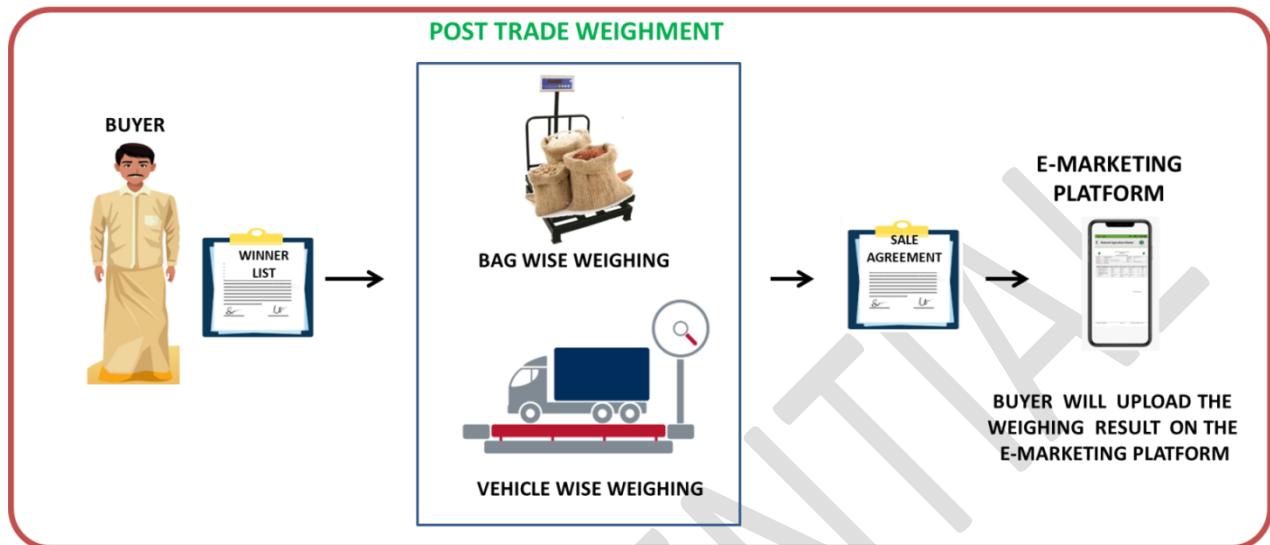
A simple dashboard analysis of high requirement produces at specific frequency, month or season can be provided to the stake holders and to the government

- ❖ Stakeholders involved in this module are
 - Trader
 - Seller

Weighing Management

This module will be used to record the weight of the produce through Mandi Trade platform. System will facilitate user to enter the weight manually which will be updated in the portal. Direct

capture of the weighment feed onto the Mandi Application through mobile devices will be integrated wherever feasible.



The Weighing Management module will consist of the following features:

- ❖ Farmer's produce will be weighed at designated weighing centers. This information is also updated in the portal and linked to the lot number of the produce by the farmer or the commission agent.
- ❖ The entries will be directly fed into the web portal from the electronic weighing machine wherever feasible.
- ❖ The agency/official shall authenticate themselves by availing Aadhaar services while submitting the weight of the produce to support any audit/RTI/Grievances related to the same.
- ❖ Persons who do not bring the produce to the APMC Market, wherever permitted, will get the produce weighed from designated weighing centers and the same will be updated in the Mandi Trade Application.
- ❖ Mobile application shall facilitate the users to show total number of and nearest weighing centers.
- ❖ Facility in Mandi Trade Application to generate auto sale agreement & sale bill at the time of weighment.
- ❖ Stakeholders involved in this module are
 - APMC Staff

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- Weighbridge Operator
 - Trader
 - Farmer

Invoicing Generation & Payments Settlement

After weighment module, the sale agreement and sale bill will be generated and shared to the seller and buyer.

The invoice module will consist of the following features:

- ❖ With the available Seller Information, Commodity Information and Winner Information, Mandi Trade system can generate the Invoice.
- ❖ APMC staff will take care of the invoicing process.
- ❖ Specified fee structure has to be made for the generation of the Invoice.
- ❖ Generation of the Invoice is the confirmation of the trade.
- ❖ Party Types for the fee components are selected.
- ❖ The same Sale Agreement and Sale bill can be accessed through the reports from the Mandi level and trader login also.

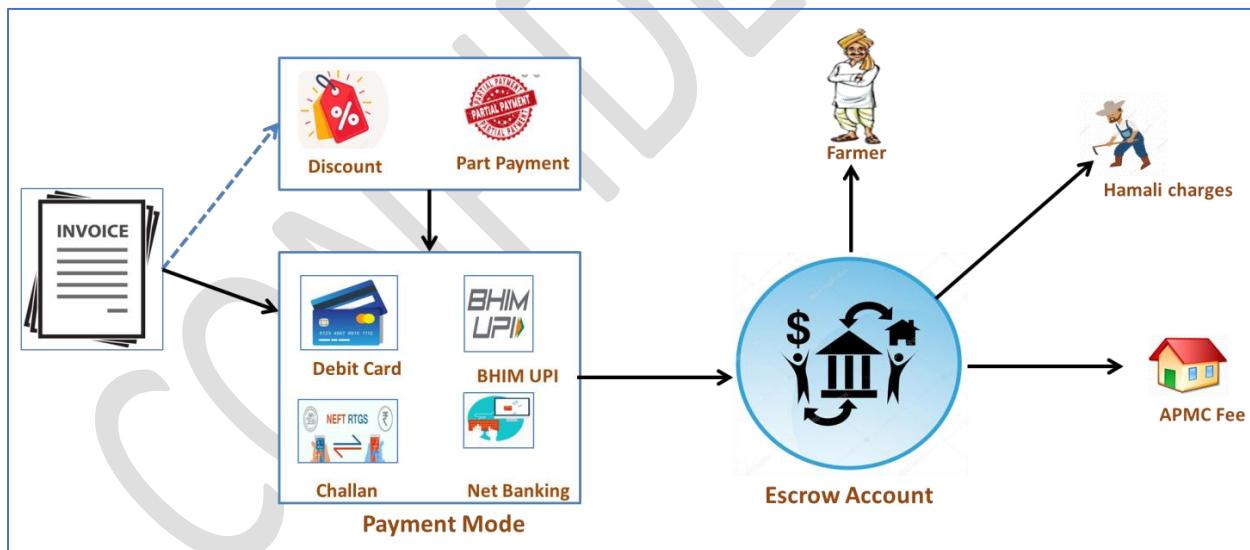
Payment & Settlement

Lots for which sale bill is generated are visible in trader dashboard to initiate the online payment process.

The Payments & Settlement module will consist of the following features:

- ❖ Based on the selected date range, trader can see the list of all lots available for the online payment.
- ❖ Lots are visible for the specific time period only and within that time period, the trader is expected to do the online payment.
- ❖ Traders may have the facility for late payment up to certain timeline with late fee.
- ❖ Application is enabled with different modes of online payments. Based on his choice, payment can be made and within the stipulated time the payments are settled to all stakeholders involved on the invoice. Ex: Market Fee, Govt. Charges / cess etc.
- ❖ Online payment can be done through the secure payment gateway of banks.
- ❖ Online payment can be done either through
 - Challan mode

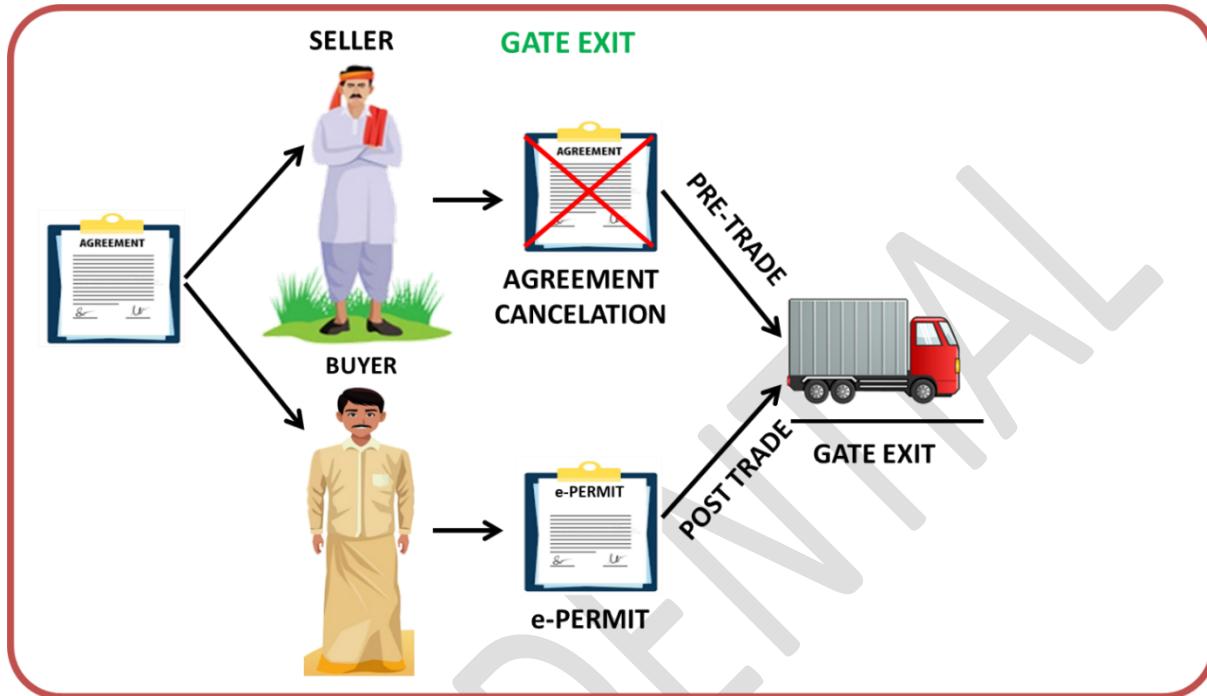
- Net banking
- Debit Card
- UPI -BHIM
- ❖ Trader has the facility to pay single invoice or pay multiple invoices at once
- ❖ Application has the facility to initiate incentives / discount / part payment based on the state and Mandi Act.
- ❖ Web portal shall have the information related to the mandi act & state-specific act to avail best of the incentives/discount.
- ❖ Seller and other stakeholders will receive the online payment based on the bank frequency. If the payment is made during the working hours it will be settled on the same day or next day based on the bank working hours and the time of initiating transaction.
- ❖ Stakeholders involved in this module are
 - Bank Partners
 - Trader
 - APMC Staff



Gate Exit Process

Depending on the terms of delivery, the winning bidder can take the delivery of goods at the APMC market through Post trade exit. The seller will dispatch the goods through a Goods Return if the commodity is unsold.

Simple analysis can be provided for unsold commodities that shall help the users to identify the reason and to make most of the sale.



The Gate Exit module will consist of the following features:

- ❖ After successful payment to the farmer, the commodity is handed over to the trader and subsequently the mandi official generates the exit pass.
- ❖ Both the farmer and trader have to confirm the transaction via mobile application after which the mandi official will generate the exit pass. The exit pass will also be available in the mobile app with barcode which can be confirmed and validated at the exit.
- ❖ If commodity is not sold, then seller has to exit mandi through "Goods return"
- ❖ Condition for post trade exit is trader is taking the commodity out of the APMC
- ❖ To record every vehicle going out of the Mandi, the module should have provision to capture the following details at the exit gate:
 - Entry Pass No (manual input)/ QR code scanning
 - Exit Pass Number (auto generated)
 - Date & time of Recording (system date)
 - Vehicle number
 - Net weight of produce
- ❖ Should be able to generate unique exit gate pass number across all Mandis.

- ❖ The module should be able to interlink with the electronics weight scale to capture the gross weight of empty vehicle. In case, the facility of electronic weigh scale is not available in the jurisdiction of APMCs, then it should allow manual input to capture this record.
- ❖ Restrictions and load carrying capacity shall be defined as per the law and shall be confirmed/ensured at the exit
- ❖ Stakeholders involved in this module are
 - Farmer
 - Trader
 - APMC staff

Master Configurations

Administration module is considered as the key area to configure and operate the Stakeholders and the modules as per the standard process. Below is the list of the modules under the administration module which will be administrated through this section.

| | |
|---|-----------------------------|
| 1 | • Organization Master |
| 2 | • Operating Units |
| 3 | • User Master-APMC |
| 4 | • User Master-State |
| 5 | • User Master-Global |
| 6 | • Role Master |
| 7 | • Commodity Group Master |
| 8 | • Commodity Master (Global) |

Mandi Configuration

For every APMC, Administration module is considered as the key area to configure and operate the Stakeholders and the modules as per the standard process.

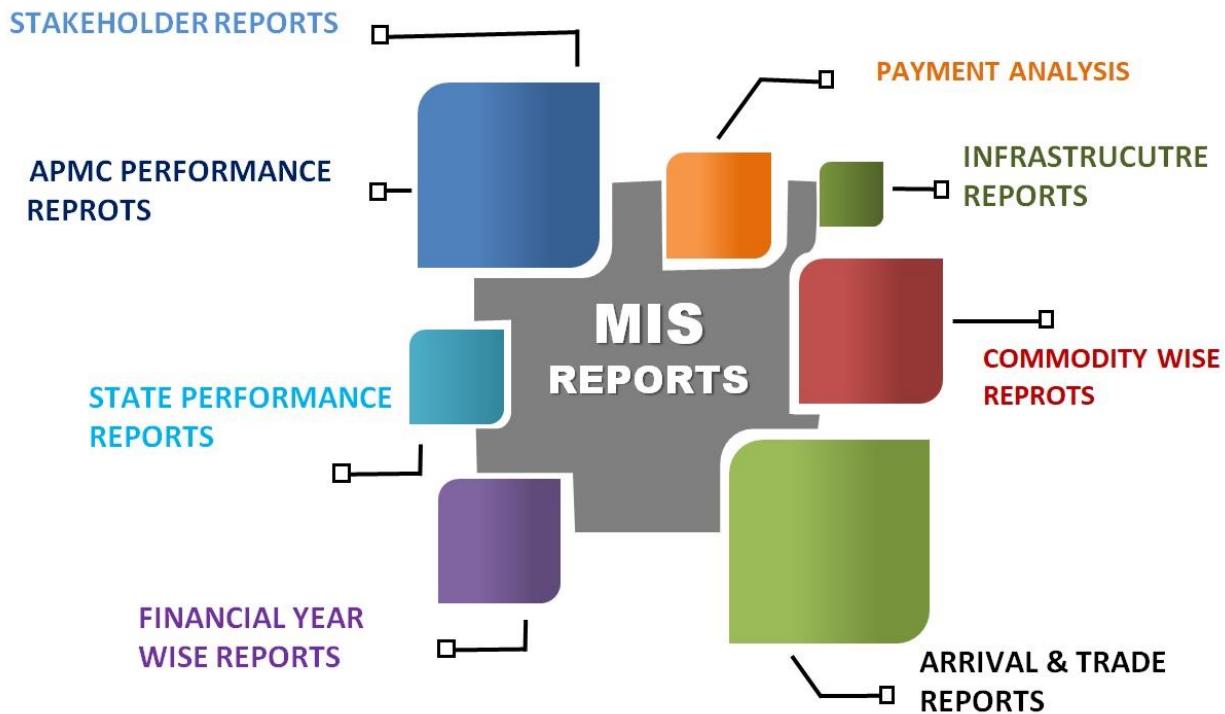
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- 1 • Fee Component(APMC Applicability)
 - 2 • Vehicle Type master
 - 3 • Commodity Master(APMC Applicability)
 - 4 • Fee Category
 - 5 • Agent Registration (Trader, CA, Service Providers)
 - 6 • Farmer Registration
 - 7 • Bag Type Master
 - 8 • Temporary Farmer Registration
 - 9 • Stake Holder Incentives

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Reporting

MIS Reports are reports required by the management to assess the performance and allow for faster decision-making. The MIS reports module would be used by the officers at the state and sub-state level offices. The officers would be able to set and select the input parameters and derive the results in the form of MIS reports.

The reports will be developed as per the requirements of application to facilitate different levels of users. Also, security feature will be maintained for sensitive data (eSign / KYC / Digital Signature). Date filters and various parameters will be applied for logical data display. All the reports will be saved in the formats like excel, word, pdf, csv. After saving, they can be emailed.



License Allotment Management Module

This module pertains to issue of licenses for establishment of private consumer market yards and sub-yards, direct purchases and licenses for various market functionaries.

This module also issues licenses for traders / commission agent / brokers as well as laborers (who perform loading, unloading, cleaning, weighting activities) within APMC notified area. The indicative functionalities of the module are discussed as under:

- ❖ The module will be accessible to the Departmental and public users.
 - Director: For providing final decision (approval / rejection) on license allotment to the applicant
 - Officer-in-charge: Overall monitoring of license allotment process
 - APMC officer:
 - To track mandi wise status of submitted applications as authorized by DAM.
 - Responsible for providing status updates and providing response to clarifications initiated by DAM, Public User / Registered User / Applicants
 - Uploading documents related to the license requisition

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- To view and download final findings related to the allotment
 - To track status of submitted complaints.
 - Escalation system for pending approvals.
- ❖ Provision for creating unique login ID for users on provision of certain mandatory details such as
- Name
 - Department
 - Designation
 - Location
 - Office Address
 - Residential Address
 - Contact Details
 - Email id
 - ID proof
 - Bank Account details
 - Aadhar
 - Pan Card

Acknowledgement and agreement to be taken by users registered to obtain the license to bound the user under terms and conditions and govt. regulatory acts.

- ❖ Provide access rights and privileges according to login ID and password. The rights and privileges allowed to that user should be as per Department guidelines and policies.
- ❖ Provide a mechanism for resetting and emailing the new password to the users registered email ID, in case one forgets his password.
- ❖ Prompt the user to change the password on the first login
- ❖ As part of registration, the module shall establish validations for future online sessions. Details such as a username and password, challenge question and response answer should be asked if login details are forgotten.
- ❖ Apply spam control measures like 'CAPTCHA' images during registration to avoid false details being automatically submitted and ensure that data is submitted by humans only.
- ❖ Provide online application form for issue of licenses to:
 - Commission Agents
 - Warehousing agencies
 - Brokers

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- Labourers
 - Traders
 - Farmers
- ❖ Facility to create master for application fees / deposits corresponding to the various categories of licenses.
 - ❖ Provide feature to list out supporting documents needed to be attached along with application forms under each category.
 - ❖ Attachment of scanned copies of necessary document with self-attestation
 - ❖ Able to define the complete workflow required for application process. It should capture the steps / business rules and digital signatures required and further role-based actions required to approve and grant licenses.
 - ❖ Facilitate workflow for License cancellation
 - ❖ The module should have integration with payment gateway and should provide online facility for payment of application fees and deposit amounts.
 - ❖ Provide license renewal work flow as per business rule of e-NAM before expiry.

User Management

User Management module will be used to manage following operations

- a) Create/Update/Delete Role
- b) Assign user profiles to roles
- c) Create/Update/Delete User Group
- d) Create/Update/Delete Users
- e) Activate and deactivate user
- f) Login and Logout
- g) Change /Reset Password
- h) Password policies
- i) Forget Password
- j) Update User Profile
- k) User access audit log

User Characteristic

APMC

- Administration of APMC specific features

GPL

- Administration of GPL controlled parameters/features

Sellers

- Individual Farmers
- Farmer Groups
- Farmer cooperatives

Buyers

- Individuals
- Institutions (Corporates and corporative groups)

Channel Partners

- Commission agents
- Logistics providers
- Warehousing firms
- Aggregators

View only users

- Central Ministries and Departments
- Research institutions
- State institutions
- Knowledge partners

State Government

- Department of Agriculture & Cooperation
- Attached offices & Directorates
- Testing Labs

Note: Channel partner's access to application will be very limited in the current scope but can be enhanced in future. Field level security is out of scope.

User Registration

The proposed solution will be accessible only for the registered users. User can register based on his specific user characteristics. Provisioning user access is the process of adding identities to an identity store. The provisioning will incorporate the following sub processes:

- User registration (Receiving User request) – Buyer, Farmer and Commission agent
- Submitting KYC form along with necessary document attachments
- Verification/ Approval process
- Payment of deposit amounts
- Assignment of identifier which is unique
- Issue of credentials
- Creation of identity in identity store



Advantages for various stakeholders

Sellers:

- They can sell products without the interference of any CA / middlemen thereby making competitive returns out of their investment.

Traders:

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- Traders will be able to do secondary trading from one APMC to another one anywhere in India.
 - Local traders can get access to the larger national market for secondary trading.

Service Providers

- Mandi trade application aims to improve the marketing aspect of the agriculture sector.
- With one license for the entire state and single point levy, an entire state becomes a market and the market fragmentation within the same state gets abolished.
- It will improve the supply chain of commodities and reduces wastages.

Buyers, Processors & Exporters

- Buyers like large retailers, processors or exporters will be able to source commodities from any mandi in India thereby reducing the inter-mediation cost.
- Their physical presence and dependence on intermediaries will not be needed.

Mandis

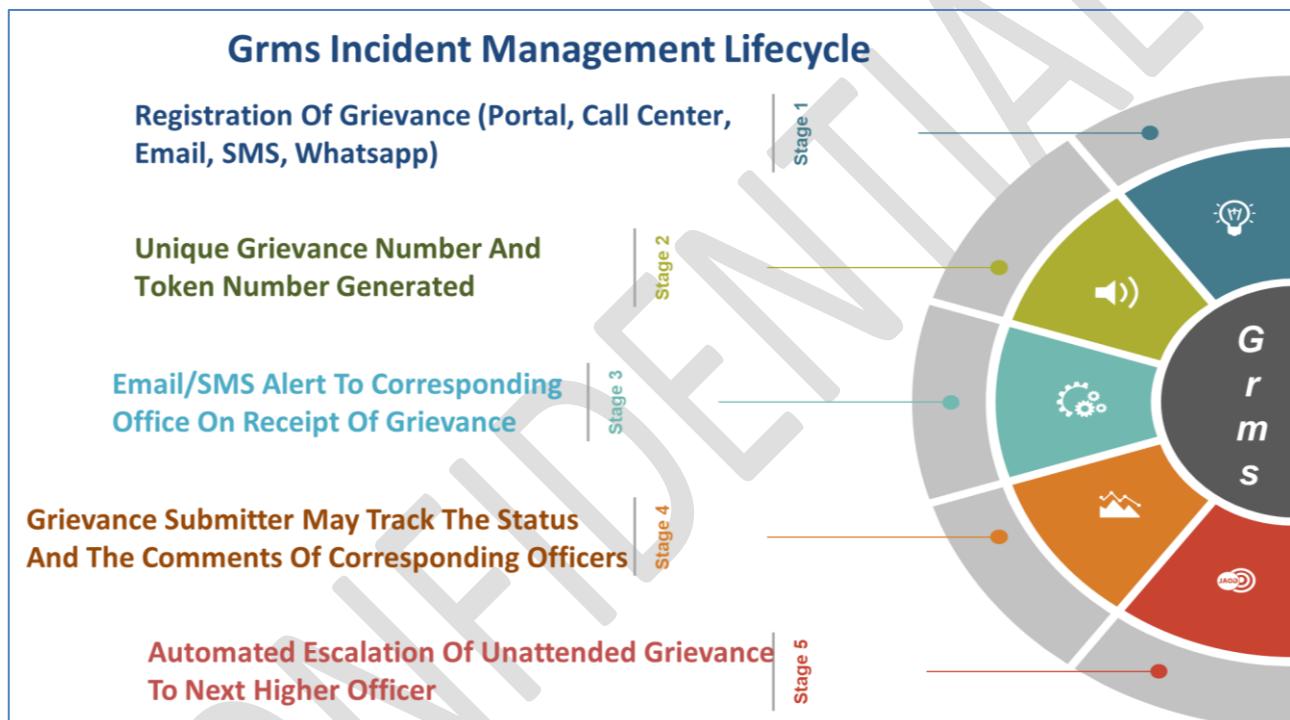
- There will be a reduction in bookkeeping and reporting system as it will be generated automatically.
- Monitoring and regulation of traders and commission agents become easy.
- Transparency in the process eliminates the scope of manipulation of tendering/auctioning process.
- Market allocation fee will increase due to an accounting of all transactions taking place in the market.
- It will reduce the manpower requirements as the tendering/auctioning process is carried out electronically.
- For instance, the system declares the winner of lots within a few seconds.
- It eliminates information asymmetry as all the activities of an APMC can be known directly from the website.

Grievance Redressal Management System

The grievance management module would facilitate the farmers/traders/buyers/general citizens to raise their grievances related to the services offered in NAM. The raised grievances would be forwarded to the assigned person to address the grievances.

The status tracking module would assist the farmers and private sector to track the status of their grievances or the queries posted to seek expert advisory, which is assumed to be in processing. The module would allow the user to trace the status using the unique reference number generated at the time of posting query/grievances.

As and when any farmer, trader or market functionary makes any complaint in this office, their grievance is heard and redressed by concerned authorities using Grievance Redressal Management System. The following features are available in the grievance redressal management system:



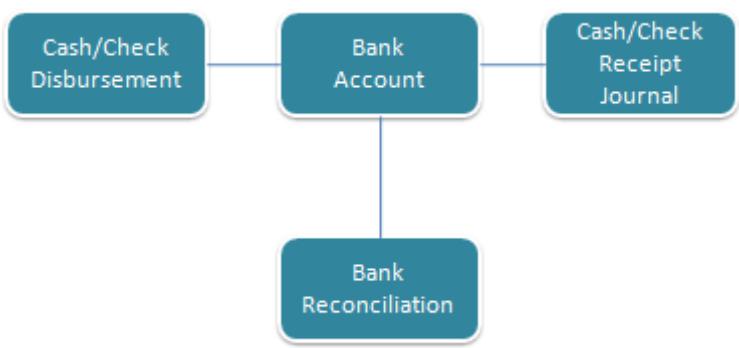
- ❖ Candidate files the complaint to the Mandi secretary/authority.
- ❖ Mandi Secretary/authority reviews the complaint and discusses with different parties. Mandi Secretary/authority may forward the complaint to the respected authority.
- ❖ Respective authority solves the complaint with the help of Mandi Secretary and Mandi Authority.
- ❖ Mode of grievance submission:
 - By Complainant
 - Web - with facility to upload scanned document
 - e-mail with facility to accept attached document
 - SMS
 - By officers for Grievances appeared in Print and social media

- ❖ Application Status Alerts and Tracking, Decision, reply – through Web interface, e-mail, SMS, IVRS
- ❖ Grievance categorization
- ❖ Other related information – contact address (name, designation, room number, telephone number, fax) of Director of Grievances and other officers dealing with grievances, their roles and functions, procedures, FAQs
- ❖ Management reports helpful in monitoring and analyzing and identifying nature and areas of dissatisfaction to take pro-active measures
- ❖ Workflow system for processing the grievance
- ❖ Online status checking
- ❖ Provision to define services level agreements (L1, L2 and L3)
- ❖ Document management system
- ❖ Flexibility to configure the levels
- ❖ Status tracking online
 - Immediate Acknowledgement
 - Immediate Reference No.
 - Status change Grievance Redressal Online
 - Initial response time

Bank Reconciliation

The Bank Reconciliation Module is required for monitoring & reconciliation of all financial statements of deposits/withdrawals from various banks

The indicative functionality of the module is mentioned as under:



- ❖ Provision to maintain a record of all financial transactions with banks.
- ❖ Ability to compare the debit and credit entries in cash book with bank.
- ❖ Provision to generate a report of outstanding balance of Cash Book and Bank.
- ❖ Provision for authorized users to put their comments online for error correction.
- ❖ Manual import of bank statement into system for reconciliation
- ❖ Separating the reconciled and unreconciled transactions in the system
- ❖ Maintain the audit trail of correction/changes in the transactions.

Security Audit Trail

Security auditing is typically used to monitor the occurrence of events, problems and security breaches. It provides a means to monitor access management events and changes to directory objects. Critical data after granting appropriate access will be maintained through Integrated Identity and Access Management system. Track of user activities and access violations will be maintained using Identity and Access Management solution. Establishing a security auditing policy will result in early detection of attacks, alerting mechanisms to initiate emergency procedures.

Audit trail will also help in monitoring activities of the Super user accounts, System administrators and system. Required audit records will be produced and kept for an agreed period to assist future investigations and access control monitoring.

Audit trail of following activities will be maintained

- ❖ User activities
- ❖ Access violations
- ❖ Authentication events
- ❖ Authorization events
- ❖ Changes to directory objects

Trigger alarms and alerts will be generated in case of security breach. The Identity and Access Management will be used to

- ❖ Track all changes in directory objects and access privileges
- ❖ Record all access activities and events
- ❖ Consolidate logs and events
- ❖ Compile reports and
- ❖ Trigger alerts

Alerts/Notifications

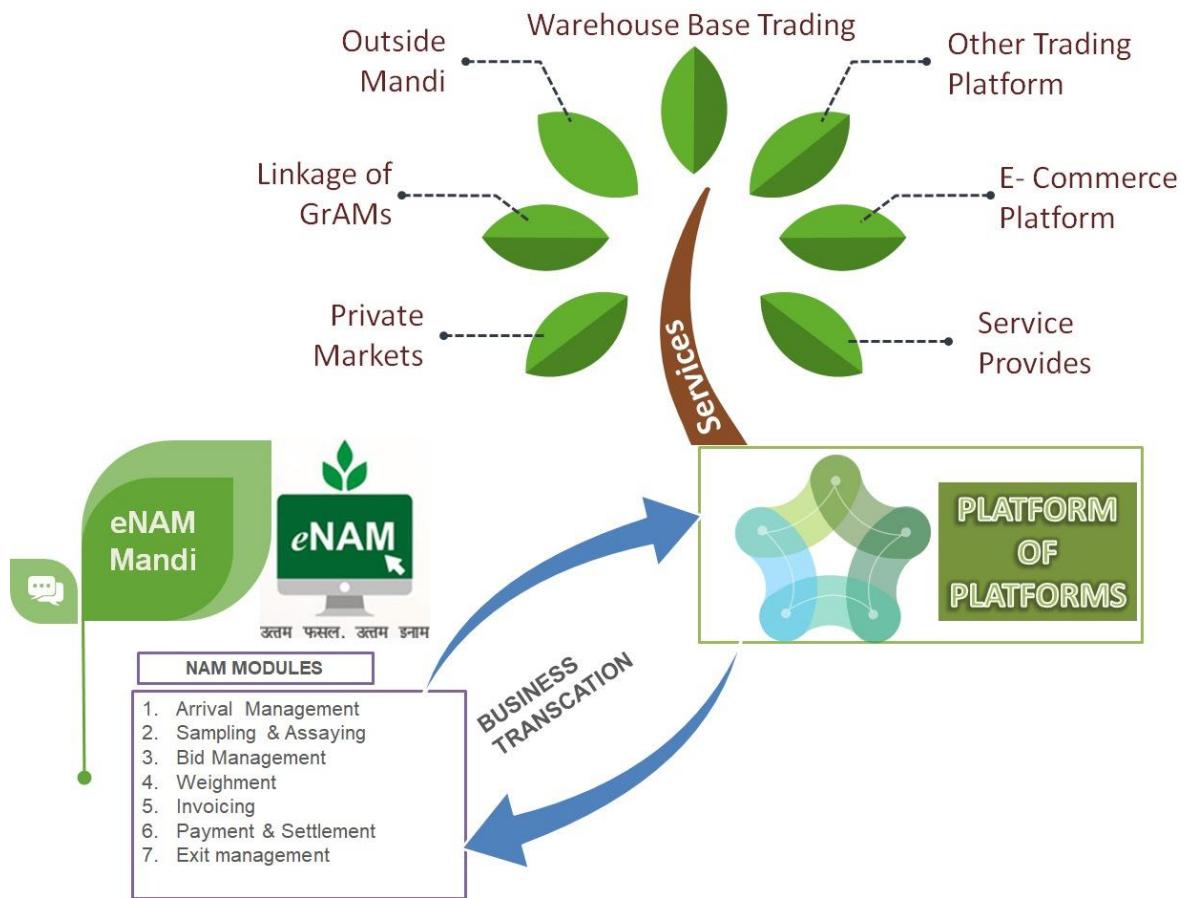
1. Alert rule creation
-

-
- Change based alerts (SMS and Email)
 - 2. Due date alerts (SMS and Email)
 - Displaying alerts on dashboard and sending email, SMS
 - 3. Traders desiring the advance mobile alert facility as arrival of 2-3 different specific commodities in selected mandis of his choice to be provided in Mandi Trade Platform.
 - 4. SMS alert / Notification on mobile app shall be provided to traders, buyers for registered commodities in specific mandis at least 15 min before the closure of bid for that commodity. This will facilitate distant buyers to promote inter state trade and inter mandi trade.
 - 5. SMS alert / notification on mobile app to traders regarding the details of mandis where maximum arrival of particular commodity is reported.
 - 6. Alert to Mandi secretaries where Inter-State trader has not paid & taken the commodity out of exit gate on same day. Further, facility for mandi secretaries to remind the inter-State trader shall be provided.

MANDI Trade Integrated with POP

By platform of platforms, the authority proposes to integrate Mandi Trade Application with various platforms (Farmgate, FPO etc) to build supply chain in agriculture sector which brings unique set of capabilities into one synchronous orchestrated way of ecosystem. Mandi Trade Application is a centralized web-based application designed to be accessed by all the users (Farmers, Farmer Groups, Business community and Government) across the Nation. Internal users can access web portal and application modules of Mandi Trade Application through an enterprise wide secured interface/portal. Farmers, business community and other registered public users can access portal through internet.

PROCESS FLOW chart of eNAM MANDI with POP



1.1.2 Introduction of Virtual eNAM

Most farmers in India face the challenge of marketing their produce and most often sell the produce at unpredictable market prices, many times at lower rate. How can technology help these farmers?

Virtual Farmers Market is an app-based e-commerce platform where farmers' surplus and buyers' demand for crops are offered for traded. The platform provides a transparent, open and trustworthy space for smallholding farmers and buyers to negotiate fair prices and deals.

The VFM platform supports smallholding farmers organized by lead farmers (VFM Ambassadors) to estimate their community's production and selling price and publish this information on the online market. Allowing buyers to access this information and communicate directly with the farmers gives farmers the opportunity to increase their business by accessing larger volumes of quality produce. As smallholding farmers become more visible to new buyers, VFM increases competition between buyers for farmers' produce, thus helping farmers get better prices and more favorable marketing options.

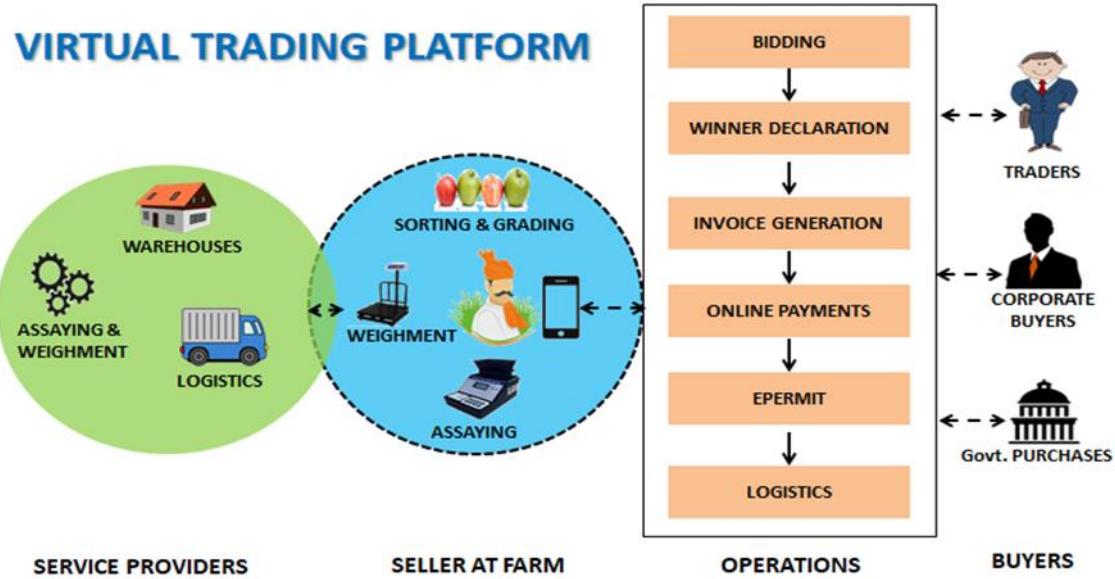
The VFM app helps to connect smallholding farmers to markets and creates a virtual, app-based network that allows farmers to interact with traders and other buyers. VFM builds on Purchase for Progress (P4P), connecting smallholding farmers to markets. The app supports the emergence of a sustainable and fair marketplace, thereby increasing smallholder farmers' bargaining power and potential profits by providing them with real-time information about worth of their crops on different markets. It also enables cooperation and knowledge sharing, and boosts farmers' productivity by ensuring their market access.

Together, this creates a virtual marketplace where the purchase and sale of produce is initiated and closed electronically after due diligence or face-to-face meeting. This also gives farmers a broader market to sell their produce and allows farmers to connect with a broad community of peers.

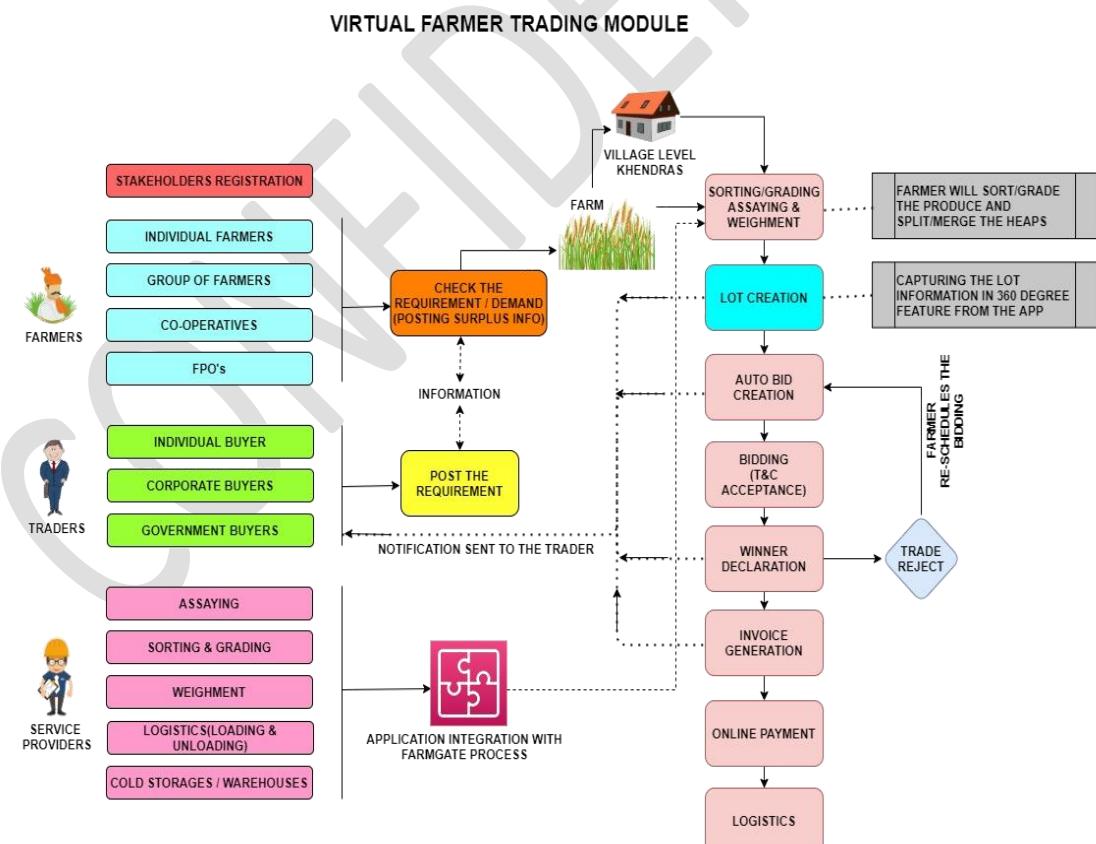
Through this platform the farmer can stay at the farm / godown and can sell the produce to the bulk buyers through the transparent trading platform. Many Farmer organizations/groups can register in this platform to avail the benefits.

Business Process Flow:



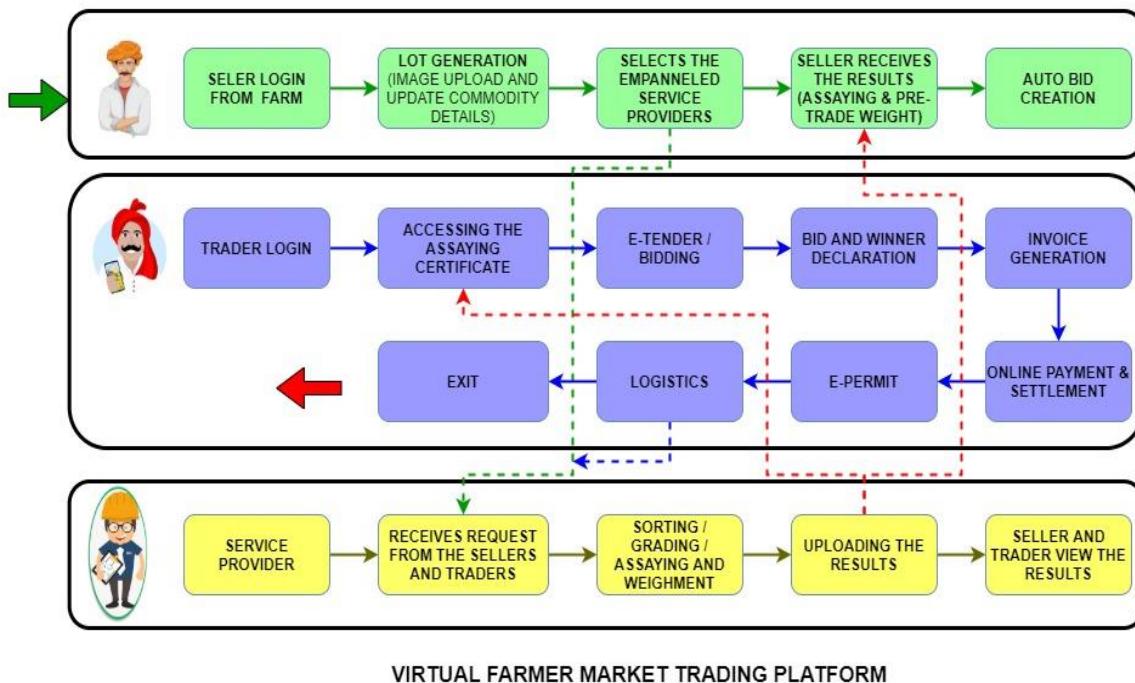


Transactional Process Flow:



Above diagram explains the detailed process of the functioning of the Virtual Markets.

Detailed Process Flow:



Benefits of Virtual Trade Market:

1. The online virtual market will prove to be a more transparent and secure platform for the farmers to sell their produce.
2. This will reduce the chances of middlemen adding any extra cost or seeking double commission.
3. This will help farmers to get better accessibility to their Agri buyers, Corporate Buyers and Government Buyers.
4. Sellers can sell the produce directly from their fields.
5. Buyers can know the produce information from anywhere through 360 degree view images and quality certificate

6. Transportation cost for the sellers will be reduced
7. Better quality of produce due to elimination of multiple stages in handling of produce
8. Faster cash-to-cash cycle time for farmers
9. No need to travel long distances to sell the produce
10. Freedom of pricing and freedom of access
11. No bargaining system
12. Seller can export his lots/produce to different Mandis/States
13. Seller can receive the payment through online in secured way and less time
14. Virtual market can also access the other platforms for the trade through POP
15. Seller can post the surplus commodity details on the application
16. Buyer can check the demand/requirement on the portal and can trade
17. Secondary trade is allowed in this platform
18. Buyer can get the best quality of the produce directly from the field
19. Seller will get the better price more than the market rate
20. Traders need not to pay any Market Fee as part of Invoice preparation
21. Traders can view the quality and assaying certificates directly on their mobile app
22. Trader can make the online payment to the seller
23. Buyers can see the Produce details and suggestions online
24. Buyers can give the feedback on the trade and service

Key Stakeholders:

In the virtual market trading platform, the key stakeholders are seller, trader, service providers and operators. Service providers are linked with the sellers and operators for the application integration. Traders will be participating in the live trade and the operators will manage the process by linking the seller and the trader.



SELLER



BUYER



SERVICE PROVIDER

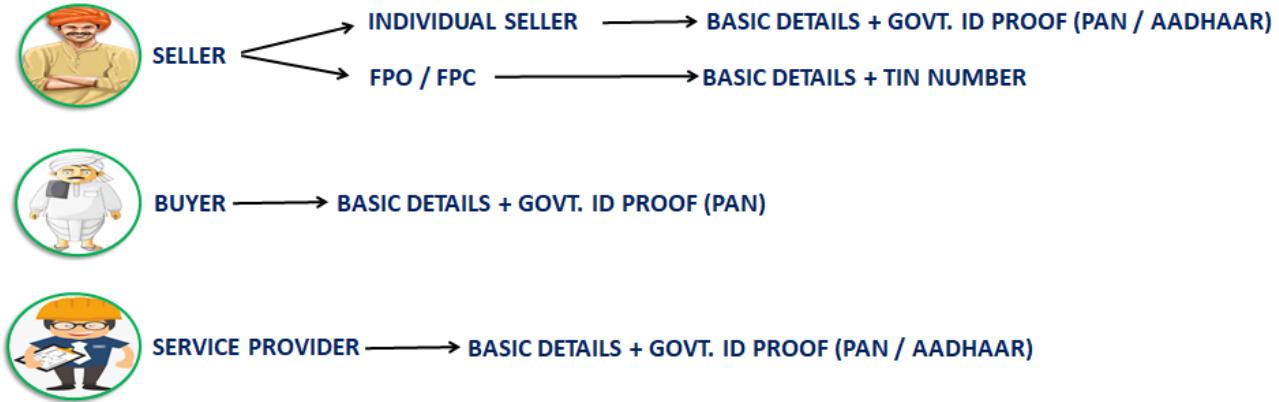
| # | Stakeholder | Activity |
|---|-------------------------|--|
| 1 | Seller | <ul style="list-style-type: none"> ○ Sell the Produce through Virtual Market ○ Create the Lots and Upload the Lot Images from the Farm ○ Upload the Assaying and Weighment Certificates ○ Accept / Reject the Trade. Track the Lot Process ○ Guiding the Trader for the Logistics |
| 2 | Buyer | <ul style="list-style-type: none"> ○ Buy the Produce from the Seller ○ Participate in the Bidding. ○ Verifying the Quality and Weighment Certificates ○ Making the Online Payment ○ Linkage with Logistics Service Providers ○ Secondary Trade Participation |
| 3 | Service Provider | <ul style="list-style-type: none"> ○ Coordination with Seller and Operators ○ Integration of Assaying and Weighment Equipment ○ Providing the Logistics Services to the Seller and Buyer ○ Support to the Seller and Operator |

Operations:

Stakeholder Registration:

As discussed in the above section there are four key stakeholders participating in this virtual trading platform - seller, trader, service providers and operators.

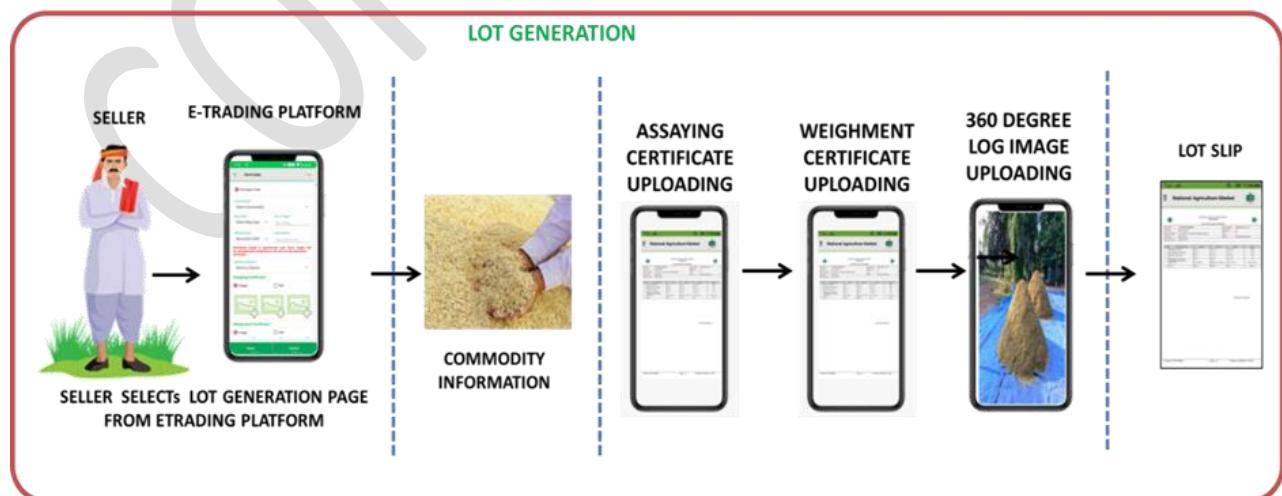
A separate registration page will be provided in the application through which the above-mentioned stakeholders can do their self-registrations by filling the necessary details as per the registration form. Users need to upload the necessary KYC proof documents to make them registered. An automatic system will be configured in the application to validate the details they have provided. Upon proper registration and validation, a unique registration number and Login-id will be generated.



Pre-Bid Management:

In the virtual market trading platform, the seller will upload the commodity information directly from their farm or go downs.

Sellers will be initially registered on this platform and they will be provided with Login-id and password. Through the Login-Id and password seller will login the application. Seller need to provide the necessary KYC documents during the registration process. Produce will not be physically visible to the buyer in this platform. Sellers will do the sorting and grading in their farms and they will convert the heaps into the separate Lots. Through the virtual trading platform (VTP) application, seller will enter all the commodity relevant information like commodity variety, quantity in quintals, bag type and number of bags. Seller will capture the commodity information through pictures of the LOT in 360 degrees view in order to communicate the physical quality of the produce. The posted information against the LOT will reach to the traders on their mobile app.



Upon successful submission of the LOT details, a lot slip will be generated internally in the application and can be retrieved later for reference. This slip can also be printed if necessary.

Assaying and Weighment Services:

Seller can use the Assaying and Weighment services through the third-party service providers. Application will allow the seller to login and access the service provider link through which seller can post the LOT number and basic commodity details. Seller will book the assaying service online and the count of samples to be assayed will be entered on the portal. Service provider can reach the seller using the GPS system for rendering the service. A confirmation message will be displayed on the portal after successful booking of the assaying service.

Service providers will visit the seller farm / go-down where the produce is kept. Service provider will do the quality assaying and the assaying results will be passed to the application through the integrated API services. Seller will be able to see the assaying certificate if the service provider is integrated with the application. If the service provider is not integrated with the application then the seller / the service provider will manually enter the assaying results against the lot and the same can be viewed by the traders who are ready to trade.



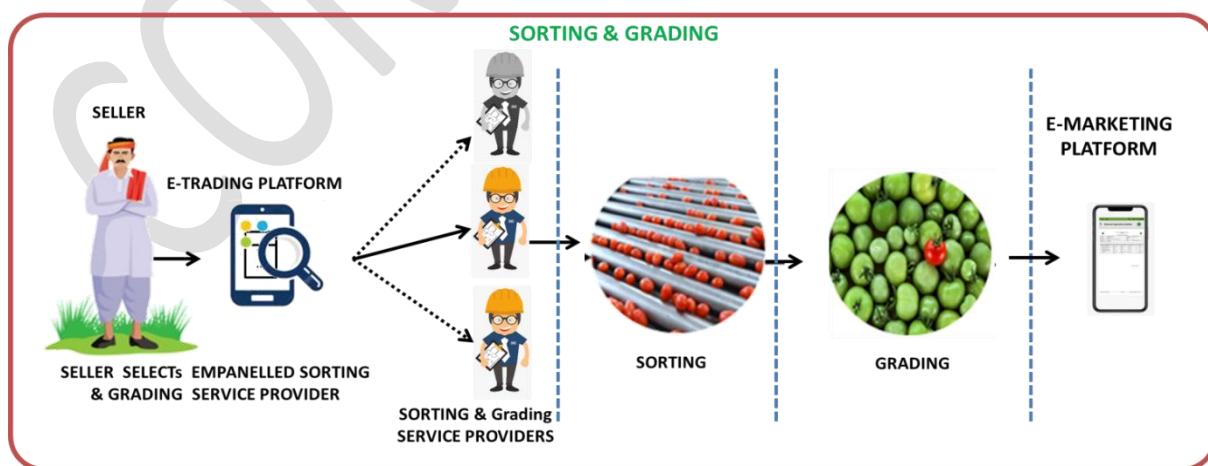
Sorting and Grading:

Sorting & Grading are important post-harvest operations which play a major role to help the farmers to fetch better price realization for their produce. Sorted and graded products are eligible for more price than the non-graded agriculture produces.

Sorting means separating the similar agricultural produce in to various categories based on specific criteria like origin, size, shape, color, smell, technology, quality, legal conformity and market value etc. It is generally preferred for the fruits and vegetables.

Grading is the classification of agri-commodities on the basis of commercial value or end use (product quality). The grading may be manual or mechanical, in which the agriculture commodities are assessed on the basis of its size, shape and quality. Grading is sorting or categorization of Agri produce into different grades according to the size, shape, color, and volume to fetch high price in the Mandi.

Agricultural produce particularly fruits and vegetables form an important part of trade both nationally and internationally. Among the post-harvest operations applied during handling of Agri produce, grading plays an important role to remove undesirable or foreign matters from the harvested crops. We will integrate with the Sorting and Grading equipments in Mandis. Sorting and grading is considered as the value-added advantage to the seller. The best quality produce can be separated and sold for the best price in the market. Traders will be actively purchasing the high quality produces from the sellers. All the farmers have to provide an agreement on the compliance of the law of action against use of harmful chemicals or fertilizers / artificial color. The system has the sorting and grading parameters and testing results, which can be used to rate the farmers produce and any low grade/harmful produce can be reported to the authority for not allowing trade of such produces.

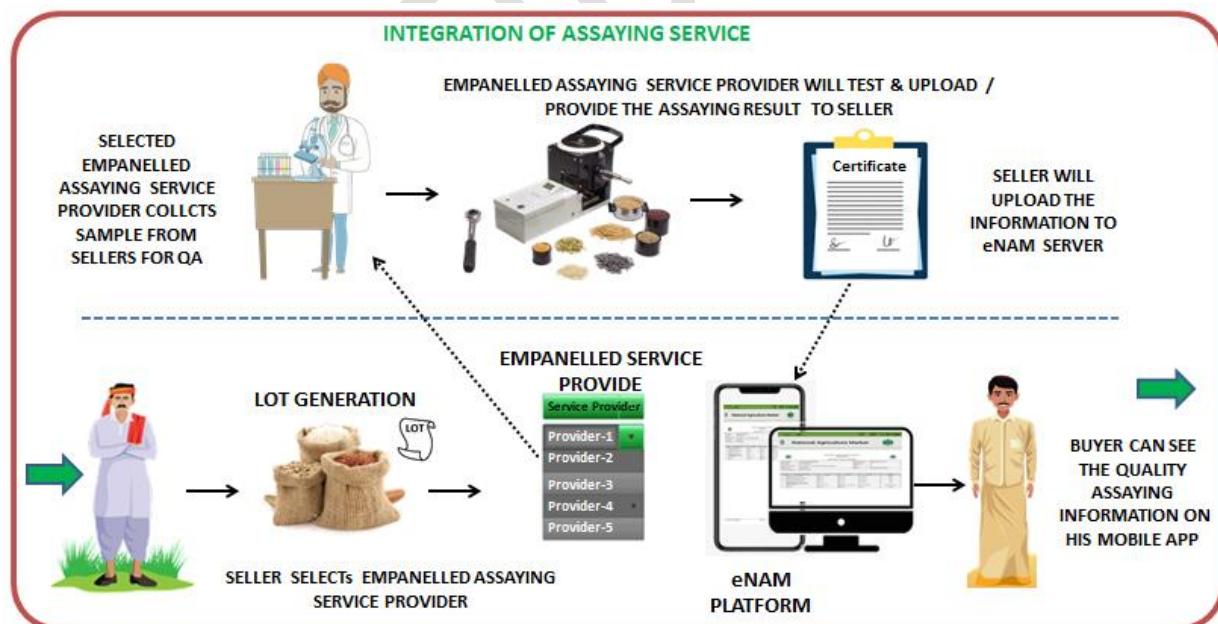


Sampling and Assaying

The fragmented nature of the commodity supply chain results in a lack of standardized quality grading leading to opacity in pricing and inefficient value realization by both sellers and buyers. In order to address this challenge, this module facilitates assaying of produce by farmers itself or any other authorized labs through approved sampling procedure and uploading of information on application.

Seller can be tied up with any third-party assaying service providers and through their support assaying of the commodities can be done at the farm itself or through the labs with the desired samples collected from the field. Any third party assaying the samples shall validate themselves by e-Sign/e-KYC/digital signature to maintain the sanctity of the report. Self-assessment shall also be validated by availing Aadhar service.

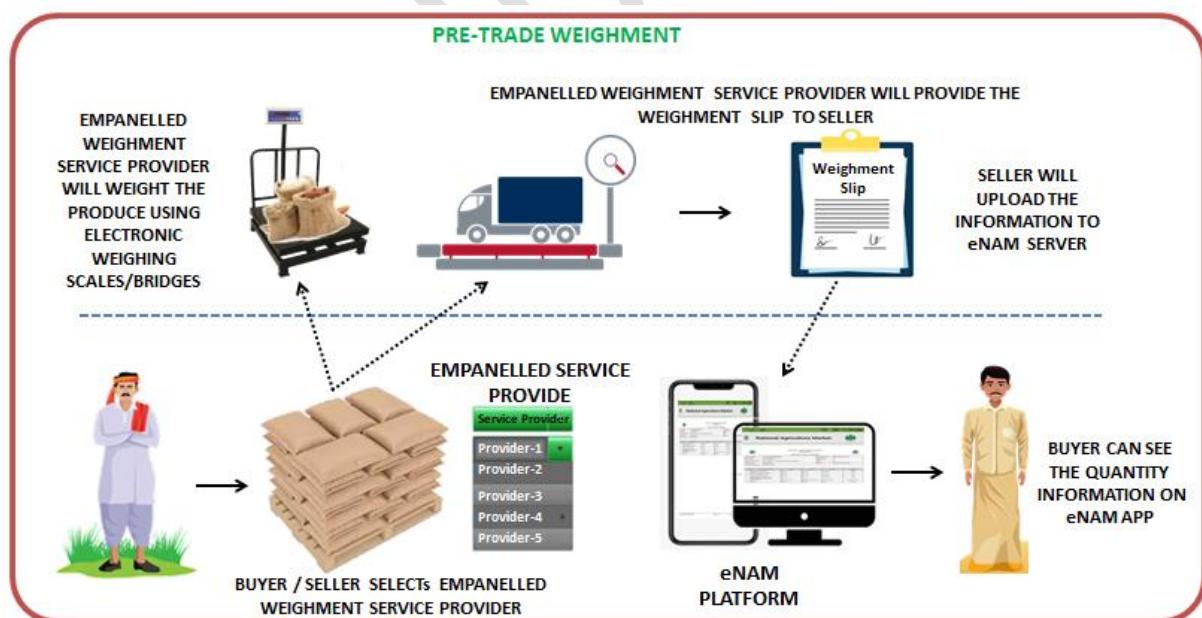
Through the samples collected at the farm, assaying can be done using the integrated assaying equipments or using the third-party assaying agencies. There will a dedicated screen for the collection and creation of the sample. While collecting the sample in the application, seller need to select the lot and then select the quantity of the sample collected along with the unit of measurement. More than one sample can be created for the lot and they can be used for the assaying.



Sellers will login to the Service provider portal to avail the quality assaying process. If the service providers are integrated online then the assaying results will be updated online against the lots. If the service providers are not integrated online then the seller will deal the process manually. The assaying results can be directly fetched from the assaying equipments that are linked with the service provider and displayed on the quality certificate. The same quality certificate can be verified by the seller and can upload the same against the lots so that the end users like traders, corporate buyer or any government agencies that are willing to buy the produce can see the quality certificate and proceed for bidding. Assaying results are classified based on the ranges 1, 2 and 3 but the final result is given under grades A, B and C. The lots that get the best quality will fall under the A category and the medium quality will be falling under B category and the least quality falls under C category.

Weighment Pre-bidding:

Weighment of the produce will be done at the farm level by the seller with the help of any third-party service providers or if the sellers are capable to check the weight through any integrated machines they will check the weight initially from the farm itself and they will update the weighment information during the lot creation or posting. Weighment can also be automated by integrating with the assaying equipments with the help of third-party service providers.



During the weightment process, seller will select the date range to fetch the lots and the application will fetch the lots which are not weighed. Seller will select the lot and will punch the weightment in terms of bag type, number of bags and unit of measurement.

E-Trading

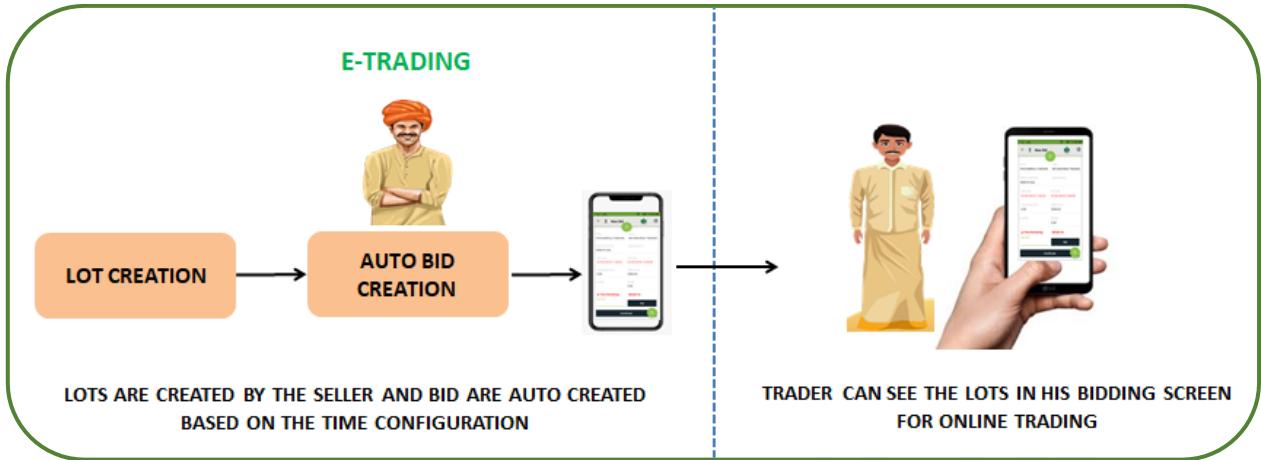
E-Trading is considered as the core part of this platform. The lots that are created and posted on the virtual platform will fall under bidding process through automatic process. Automatic bid creation will happen with the configuration made initially by the Operators.

During the bid creation, there are some mandatory fields to be filled. Initially during the lot creation, the seller has to furnish basic information of the bid like Minimum selling price for the commodity, bid type, number of bidders to be allowed, allow multiple bids etc.

Alerts and notifications are sent to the registered traders and those who have accepted and added the notification on preferred commodities for bidding.

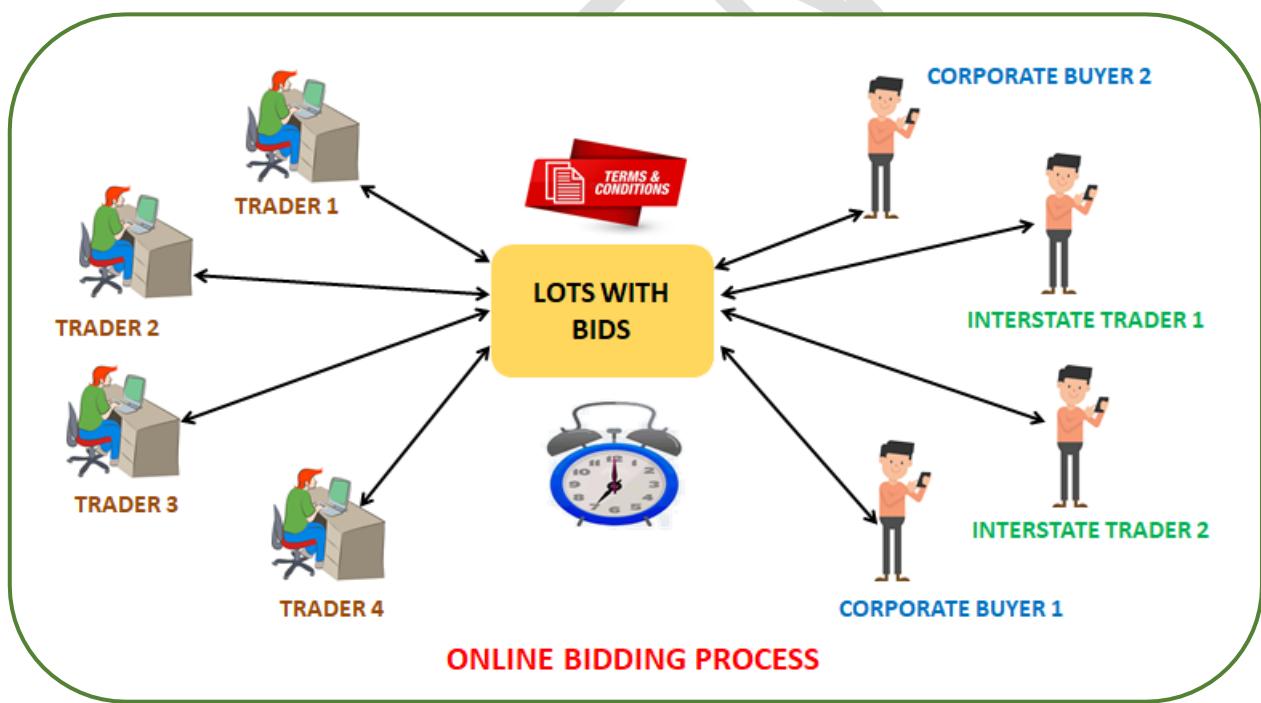
Traders, based on the alerts and notifications, will participate in the e-trading through their mobile app. Based on the bid pattern, trader will quote the bid price against the lot and will submit the lots. Trader can also select multiple lots and can submit the single bid price for all the selected lots. But, the selected lot should be of same commodity only. If the bid is open, then the price quoted by the other traders will be displayed for all the traders involved in the bid and if the bid type is closed then the trader cannot see the bid price of other traders. Trader can see the bid starting and ending time also in the bidding grid against each lot. Trade count down time is also available against each lot so that the trader can speed up the bidding process.

If the trader is interested to participate in the e-trading, he needs to accept the terms and conditions that are populated on the application during the login time. This is mandatory and the trader can see the modules only if he accepts the terms and conditions. Terms and conditions will be included with the logistics information and process of pickup.



Trader Trading Portal:

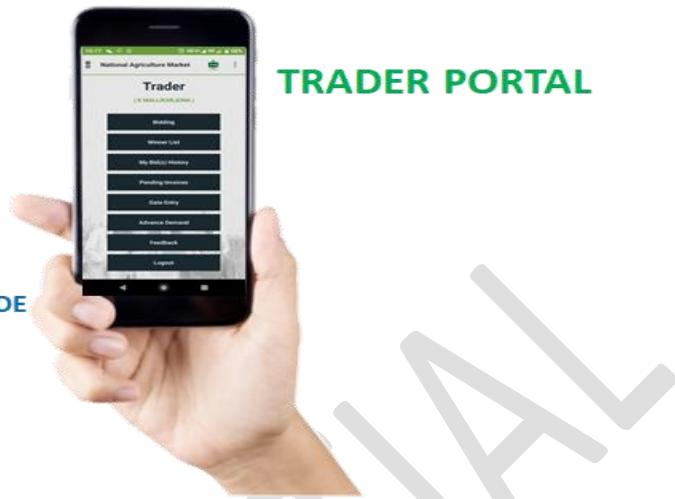
Trader will be provided with the dedicated mobile app with specialized features for the bidding. Trader portal contains different modules which are explained as below:



- ❖ **Bid listing** is the module where the actual bidding is taking place. Trader will select the state and place for seeing the lots for trading. There will be specific filters to get the lots such as commodity, seller, state and place (APMC).

-
- ❖ **Preferred commodities** are the module where trader can see all the commodities available for the trade. Trader can choose the preferred commodities of his choice and can add to his favorites.
 - ❖ **Shopping Cart** is the feature used by the traders to select the lots and add to the cart for further trading. Through this feature/module trader can select the preferred lots for the trading.
 - ❖ **Inter mandi and Interstate** Lots are the features where the trader is allowed to trade the lots with in the state and out of the state also. Trader need to accept the terms and conditions to do these trades.
 - ❖ **FPO lots** can also be visible in the trader module so that he can trader the FPO lots also.
 - ❖ **Logistics** is also a new feature available in the trader modules through which trader can get the logistics service providers nearby or on the other state to move the produce.
 - ❖ **Online payments** provision is available on the trader portal through which trader can do the online payments to the Invoices he has won. Based on the date range selection trader can see the lots for the Online Payments processing. Part payment and Incentives can also be availed through this feature.
 - ❖ **Reports and Dashboard** is another feature available in the trader portal through which trader can download the reports and invoices. Trader can also track the bidding history and payments history. Through the dashboard trader can see the trend of the trade and price comparisons in the selected state and APMC.
 - ❖ **Tracking the farmer** is the feature where trader can track the farmer location or the location in which the lot is uploaded. This is used to navigate and turn up the produce by the trader later on the trade completion.
 - ❖ **Advance demand** is the feature available at the trader end where the trader can post his commodity requirement in terms of quantity and quality so that the sellers can respond on the same for the trade.

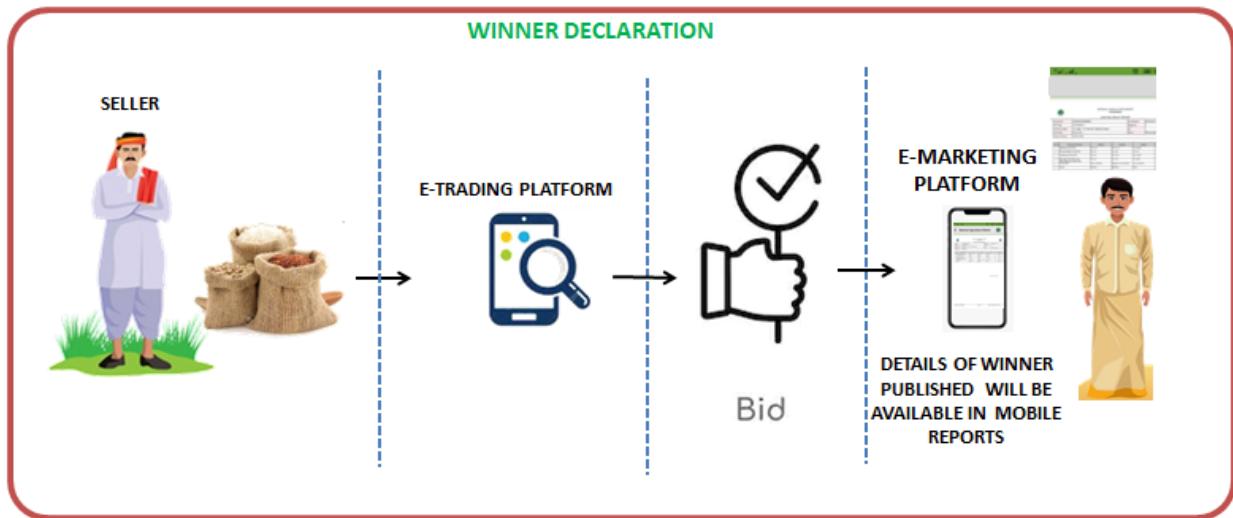
- **BIDDING**
- **SHOPING CART**
- **ADVANCE DEMAND**
- **ONLINE PAYMENT**
- **FEEDBACK**
- **REPORTS**
- **HISTORY**
- **INTERSTATE / MANDI TRADE**
- **LOGISTICS**
- **GPS TRACKING**



Winner Declaration:

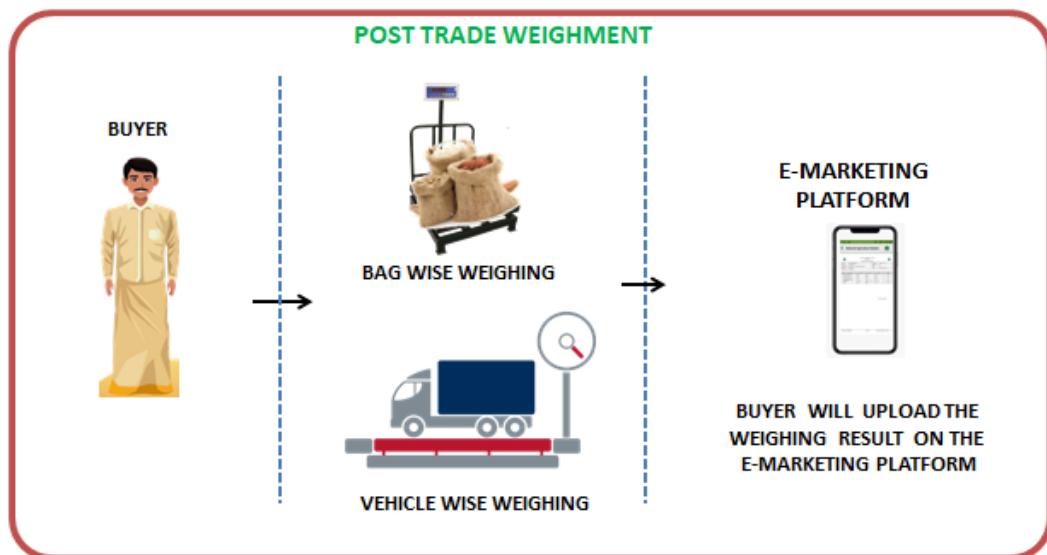
After successful bidding the lots will be declared and winner will be announced. Trader and the seller will be receiving the mobile notification regarding the winner list and the price information against each lot.

Seller can reject the trade if he is not accepting /satisfied with the trade through the application itself. The rejection notification will be sent to the trader and the operator. Bulk selection of lots and declaration is possible by the operators. Winner declaration can be done automatically for all the lots selected at a go. This configuration will be made during the bid configuration. Trader can see the winner list in this application based on the date selection. If the trade is not accepted by the seller and still want to extend the bidding time, then the operator can extend the bid timing so that the traders still can proceed for the bidding. Once the complete bidding is done the final winner for the lots selected can be declared.



Weighment Post Trading:

This module will be used to record the weight of the produce through software which captures the weight of the produce that has been brought in. System will facilitate user to key in the weight manually which will be updated on to application. Direct capture of the weighment feed onto the application through mobile devices will be integrated wherever feasible.



Post trading, the trader will be visiting to the farmer location and conduct the actual weighment so that the quantity that is captured will be the final and for the same quantity the invoice will be

created. Weighment can be done manually and updated in the application or by integration with any third-party weighment service providers through API services.

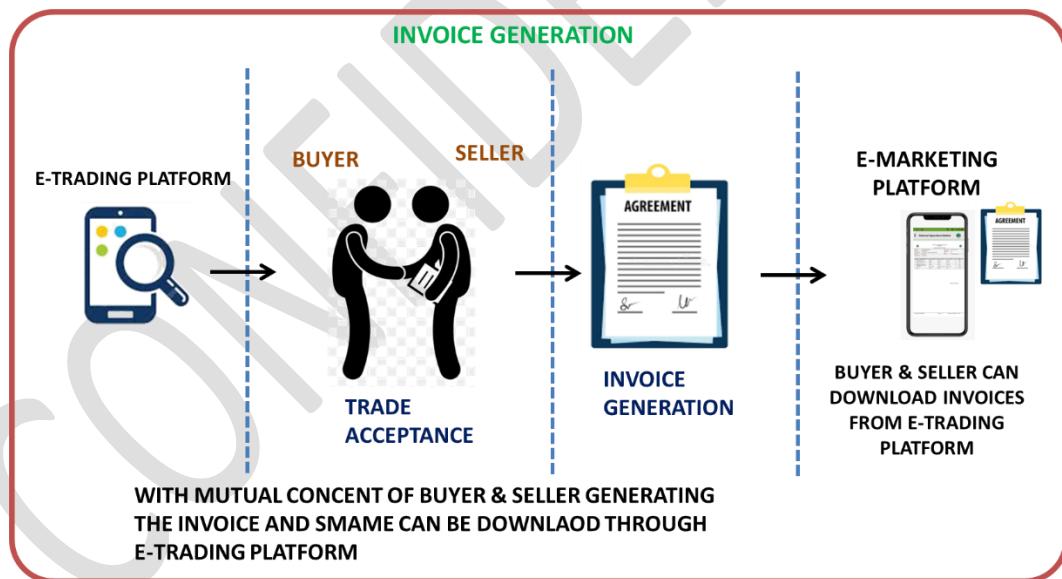
During the weighment process, seller will select the date range to fetch the lots and the application will fetch the lots which are not weighed. Seller will select the Lot and will punch the weighment in terms of bag type, number of bags and unit of measurement.

Invoicing:

Post weighment the generation of Sale Agreement and Sale Bill will be generated and shared to the seller and buyer.

Operators will take care of the invoicing process. Specified fee structure is to be made for the generation of the Invoice. Fee structure contains the fee categories and components which are commodity specific. Generation of the Invoice is the confirmation of the trade.

Invoice contains the commodity price only. Trade laws as per the state / central government rules can be included in the generation of the Invoice with approvals.

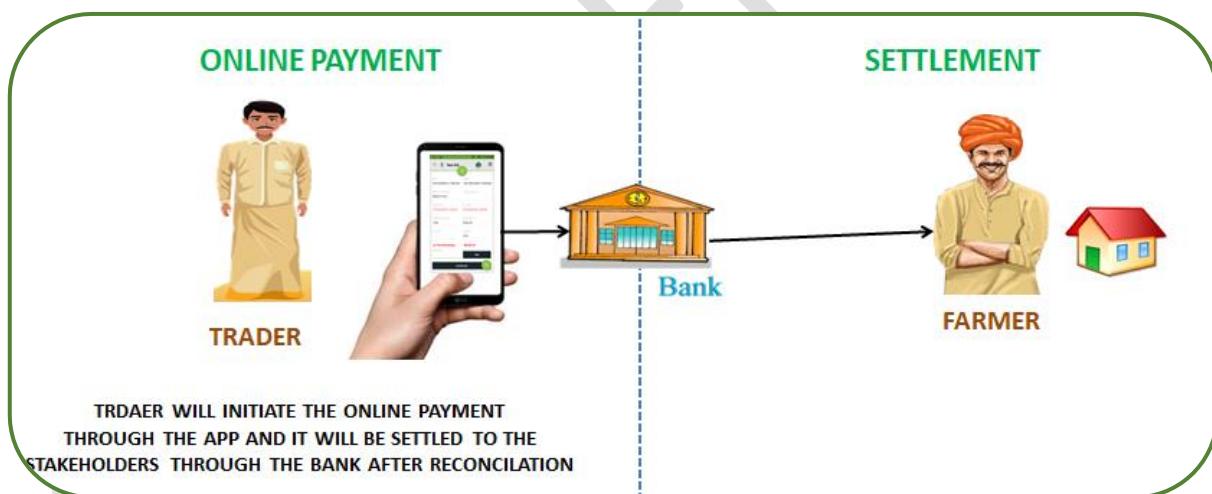


Payment and Settlement:

Trader can initiate the online payment for the lots he has won through his mobile app. Based on the date range selection, trader can see the list of all lots eligible for the online payment. Lots are visible for the specific time period only and within the time period the trader is expected to do the online

payment. Alerts and notifications are sent to the trader soon after the trade is accepted by the seller and the trader. So that trader can check the lots and initiate the online payment.

Application is having the different modes of Online payments. Based on his choice, payment can be made and within the stipulated time the payments are settled to all stakeholders involved in the invoice transaction. Soon after the trader completed the payment, he will receive the payment receipt that can be used for the future reference. Money from the trader will be deducted with proper notifications and reach to the centrally maintained bank account. The bank will start the reconciliation process for all the invoices that are received from various traders. If the Invoice amount is matching with the payment amount, then the bank will process the Invoices for the payment settlement. If there is any gap seen in the payment amount, then the bank will send the error notification to which the payment is on hold. Seller needs to correct the bank details from his end and then through the automatic verification process, payment processing will be re-initiated. The seller and other stakeholder will receive the online payment based on the bank frequency. If the payment is made during the working hours, it will be settled on the same day or on the next working day.

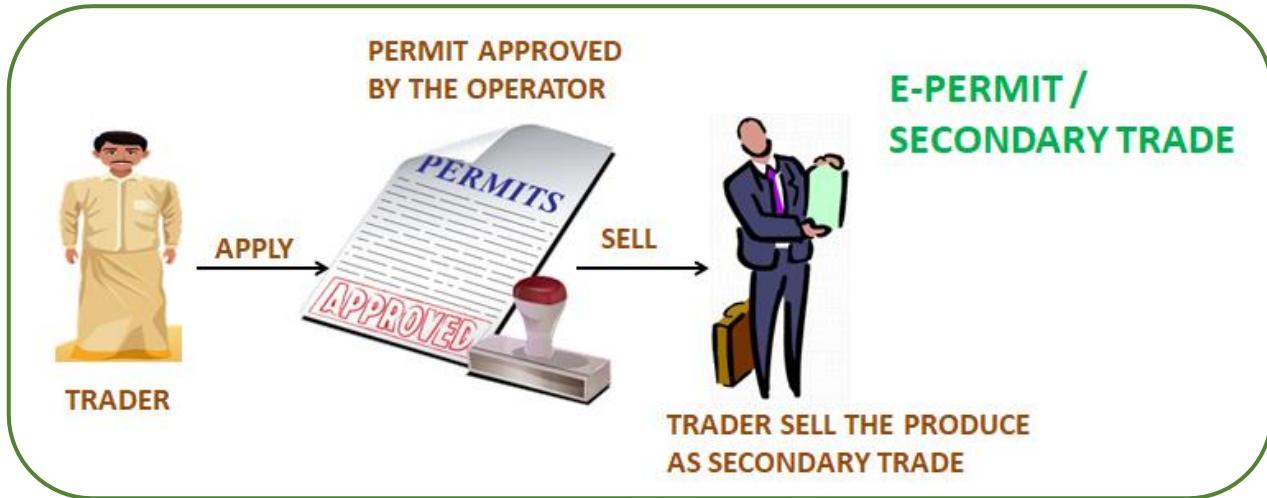


E-Permit:

E-Permit feature is available in trade portal and it will allow the trader to raise the request for e-Permit. Post the approval of concerned operator, the trader can check and download the E-Permit. After the issuance of E-Permit, the generated unique permit number will be punched by the buyer to the other trader as a seller. Such trades are also called as secondary trade and the market fee will not be charged to that trade.

Steps Involved:

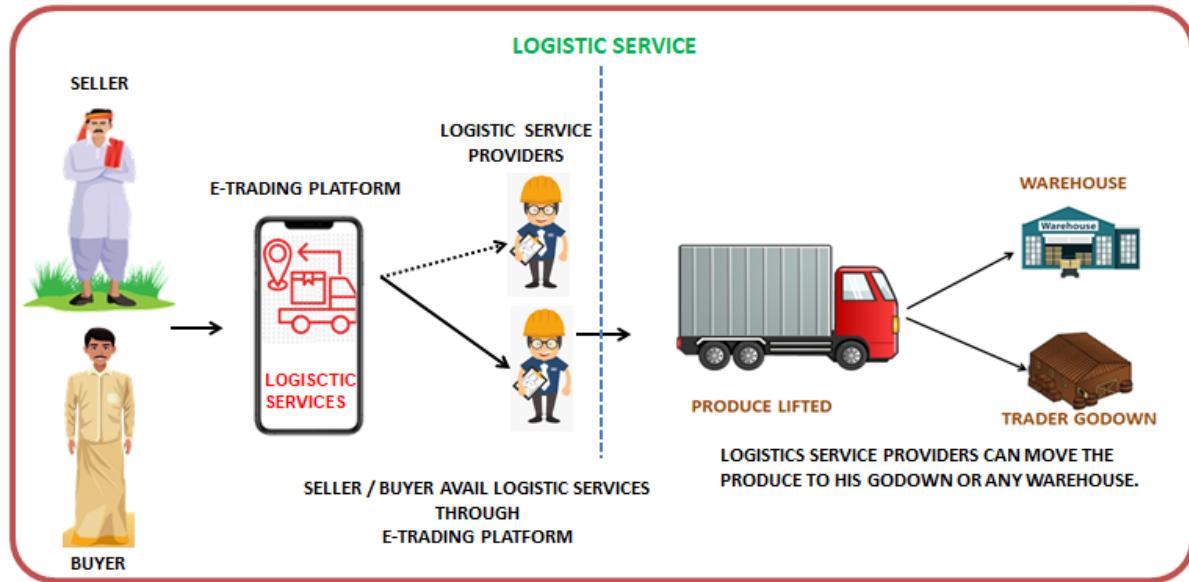
- a) Generation of Invoice
- b) Request for e-Permit
- c) Approval of e-Permit
- d) Check the Status of e-Permit
- e) Gate Entry by the Trader as Seller



Logistics:

The process of sale agreement / invoice generation is the closure of the trade. Through mobile application, trader will have the facility to communicate with the logistics service providers and can transit the produce to his Go-down or any warehouse or to his consignee.

All the logistics service providers are listed and visible with the necessary information on the Dashboard from where the trader can select the logistic service provider for necessary transition. Trader will also have the facility to provide the feedback for the opted services.



The application can also be linked with the Kisan Rath application so that all the available logistics service providers can be seen on the same platform and can use their services for pickup of the produce. Handling the logistics is purely the traders risk and the associated grievances will be handled by the respective service provider only.

Delivery of the produce in certain timeline is very important aspect to fulfill the need of any particular produce or for the preservation of the produces having fast rate of decomposition. Need to understand the scenario and logical solution of same.

MIS Reports:

All the key stakeholders registered in this platform can use the MIS reports and dashboards that are linked and available in the module. Each stakeholder will have the separate rights to access the same.

There will be reports specific for each module and a separate dashboard which can be accessed by the management to track the progress and trend on the platform based on various combinations.

Reports can be:

- ❖ Administration Reports
- ❖ Operational Reports
- ❖ Transactional Reports



Accessing Other Services of POP through Virtual Market Platform:



Platform of Platforms is assembly of various platforms that are existing today in the markets to build supply chain which brings unique set of capabilities into one synchronous orchestrated way of

ecosystem. Through the Virtual Trading Market platform, users can enter the gateway of platform of platforms to participate and use the services.

Platform of Platforms is a digital transformation to bring together agricultural sectors and operators and lead this change to meet the needs of farmers. The POP is multisided platform which connects one stakeholder to Multi stakeholders and multiple platforms. Each platform is a business model that creates value by facilitating exchanges between two or more interdependent groups, usually consumers and producers. In order to make these exchanges happen, platforms harness and create large, scalable networks of users and resources that can be accessed on demand. Platforms create communities and markets with network effects that allow users to interact and transact.

Conclusion:

This document has explained the end to end process of the virtual trading market platform and the benefits for the different stakeholders. Virtual market will be the best trading practice that is slowly cropping up in the agri-business environment. Healthy and transparent trade is possible through this model. Also, through this platform accessing the other trading platforms is also possible and useful for the users. The upcoming sections gives more details on POP.

1.1.3 Introduction of Platform of Platforms

Introduction:

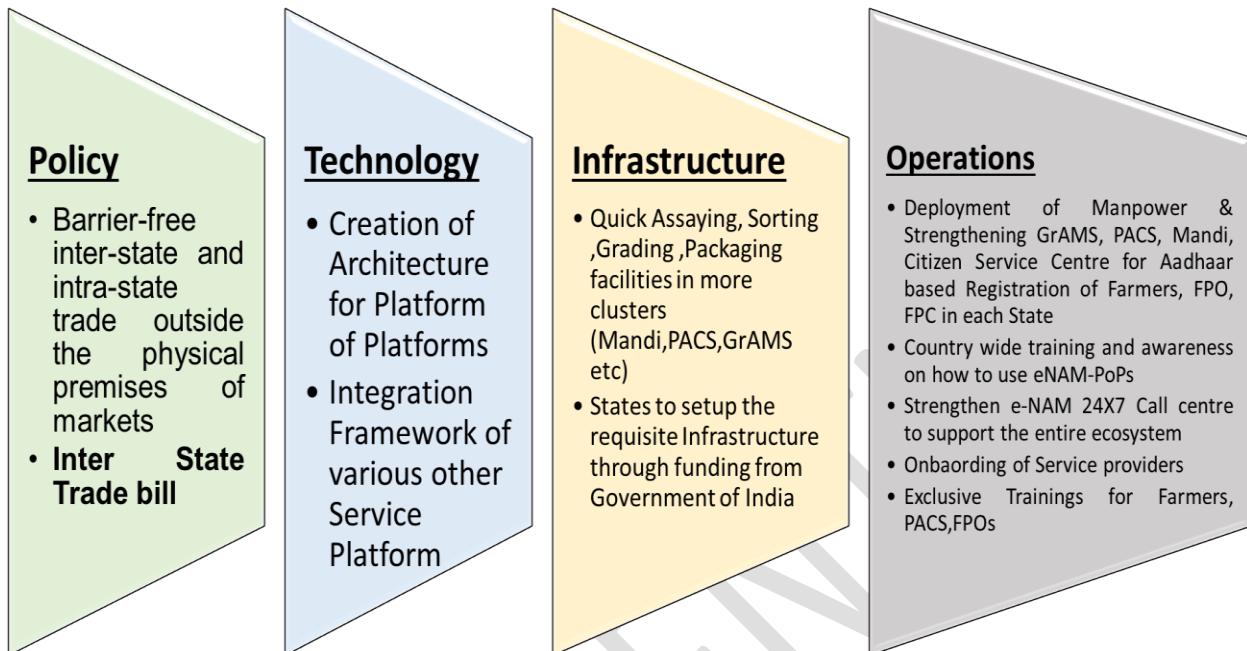
e-NAM as Platform of Platforms is assembly of various platforms that are existing today in markets to build supply chain which brings unique set of capabilities into one synchronous orchestrated way of ecosystem.

Platform of Platforms is a digital transformation to bring together agricultural sectors and operators and lead this change to meet the needs of farmers.

Platform of platforms is a multisided platform which connects each stake holder to multi stakeholder ecosystem.

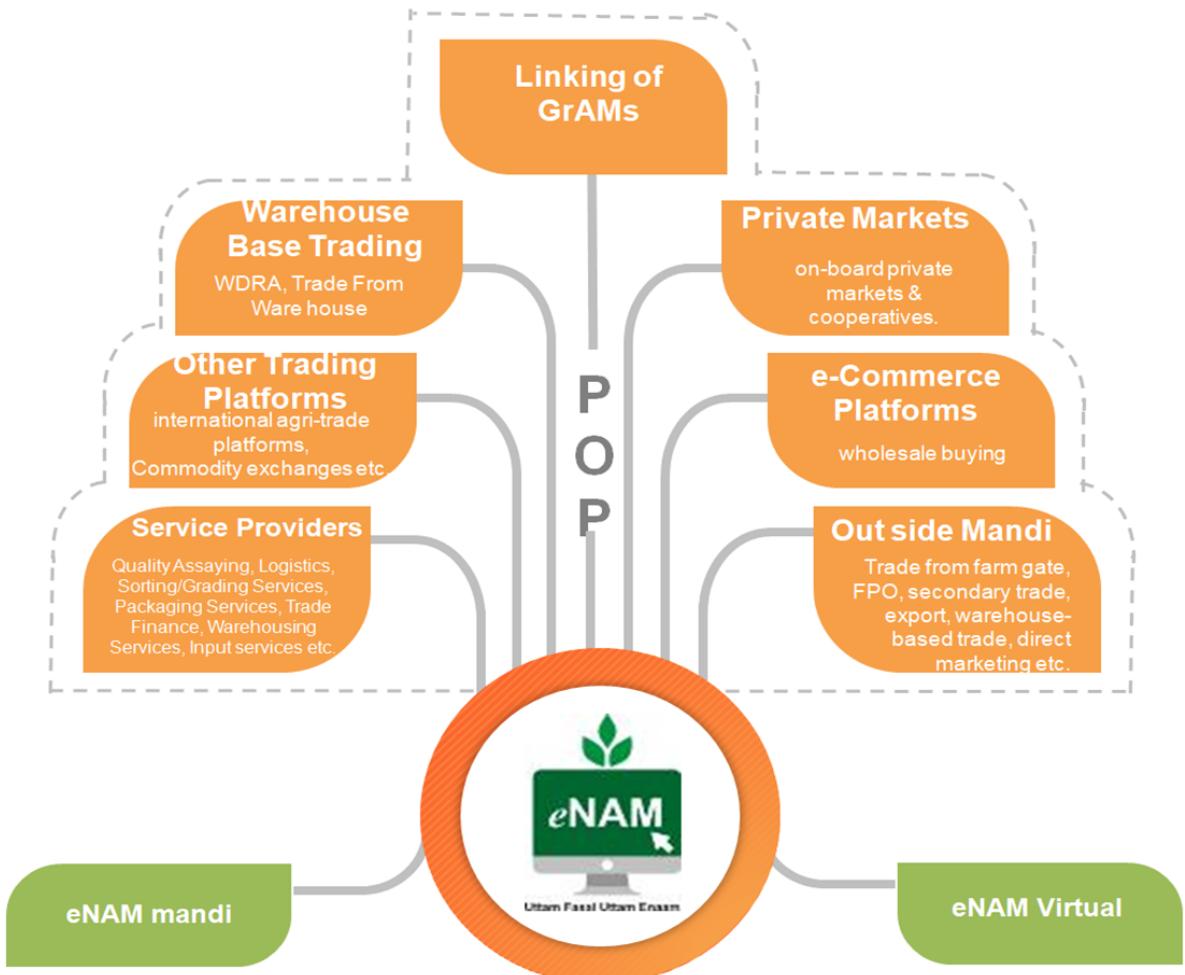
Each platform is a business model that creates value by facilitating exchanges between two or more interdependent groups, usually consumers and producers. In order to make these exchanges happen, platforms harness and create large, scalable networks of users and resources that can be accessed on demand. Platforms create communities and markets with network effects that allow users to interact and transact.

Platform of Platforms –Framework



Stakeholders

| Individual Farmer | Individual Buyer | Logistics, Kisan Rath | Ecommerce Platform |
|-------------------|---------------------|--------------------------------------|---------------------------|
| FPO | Institutional Buyer | Sorting, Grading, Packaging Services | Commodity Exchanges |
| FPC | Exporters | Assaying Services | Private Trading Portals |
| Others | Processor | Banking Services | Warehouses & Cold Storage |

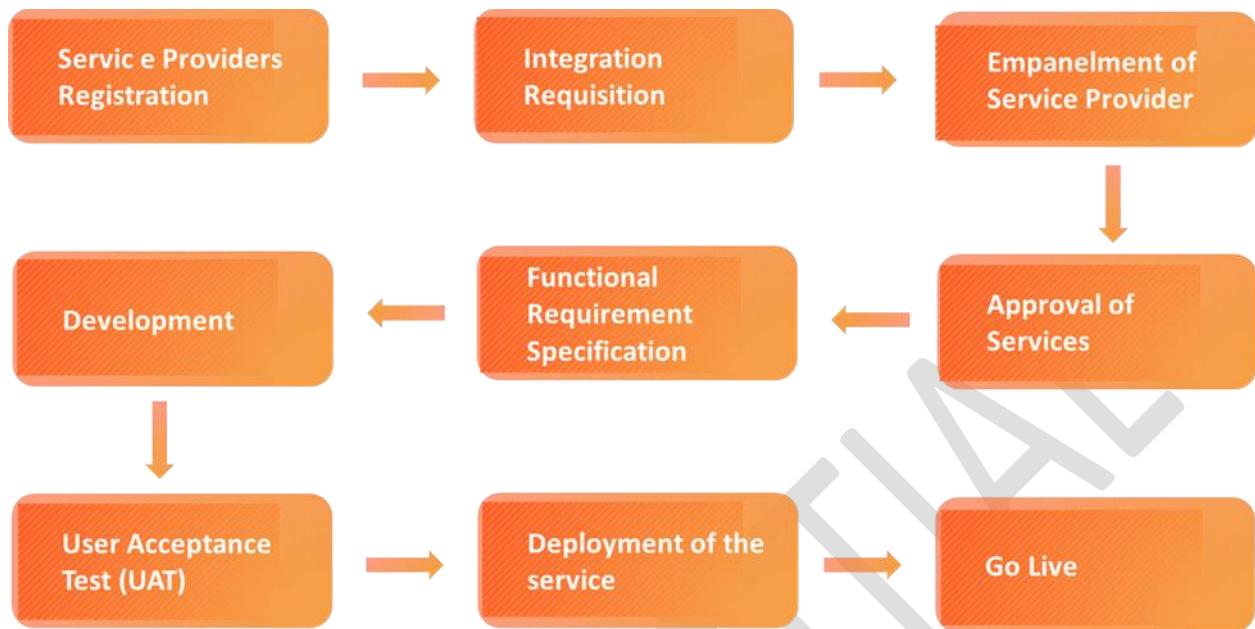


Development and Implementation of POP

The strategic partner will develop the new generation architecture to facilitate a state-of-the-art POP framework to make effective and efficient coordination among agri-stakeholder and its value chain. This new framework will augment the overall performance of the platform, implement corrective measures, resolve constraints, create opportunity and strength in the role of agriculture value chain.

- ❖ Development of Next Generation Architecture for the Platform of Platforms
- ❖ Bring e-NAM in all Mandis / link GrAMs & PACs (Project Appraisal Committee) with e-NAM and onboard all FPOs / FPCs
- ❖ Linking eNAM with other trading portals

Process flow - Integration of Service Providers



Integration Framework:

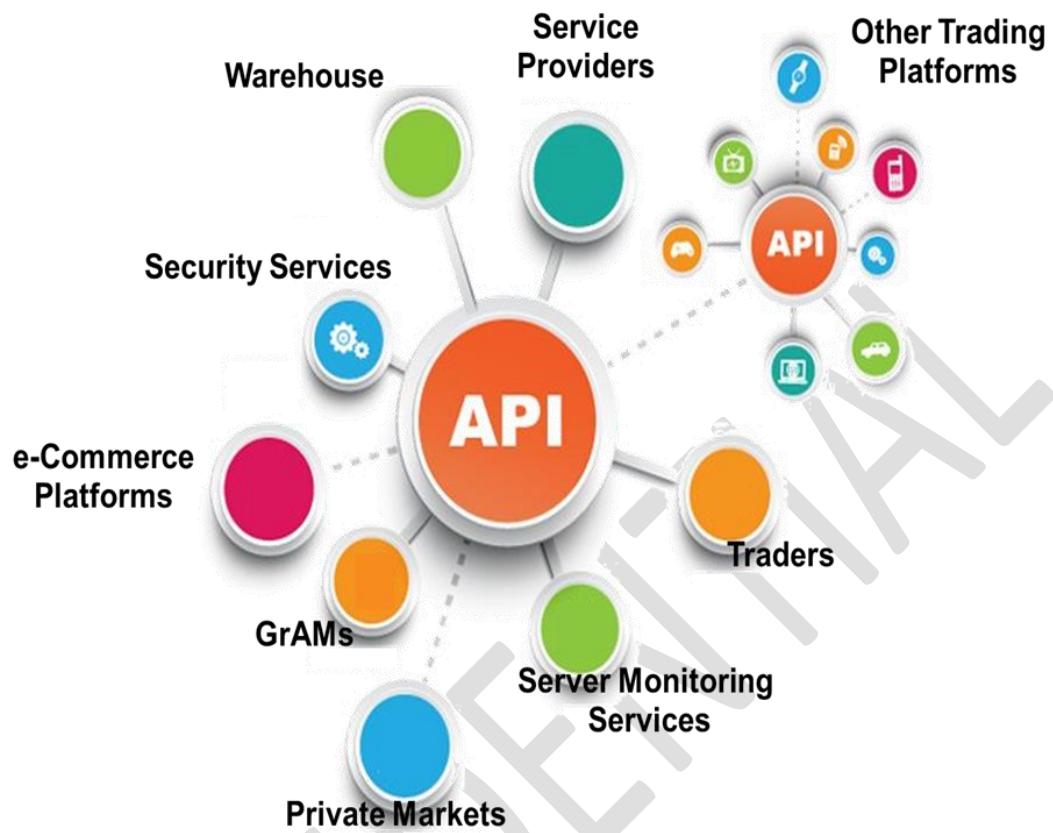
For Integration with eNAM, users need to raise requisition on eNAM portal for Approval. The URL to access requisitions is: <https://eNAM.gov.in/api/requisitions/>

Integration can be done with below mentioned process

1. API Integration
2. File Based Integration
3. SSO Integration

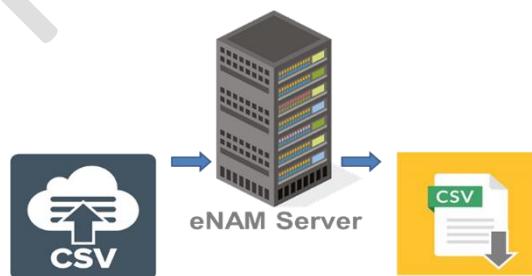
API Integration

API Integration is the connection between two or more applications, via their APIs, that lets those systems exchange data. API integrations are used in many high-performing businesses that keep data in sync, enhance productivity, and drive revenue.



File-based Integration

File based integration is when either source data and/or destination data must be represented in a file (like a CSV file). This means they can be imported and exported from programs that store data in tables.



SSO Integration

Single sign-on (SSO) is a property of identity and access management (IAM) that enables users to securely authenticate with multiple applications and eNAM websites by logging in only once—with just one set of eNAM credentials (username and password).



Domains in Platform of Platforms

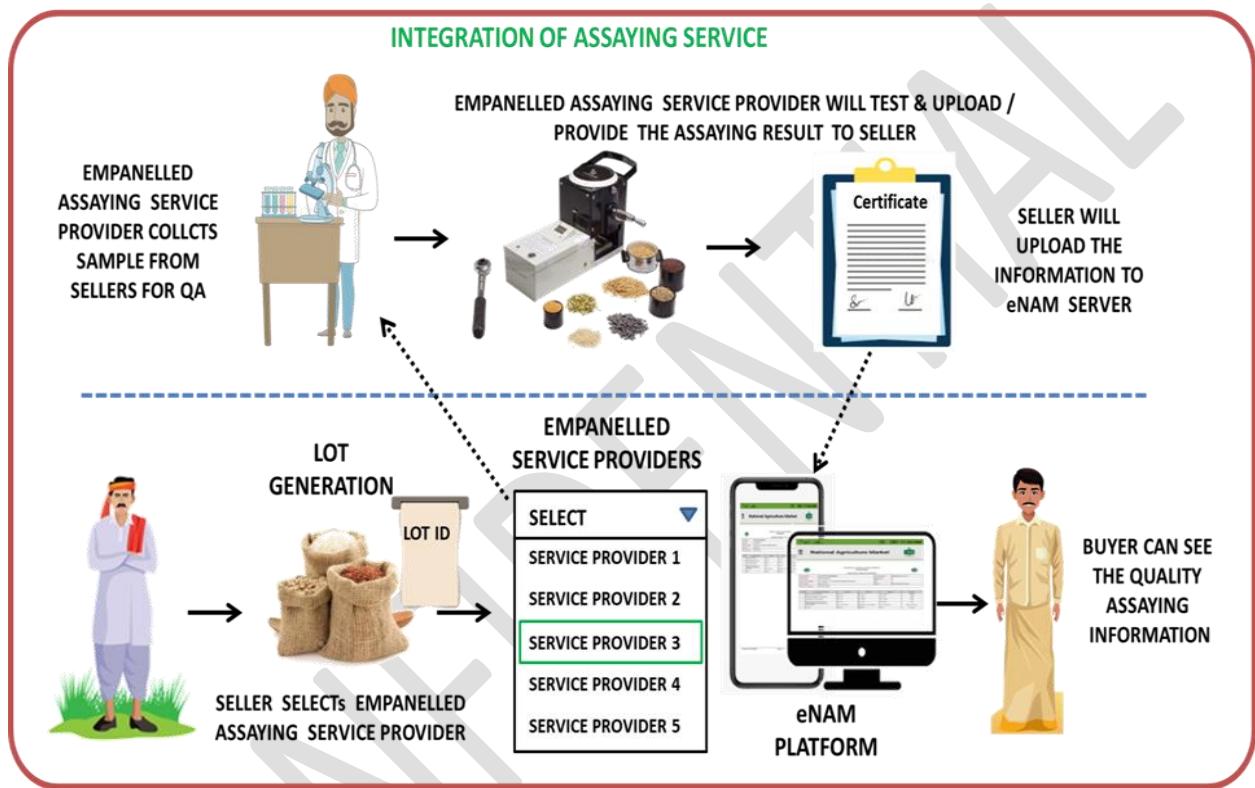
- ❖ Service Providers
- ❖ Other Trading Platform
- ❖ Warehouse base trading
- ❖ Linking of GrAMs
- ❖ Private Marketing
- ❖ e-commerce Platform
- ❖ Outside Mandi

Service Providers

- ❖ Quality Assaying
- ❖ Logistics
- ❖ Sorting / Grading services
- ❖ Packaging / Pack house

Quality Assaying

The fragmented nature of the commodity supply chain results in a lack of standardized quality grading, leading to opacity in pricing and inefficient value realization by sellers and buyers. In order to address this challenge, Quality Assaying module facilitates assaying of Produce by APMC Lab or any other authorized testing lab.



Testing/Assaying module will facilitate following features

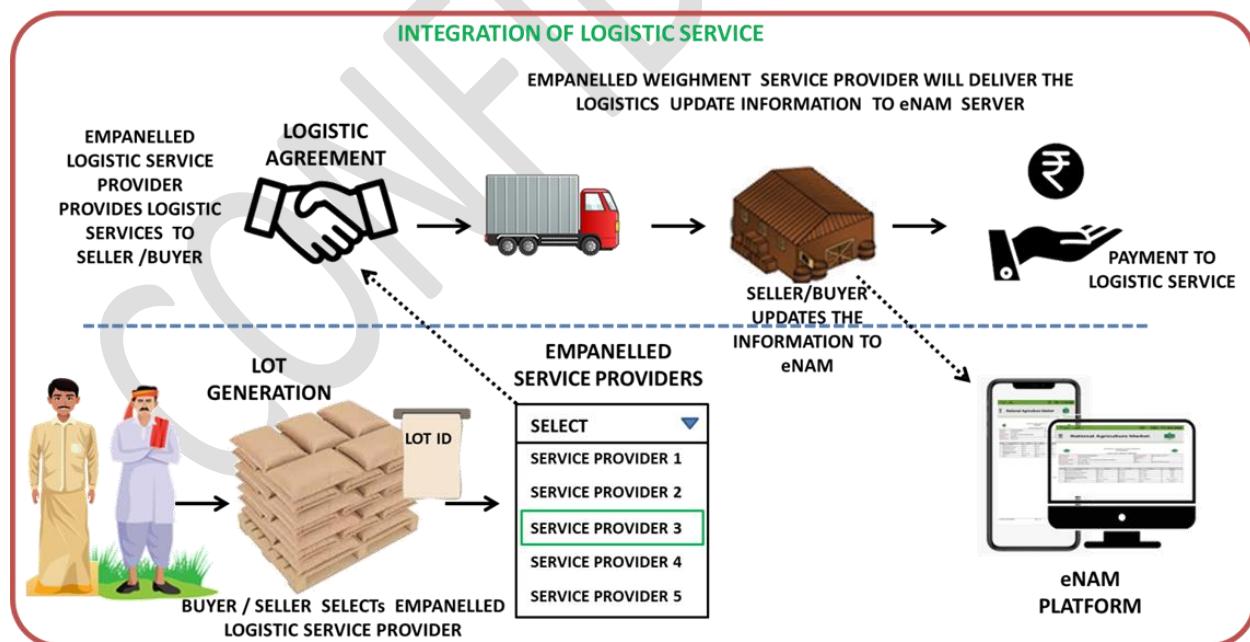
- If the farmer requires sorting and grading of their produce, APMC may provide such facilities
- Sorting and grading is to be carried out prior to assaying.
- Once sorting and grading is done, the farmer gets a system generated unique LOT number along with the barcode. This lot number will be pasted on the bags that contain the commodities.
- This LOT number is used for displaying the quotes in the market by the traders.
- The farmer is permitted to have an alias ID (LOT Number) for that day, and easy reference of his /her lots.
- Farmer or commission agent to get the produce assayed at the APMC testing lab or any APMC authorized testing lab.

- Lab technicians or the commission agent will log into the NAM portal and upload the testing results and linking it to the lot number of the produce.
- Remote access of lot wise testing results through NAM portal by authorized users.
- Uniform parameters for capturing the test results per commodity (Max 30 parameters per commodity).
- Based on the test results the lots can be split or can be merged.

Logistics

Agri-logistics is the backbone of agri-business, which enables the connectivity between production & consumption centers over both "space & time" with minimal loss of quality as well as quantity.

The need for agri-logistics will arise when buyer / seller participates in the online bidding in Inter-Mandi or Inter-State trade on eNAM. The Agri-logistic services will enable the Farmer, Producer, Organizations, Traders, Processors, Exporters and Corporate to safe-keeping of their produces and fast-track the delivery to the markets. Logistics is the part of supply chain management that plans, implements and controls product development and deployment. Logistics will facilitate farmers, FPOs and traders across India to search and contact the transport service providers for transporting the Agriculture produce. The strategic partner will integrate with the logistics services on eNAM application



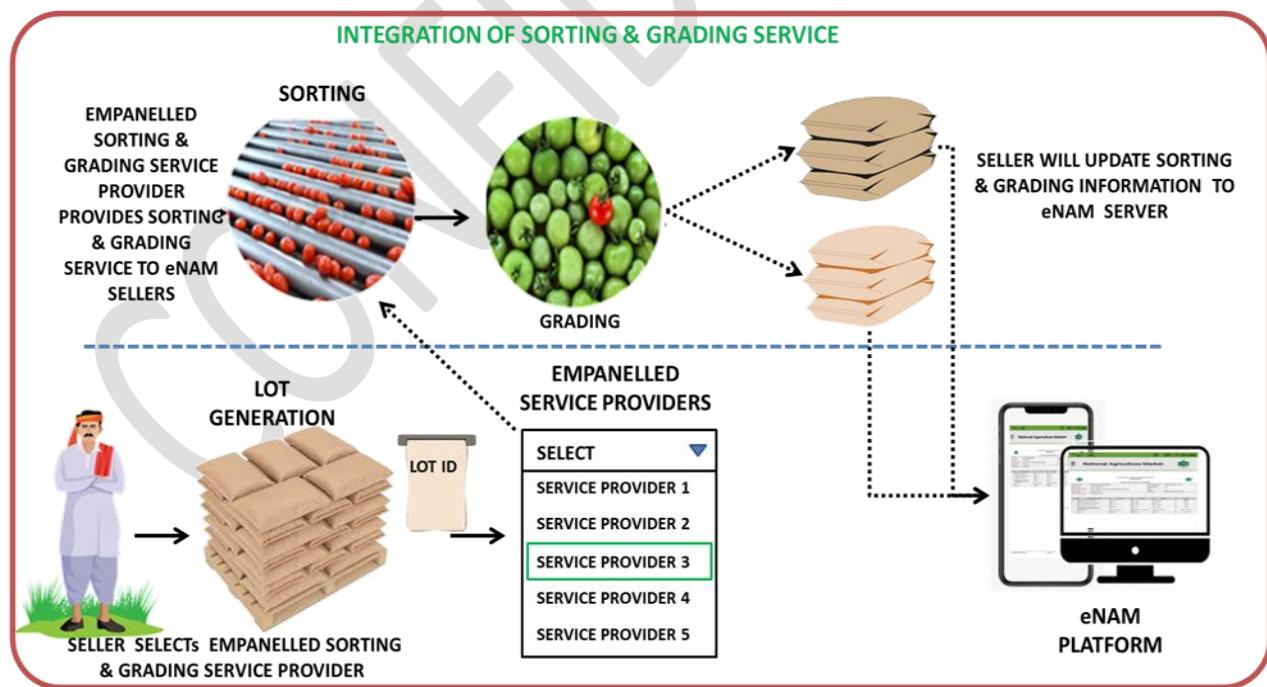
Sorting / Grading services

Sorting & grading is important post-harvest operations which plays a major role to help the farmers to fetch better price realization for their produce. Sorted and graded products are eligible for better price than the non-graded agriculture produces.

Here, Sorting stands for separating the similar agricultural produce in to various categories based on specific criteria like origin, size, shape, color, smell, technology, quality, legal conformity and market value etc. It is generally preferred for the fruits and vegetables.

Grading is the classification of agri-commodities on the basis of commercial value or end use (product quality). The grading may be manual or mechanical, in which the agriculture commodities are assessed on the basis of its size, shape and quality.

Agricultural produce, particularly fruits and vegetables form an important part of the tradenationally and internationally. Grading plays an important role to remove undesirable or foreign matters from the harvested crops into various fractions among the applied post-harvest operations. Grading is sorting or categorization of Agri produce into different grades according to the size, shape, color, and volume to fetch high price at the Mandi. The strategic partner will integrate with the Sorting and Grading equipment's in Mandis.



Packaging / Pack house

Packaging of Agri-commodities offers immense value addition to the produce. It is quite necessary for the farmers to understand the importance of packaging of their produces. It results into better shelf life and ease of handling during the entire value chain. Packaging of agri-produce always supports easy transportation from the farmer's field to its destination, be it market yard or the end consumer point. Better packaging practices & usage of good quality packaging material by the farmers, will definitely help them to fetch better prices and also preserve and minimize transportation losses.

The packaging refers to all those activities related to designing, evaluating and producing the container for a product. Simply put, the box-like container, wherein the product is stored to protect it from any physical damage and at the same time attracting the customer through its appeal is called as packaging. A packing house is a facility where produce is received and processed prior to distribution to market.



Bulk fruits (such as apples, oranges, pears etc) are delivered to the assaying plant via trucks or wagons, where it is dumped into receiving bins and sorted for quality and size. In the case of citrus, ripe fruit with a greenish tint is placed at special storage rooms where ethylene gas is used to bring out the color. Obvious "culls" (fruit that is not suitable to sell for eating due to cosmetic defects) is

removed and sold for juice or other uses. Fruit that is ready to be packed into crates or flats is processed through a washer and then air-dried. A light coating of natural wax is applied to help the fruit retain moisture and enhance its appeal.

Trade Finance:

Credit is the use of someone else's funds in exchange for a promise to pay with or without interest at a later date. Farm credit or Agriculture credit is the count of loan or credit obtained from any source for the promotion & development of Agriculture.

Trade Finance is the financing of goods or services in a trade or transaction, from a supplier to the end buyer. 'Trade Finance' is an umbrella term, which includes a variety of financial instruments that can be used by an importer or exporter.

These include:

- ❖ Purchase Order Finance
- ❖ Stock Finance
- ❖ Structured Commodity Finance
- ❖ Invoice Finance (Discounting & Factoring)
- ❖ Supply Chain Finance
- ❖ Letters of Credit (LCs) and;
- ❖ Bonds & Guarantees

The terms Import Finance and Export Finance are used interchangeably with Trade Finance.

We have put together this short guide to address some of the common issues and misunderstandings around Trade Finance,

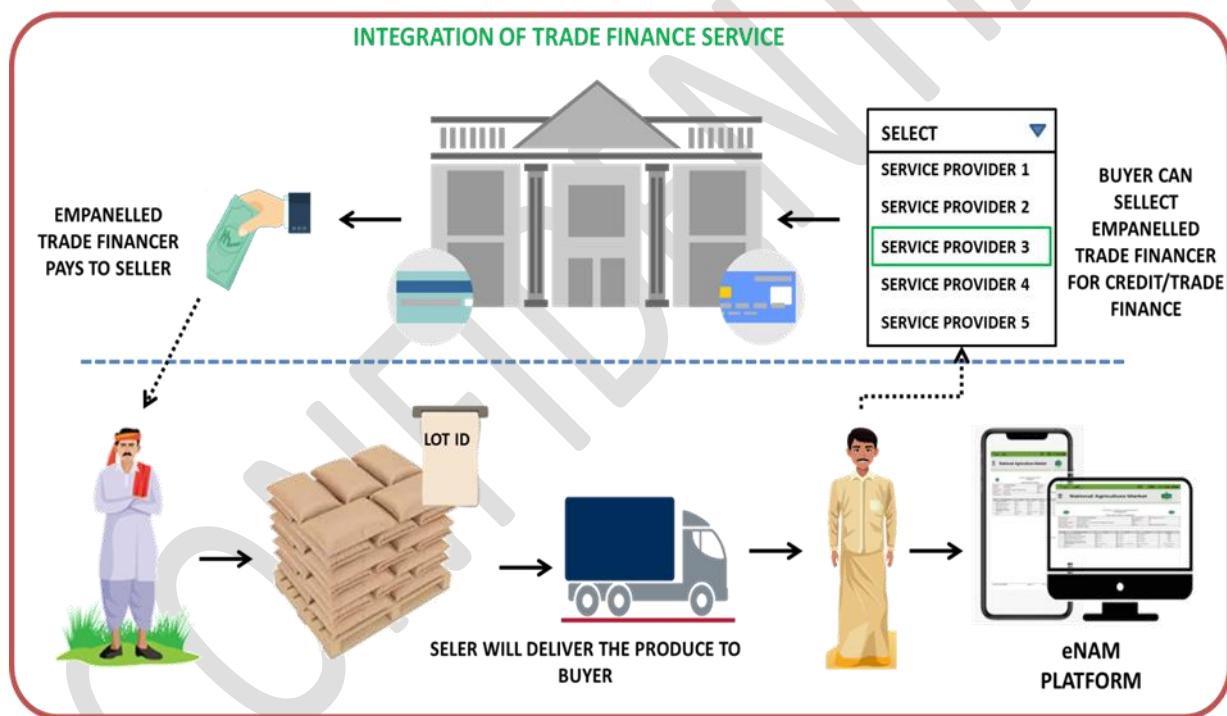
Benefits:

Trade finance facilitates the growth of a business by securing funds required to purchase goods and stocks. Managing cash and working capital is critical to the success of any business. Trade finance is a tool which is used to unlock capital from a company's existing stock or receivables or add further finance facilities based on a company's trade cycles.

Why does this help? A trade finance facility may allow the users to offer more competitive terms to both suppliers and customers, by reducing payment gaps in the trade cycle. It is beneficial for growth and supply chain relationships.

Other benefits of trade finance

- Short to medium-term working capital, using the underlying products or services being imported/exported as security/collateral. It increases the revenue potential of a company and earlier payments may allow for higher margins.
- Trade finance allows the companies to request higher volumes of stock or place larger orders with suppliers, leading to economies of scale and bulk discounts.
- Trade finance can also help in strengthening the relationship between buyers and sellers and increase profit margins. It allows a company to be more competitive.
- Managing the supply chain is critical for any business. Trade and supply chain finance helps to ease out cash constraints or liquidity gaps – for suppliers, customers, third parties, employees or providers. Payments, if made early, also mitigate risk for suppliers.



Other Trading Platform

Following are the 2 domains in other trading platforms:-

- ❖ Commodity Exchanges (National & International)
- ❖ Agritrade Platforms (National & International)

Commodity Exchanges (National & International)

A commodities exchange is an exchange, or market, where various commodities are traded. Most commodity markets around the world, trade in agricultural products. A commodity exchange is a legal entity that determines and enforces rules and procedures for trading standardized commodity contracts and related investment products. A commodity exchange also refers to the physical center where trading takes place. The commodities market is massive, trading more than trillions of dollars each day. A future contract provides an agreed quantity and quality of the commodity will be delivered at the agreed future date. Example: A farmer raising corn can sell his corn using a future contract, which will not be harvested for several months, and gets a guarantee of the price at what he will be paid when he delivers; A breakfast cereal producer buys the contract and gets a guarantee on the price that will not go up when it will be delivered. This protects the farmer from price drops and the buyer from price rise. Speculators and investors also buy and sell these contracts to make a profit and provide liquidity to the system.

Some of these exchanges are also trade financial derivatives, such as interest rate and foreign exchange futures, as well as the other instruments such as ocean freight contracts and environmental instruments. These are mentioned in the lists below.

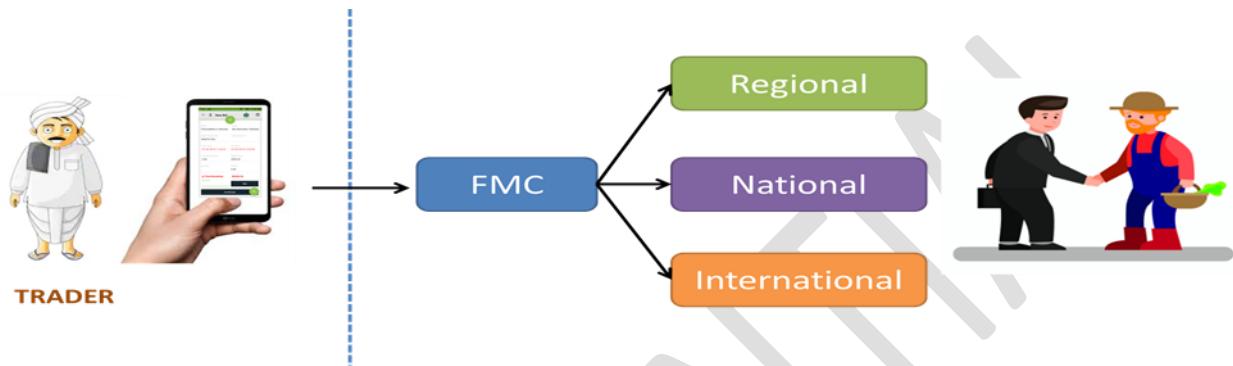
Functions of the Forward Markets Commission (FMC)

- ❖ FMC advises Central Government in respect of grant of recognition or withdrawal of recognition of any association.
- ❖ It keeps the forward markets under observation and takes necessary actions as the exercise of powers assign to it.
- ❖ It collects & publishes information related to trading conditions in respect of goods including information relating to demand, supply, prices and submits to the Government periodical reports.
- ❖ It makes recommendations for improving the working of the organization and forward markets.
- ❖ It undertakes the inspection of account books and other documents of recognized/registered associations.

Regulatory Issues

- ❖ Forward Markets Commission is a regulatory body for commodity futures / forward trade in India.
- ❖ The regulation is needed to create competitive conditions. In the absence of regulation, unscrupulous participants could use these leveraged contracts for manipulating prices.

- ❖ To ensure the market has appropriate risk management system. In the absence of such a system, a major default could create a chain reaction.
- ❖ The financial crisis in a futures market can create systematic risk.
- ❖ To ensure fairness and transparency in trading, clearing, settlement and management of the exchange so as to protect and promote the interest of various stakeholders.



INPUT SERVICES

Key Inputs: Seed, fertilizer, pesticide, Farm, Power, Machinery, Credit & wage rate, farm inputs

SEEDS

- ❖ Any part of the crop from which a new crop will grow (Agronomically)
- ❖ Seed is a fertilized ovule (Botanically)
- ❖ Seed quality is estimated to account for 20-25% of productivity.
- ❖ World seed market is about 2,20,000 crore rs.
- ❖ Indian seed market size is about 9,000 crore rs.
- ❖ The seed replacement rate in most of the crops is very low, with the exception of cotton and some other vegetables.
- ❖ Seed generations: Nucleus seed -> Breeder seed -> Foundation seed -> Certified seed

CHALLENGES

- ❖ There is a mismatch between the seed multiplication ratio from breeder seed to foundation seed and from foundation seed to certified seed.
- ❖ Comprehensive and authentic databases on seed production and trade need to be built up.
- ❖ The seed chain and the norms for quality control to be followed without any compromises or shortcuts.

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- ❖ For horticulture crops which have a long gestation period, it is imperative to ensure that only such varieties are imported that are suited to Indian conditions.

FERTILIZERS

- ❖ Macronutrients, micronutrients fulfill specific functions in plants and cannot replace each other
- ❖ All of them are equally important, regardless of the amount required physiologically
- ❖ Lack of any single nutrient will limit crop growth even if all the other nutrients are fully available
- ❖ Supply of all nutrients is essential to produce high yields of good quality
- ❖ Farm Mechanization

Why Farm Mechanization

- ❖ Labour is available at a higher cost per hectare and this would increase the demand for mechanization.
- ❖ India is a growing economy and to support a growing population we would require not only efficient but machinery that would increase the yield of food grains and commercial crops.
- ❖ Mechanical power has replaced bullock power on Indian farms.

ADVANTAGES

- ❖ Increase in crop intensity and yield thus ensuring better returns to the farmer
- ❖ Reduction of weather risk and risk of non-availability of labor thus minimizing post-harvest wastages
- ❖ Improved working conditions and enhanced safety for the farmer
- ❖ Conversion of uncultivable land to agricultural land through advanced tilling technologies
- ❖ Shifting land used for feed and fodder cultivation for draught animals towards food grain production
- ❖ Increased rural employment.

ISSUES AND CHALLENGES

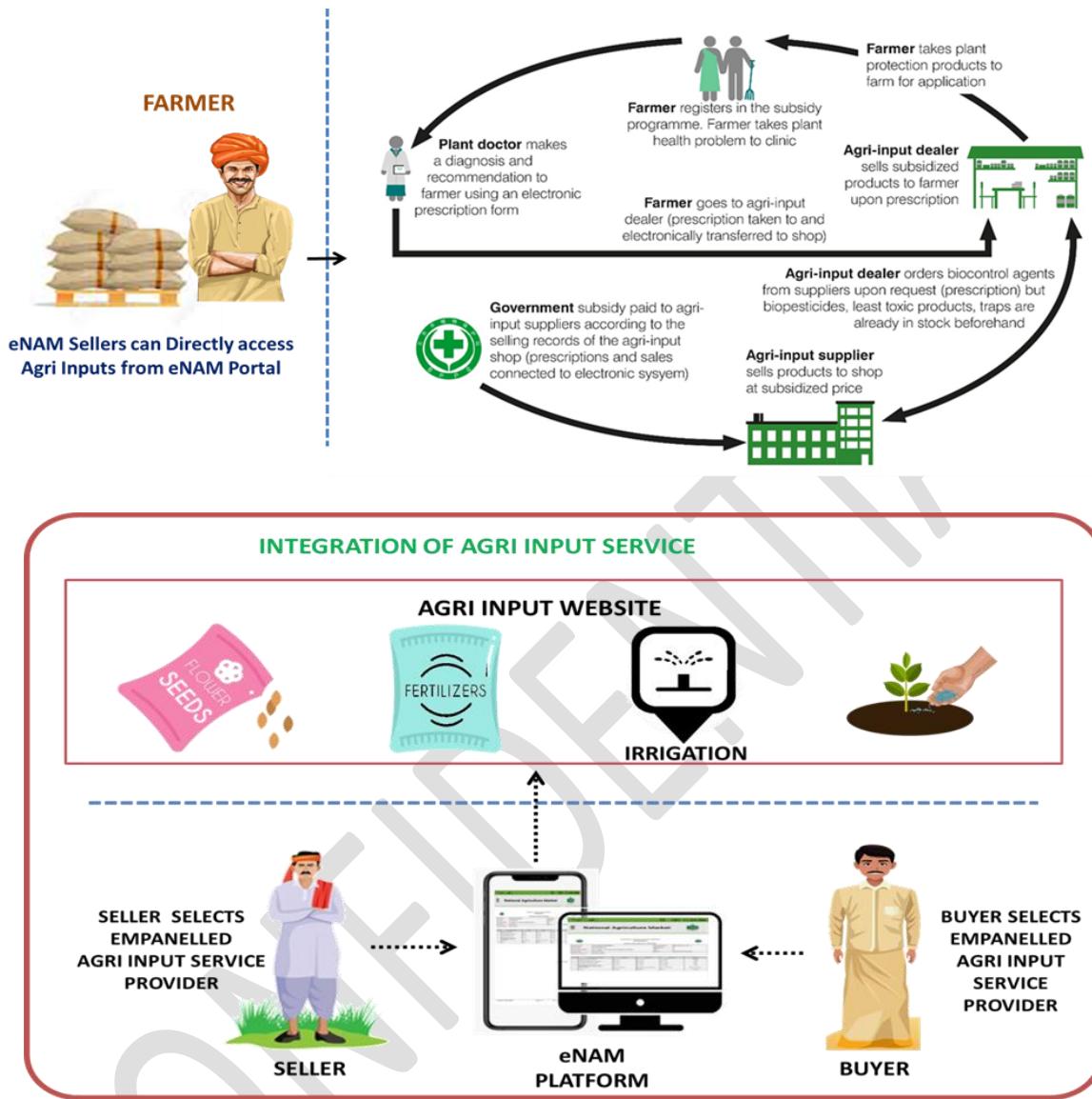
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- ❖ Highly diverse farm size & soil types resulting in the need for customized farm machinery and equipment.
 - ❖ Skewed and seasonal usage resulting in low economic viability.
 - ❖ Cattle population: Increased mechanization results in surplus draught cattle and their upkeep is a concern for the farmers.

IRRIGATION

- ❖ Irrigation potential is about 140 mha.
- ❖ 58.4mha from major and medium irrigation sources
- ❖ 81.6 mha from minor irrigation sources.
- ❖ Persistent gap between the assessed ultimate irrigation potential and actual potential that has been put to use.
- ❖ Inefficient water use in irrigation is leading to environmental degradation via water logging.
- ❖ Efficiency in systems needs to be upgraded from present level.
- ❖ Methods of Micro-irrigation should be taken in use for better utilization of water. It includes Drip and Sprinkler irrigation system Agricultural (Input & Output) Marketing

Agriculture & Labour

- ❖ Agriculture is a labour intensive activity.
- ❖ Cost of cultivation data shows that, labour accounts for more than 40 percent of the total variable cost of production
- ❖ Raising the wage levels of casual workers both in agriculture and non- agriculture sectors needs adequate policy attention. In this regard, strict implementation of the Minimum Wages Act, 1948 and targeted employment generation programs are important.
- ❖ Agricultural wages have been traditionally low due to low productivity. Large disguised unemployment in agriculture is due to lack of sufficient employment opportunities elsewhere.
- ❖ In recent years there is a perceptible change in this trend due to rapid economic growth and adoption of policies for employment generation including promotion of self-employment opportunities.



Agritrade Platforms (National & International)

Online trading platform for Agri commodities such as tur, moong, urad, wheat, maize, barley, etc.



- ❖ It connects thousands of Indian farmers.
- ❖ A user-friendly platform that generates market opportunity for farmers and industry buyers. Unlimited access to a global market from anywhere, at any time.
- ❖ Transparent and reliable market information, deal creation and negotiation. Integrated and secure platform for payment processes.
- ❖ Tailored product quality verification and logistic services.
- ❖ A market with only verified buyers and sellers.
- ❖ Customer support & insight.

Warehouse Based Trading

Warehousing is a scientific storage practice where Agri-commodities can be stored in warehouses for longer period of time, without losing its quality & quantity during entire storage period. Agricultural Storage is an important Agri- logistics & marketing function, which involves storing and preserving agriculture produce by the farmers, aggregators, traders, processors & exporters from the time these are produced until are needed for consumption.

The main objective of postharvest storage is to help the farmers and depositors to avoid distress sale during the harvest season and to fetch better competitive price later.

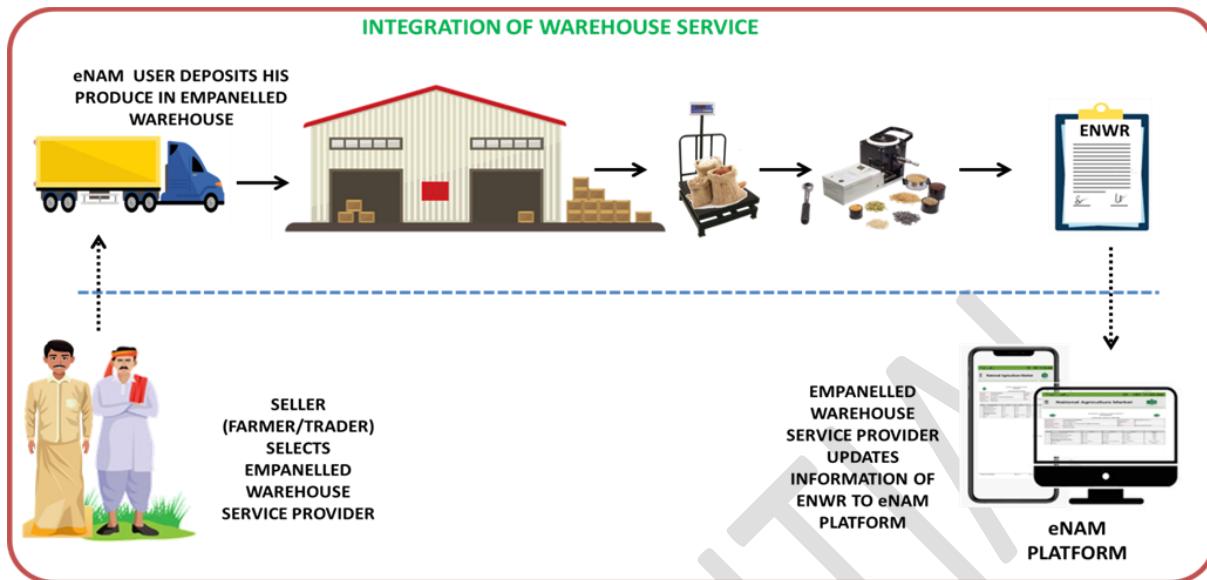
It provides complete solution of preservation and protection of various commodities such as food grains, cereals, pulses, spices, oilseeds, menthe oil, sugar, guar seed, gum etc.

APMC officials will be able to manage and track warehouse inventory details using the NAM portal. Inventory details can be entered into the portal. The portal will also maintain updated status and all related activity regarding inventory within the warehouse.

This module will be used for registration of storage details of the commodities stored in the warehouses which can be displayed for auction, issue of goods to successful buyer based on the exit slip and update inventory accordingly. This will also be used to see the warehouse availability and assign warehouse against a lot.

Warehouse Management module will facilitate following features:

- Registration of warehouses where the produce of farmer will be stored and offered for auction
- If the farmer brings the produce to APMC warehouse, the APMC official will update the stock location information against Goods Receipt Number (GRN) on the NAM portal.
- Goods receipt note (GRN) will be registered with following information
 - Farmer Details
 - Lot details
 - Storage location
 - Commission agent
 - Generation of stock reports on daily basis
- Updates to warehouse availability information on the system, in case of any conflict from system calculation
- Uploading assessment results on the sample collected from warehouse.
- Issue of goods to buyer based on the exit slip and update inventory accordingly.
- If the produce is taken out from the APMC warehouse, the same will be updated on the NAM portal and the Goods Issue Note (GIN) will be registered in the favor of buyer.
- APMC can charge fee for storage at APMC warehouses.
- Provision to create and maintain price master for storage of goods in the warehouse
- Provision for Approval of Warehouse registration; define commodities that can be stored in the warehouse (if any).
- Provision for defining various warehouse parameters like storage capacity, size, type of warehouse, quality of building, access roads, warehouse personnel details

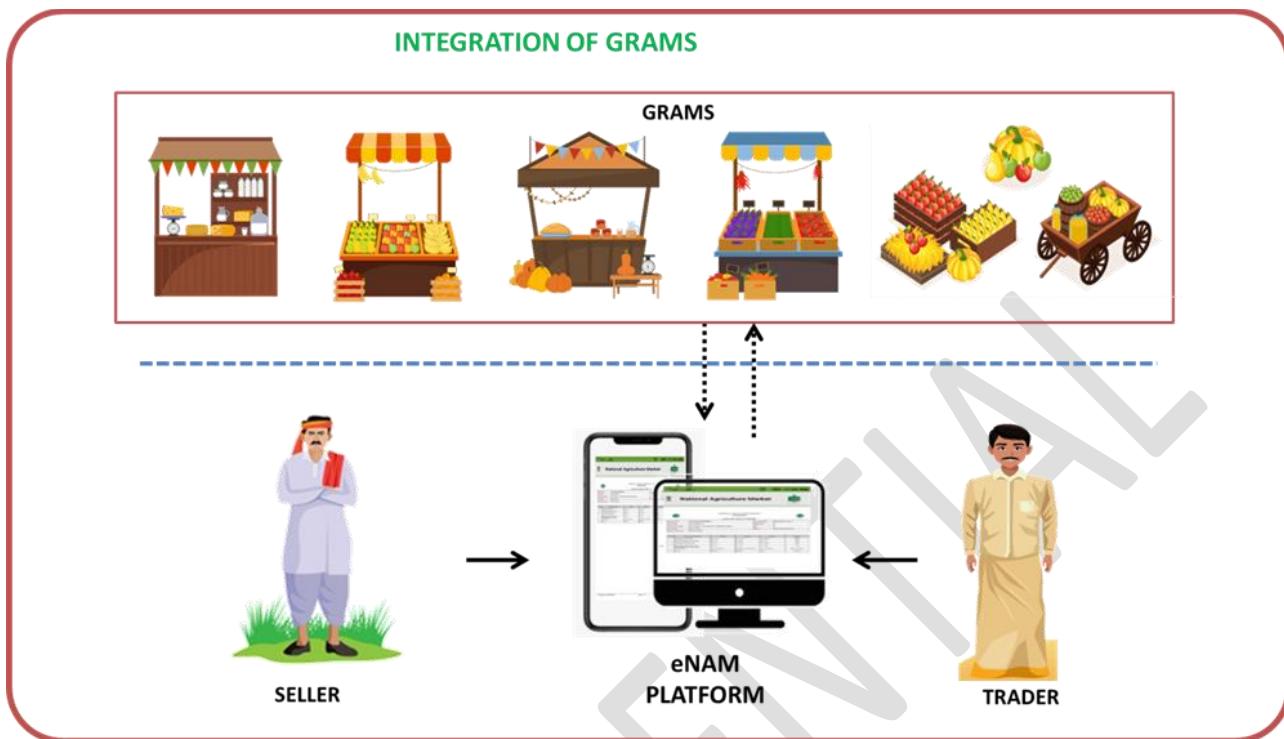


GrAMs

"Retail agricultural markets in close proximity of the farm gate, that promotes and service a more efficient transaction of the farmers' produce across the agricultural sub-sectors, by enabling both direct sale between the producer and consumer and aggregation of small produce-lots for subsequent transaction, both of which can occur either physically or online"

Advantages of GrAMs:

The GrAMs shall be organizationally linked to primary wholesale agricultural markets like APMCs/RMCs, whether in the public or private sector and the together shall provide a hub and spoke model of agricultural market structure.

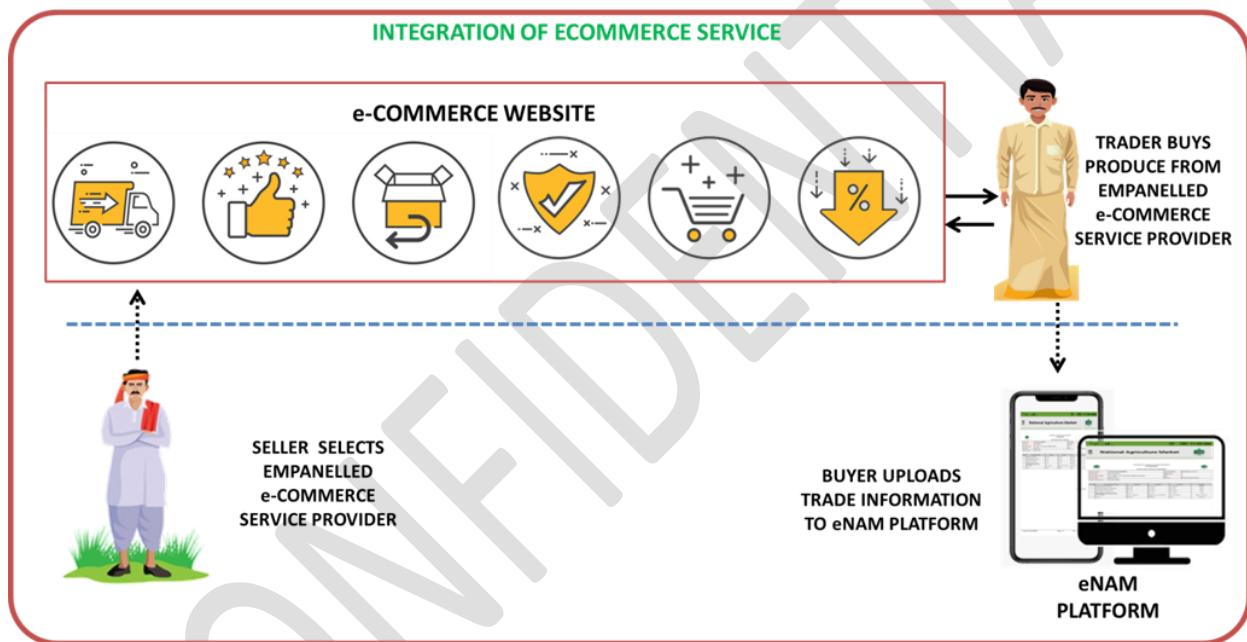


Some of the specific advantages of GrAMs are as follows:

1. Reduce the cost of first-mile transportation by offering the farmers a marketing platform in close proximity to the farm gates.
2. Reduce the cost of the transaction and enable the farmers to gain a higher share in the consumers' rupee by facilitating the direct sale – both physical and online.
3. Provide an orderly and transparent system of aggregating the small lots and substitute for the currently opaque & informal system of aggregation by the village traders.
4. Provide small farmers the opportunity to target direct sales at markets of their own volition by providing the associated market linkage services.
5. Provide the greater opportunity for mobilization of farmers through mechanisms like farmer producer organizations (FPOs-societies, cooperatives, and companies), as well as Village Producer Organizations (VPOs).
6. Offer an integrated platform for the purchase of agri-inputs, besides other consumer & white goods.
7. Serve as a place for the dissemination of new information & knowledge relating to agriculture and other aspects of life

Private Markets

The growing popularity of the commodities exchanges is one of the major factors to be taken into account. The existing agricultural marketing infrastructure has been exposed as being inadequate for today's needs and so as being planned for changes/improvements. There is just one traditional agricultural market yard in an area as vast as 435 Sq.Km. where most transactions are done by local influencers, who usually keep farmers and rural traders in the dark about how their commodity is evaluated and priced. This gap needs to be overcome in the context of the other changes taking place with regards to the marketing of agro commodities.



To improve farmers and rural trader's access to markets by building modern rural agricultural warehouses called "Private Mandi" at village level with sophisticated marketing infrastructure for Agri produces across the country. It means establishing semi-online trading platform and modern rural wholesale markets that are effective, professionally managed and responsive to farmers and rural trader's needs.

The Private Mandi's will provide farmers and rural traders a more competitive and therefore efficient modern marketing mechanism including necessary logistics support, a transparent digital price-discovery network that helps farmers and rural traders to get better price for their Agri commodity

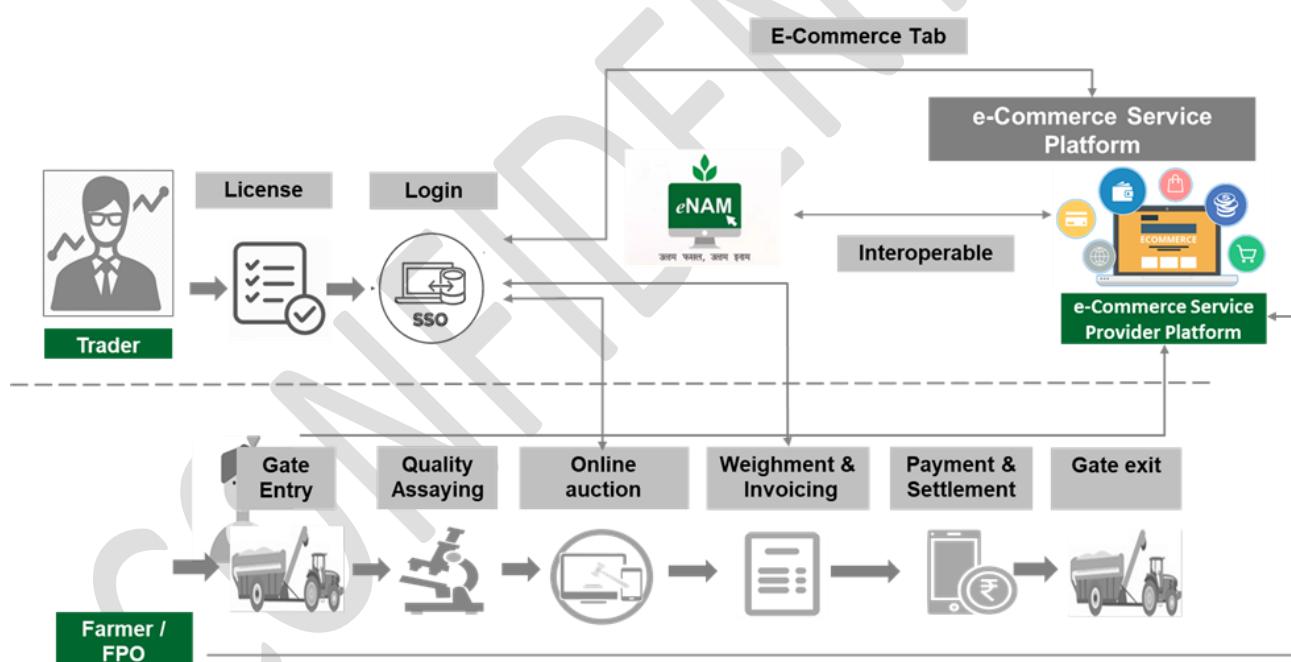
transparently with minimum support price guarantee on the spot in sharp contrast to the present system.

This move may translate into the last leg of privatization of the entire Indian Agri commodity value chain. Transparent transaction between end-buyers and corporate retail players real farmers or rural traders across the country through this Private Mandi's.

e-Commerce Platform:

An E-commerce platform allows online businesses to manage their website, marketing, sales, and operations.

E-commerce platforms like Big Commerce offer the powerful features needed to run the business, while also integrating with common business tools, enabling businesses to centralize their operations.

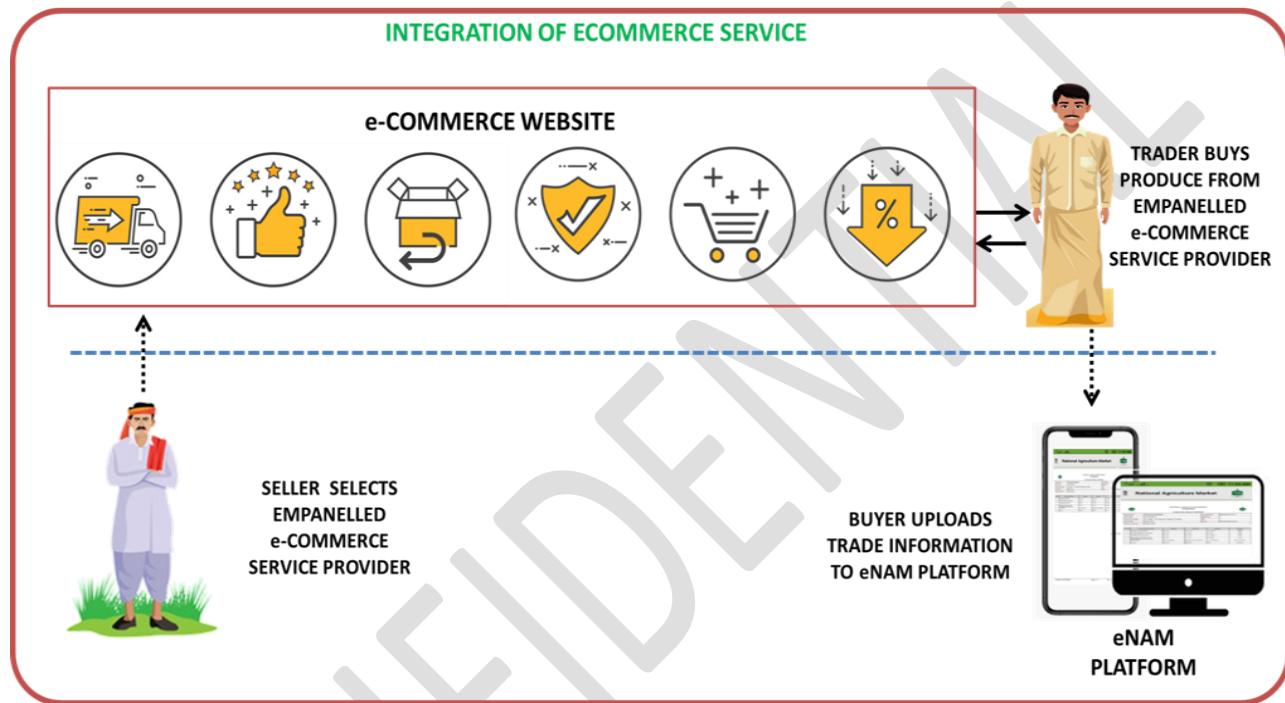


The alternatives of an E-commerce platform are:

- Building one from scratch, which is out of the question for most businesses and only justifiable for multimillion (or multi billion) dollar companies.

- Using a plug in, which isn't an option in the context to build and grow a any legitimate business.

The E-commerce platforms facilitates the business owners with the ability to customize product information and how it's solicited to best fit of their own online retail needs and which can be a mutual benefit for the business and its customers.



Co-operatives

The establishment of co-operative marketing societies was another step which has been taken to overcome the problems arising out of the present system of marketing of agricultural produce. The objectives of economic development and social justice can be achieved by channelizing agricultural produce through cooperative institutions.

The efforts of the government to improve the marketing system of agricultural commodities have been only partially successful in creating healthy conditions for scientific and efficient marketing. Moreover, the progress of regulated markets is not uniform in all areas. Private agencies dominate the trade of Indian food grains and farmers grievance for the marketing system is mainly due to high marketing charges, low prices of the farmers produce and prevalence of malpractices.

The need for strengthening co-operative organization has, therefore, been recognized for the marketing of the produce of farmers and for making inputs available for them at the right price and time. The co-operative institutions are expected to function as competitors of private traders in the market. These organizations pool the produce of the small farmers having a small surplus to market and improve their bargaining capabilities. They have also helped the government agencies in the execution of the policy decisions bearing on the procurement and distribution of food grains and other essential commodities.

A co-operative sales association is a voluntary business organization, established by its member patrons to market farm products collectively for their direct benefit. It is governed by democratic principles and savings are apportioned to the members on the basis of their patronage. The members are the owners, operators and contributors of the commodities and are the direct beneficiaries of the savings that accrued to the society. No intermediary stands to profit or loss at the expense of the other members.

Co-operative marketing organizations are associations of producers for the collective marketing of their produce and for securing the advantages for the members that result from large-scale business which cannot be secured by an individual cultivator because of his/her small marketable surplus.

In a co-operative marketing society, organization is controlled by the farmers, and each member has one vote irrespective of the number of shares purchased by him/her. The profit earned by the society is distributed among the members on the basis of the quantity of the produce marketed by him/her.

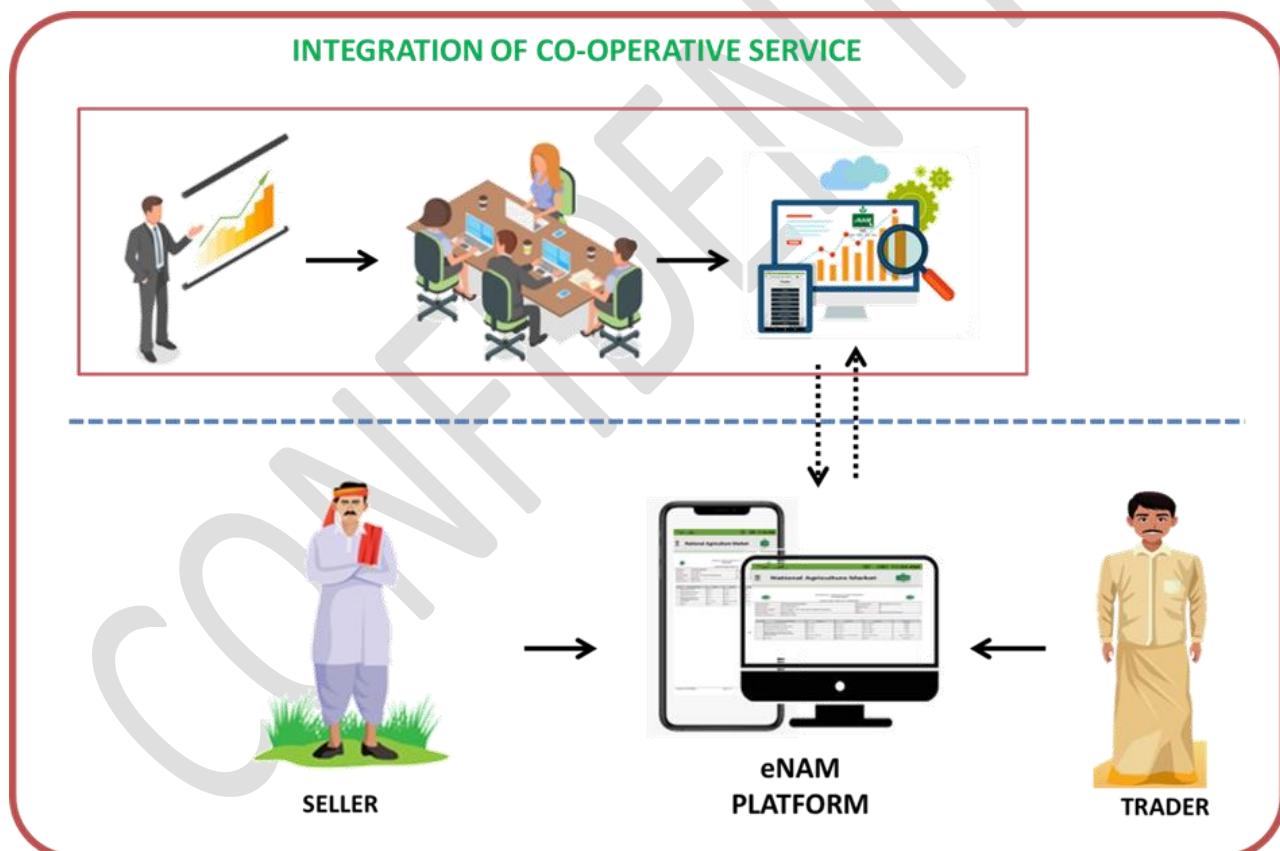
In other words, co-operative marketing societies are established for the purpose of collectively marketing the products of the member farmers. It emphasizes the concept of commercialization. Its economic motives and character distinguish it from other associations. These societies resemble to the private business organization in the method of their operations; but they differ from the capitalistic system chiefly in their motives and organizations.

Functions

The main functions of co-operative marketing societies are:

- To market the produce of the members of the society at fair prices
 - To safeguard the members for excessive marketing costs and malpractices;
 - To make credit facilities available to the members against the security of the produce brought for sale
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- To make arrangements for the scientific storage of the members' produce
- To provide the facilities of grading and market information which may help them to get a good price for their produce
- To introduce the system of pooling so as to acquire a better bargaining power than the individual members having a small quantity of produce for marketing purposes
- To act as an agent of the government for the procurement of food grains and for the implementation/execution of the price support policy
- To arrange the export of the produce of the members to ensure better returns
- To make arrangements for the transport of the produce of the members from the villages to the market on collective basis and bring about a reduction in the cost of transportation
- To arrange for the supply of the inputs required by the farmers, such as improved seeds, fertilizers, insecticides and pesticides.



1.1 Transition Plan & Technology Architecture

The implementation of any Platform or Solution will typically involve both business and technology components and the architecture will act as a guide to both to ensure that the implementation projects align with higher level initiatives of the project. The current architecture of eNAM has been implemented to realize the business goals and objectives it was set out to achieve. In order to stably support the evolution of the eNAM Platform over a period of time and also to ensure that technology backbone should be robust to accommodate new requirements over a period of time we are proposing a systematic transition of architecture and designed using Platform approach. This will be carried out by looking into a long term play of the platform by better modularizing the platform and marrying the latest technology landscape.

The core the current architecture would be affected but the entire platform would be better evolved into manageable module so that it can easily cater the requirement of Platform of Platform in a larger landscape. The underlying architectural and design patterns proposed are for similar internet scale systems using open source software as against to traditional enterprise systems design. Use of COTS products, license libraries shall be limited to bare minimum where traditional open source software is not available for e.g., SMS gateways, payment gateways, security penetration testing tools, Infra level monitoring tools, etc.

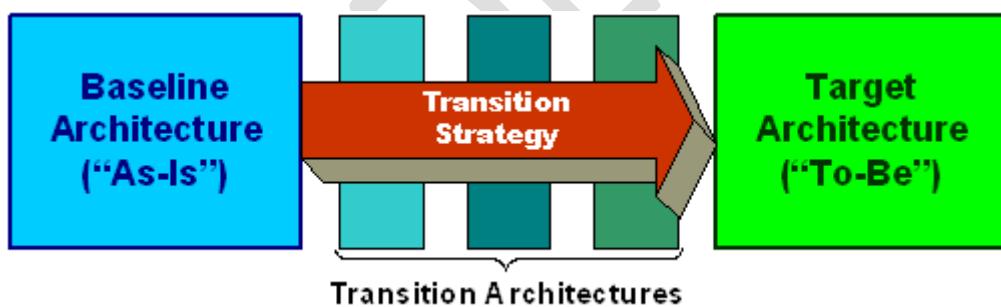
The scope and magnitude of the eNAM platform is likely to impact the service delivery of at least the identified core services in APMC markets across India, with an overarching effect on the current fragmented solutions that have been put in place by State governments. We would be taking the domain approach of reusability and would readopting by refactoring of Database and Application Layer.

The following section outlines these objectives from a holistic perspective, keeping in view the requirements of all the stakeholders of the project, as well as the constraints within which the proposed solution would need to operate. The design objectives for the proposed technology solution in eNAM platform are:

1. Adopt event driven microservices architecture
2. Develop and expose business functionality as services
3. Omni Channel experience with Web Browsers, Mobile Devices using API driven interfaces
4. Ensure confidentiality of user data
5. Enable easy discovery of information
6. Allow internal, external and associated agencies access to the online platform
7. Allow farmers, traders, commission agents and private sector to access services through a 'Single Window' interface using eNAM Platform
8. Facilitate delivery of re-engineered manual processes through an online platform

Takeover plan and Methodology:

National Agriculture Market (e-NAM), Production Application Architecture (PA) Transition Strategy Plan is a critical component of e-NAM application. It describes the overall plan to achieve its target "To-Be"

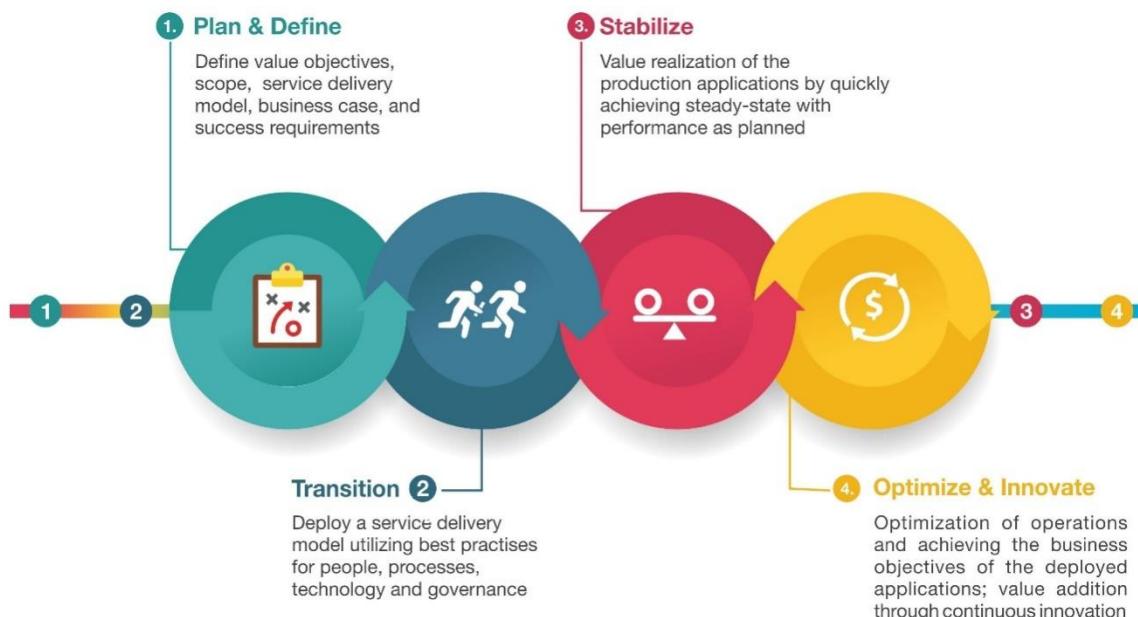


The transition framework is comprised of three phases – Architect, Provisioning, and Implementation– that extend across the entire lifecycle of information technology. In ordered to e-NAM transition strategy.

By employing our global delivery model, we would provides real results faster. We use proven project Management practices to facilitate communication between our clients, to manage project workflow and to perform detailed design and analysis phases. Development and construction phases are carried out at our offsite/offshore development centers.

The Planning transitions is aligned with a strategic plan created by our team will be followed by further category wise segregation of transaction activity solution architecting, risk and gap analysis.

This methodology is powered by Global Delivery Service, which gives us the flexibility and ability to deliver a unique mix of services, onsite at the customer location, offsite / offshore development centers. This methodology consists of the following four phases: Plan, Transition, Stable and Optimize.



Performance

Performance of the application is usually measured in terms of average response times of a business transaction at various user/system load conditions. Few of the primary reasons for performance of the applications are impacted negatively are when data access is complicated due to vast amounts of joins (using a single schema) or when application interfaces are holding up a session context at web/app tier layers. In both the cases connection management, coupling of users to a server triggers application degradation.

In the proposed design, Performance of the application is achieved by the below three core design principles:

- E-NAM Platform is built on loosely coupled micro services with smart distributed caching to keep the application servers stateless.
- Data is organized across multiple database technologies - RDBMS, NoSQL, In Memory Cache and Search Indexers to easily access data with great efficiencies.

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- c) Defining key applications (i.e. micro services) to support both synchronous and asynchronous access patterns to release the contentious resources and enable smart integrations with users and external platforms using events, call backs and alerts-based triggers.

The reporting and analytical modules shall be built on Big Data stacks to handle large data volumes with streaming.

Performance realization is achieved by following the below deployment delivery practices:

- 1. The software design will be such that deployment can be easily done using Kubernetes stack to auto scale the services based on dynamic demand.
- 2. The portal will use clustering and web-farms for deployment with adequate caching of static web pages.
- 3. Proper load balancing algorithms such that load gets distributed uniformly on all available nodes within a layer will be used. All the API endpoints shall be hosted as stateless services with optimal use of caching of required information
- 4. Proper caching mechanism for master data and mostly read data like user profile information, configuration parameters will be used.
- 5. Provision to trigger all compute intensive tasks will be executed asynchronously.
- 6. Most of the application level logging will be disabled in production code with a balance to get the required information to monitor and support the application.
- 7. Code will be optimized using performance testing/analysis tools before deploying in a production environment.

Portal Functionality

In addition to user and application specific functionalities, NAM platform will provide following portal functionalities

- Seamless integration with users and systems (external platforms) alike using common APIs
- Data as a Service for all business applications by abstracting the underlying stores using respective business services.
- Ensure reuse of data, create single source truth clusters for respective data sets (Farmers, Traders, Commodities, etc.,)
- Separation of Data and Business logic. Enabled Databases to be used for persistence storage and all business logic is abstracted in micro service layer.

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- Standard interfaces to integrate with similar platforms, for e.g., logistics platforms, banks, e-Commerce marketplaces, etc.,
 - Separate MIS and Analytical data stores to serve Real-time and near real time reporting to all stakeholders.
 - Separate CMS portal will be available to the platform for dynamic content information / Notifications
 - **Metadata Synchronization** – NAM platform will comply with defined standard for content taxonomy, metadata, and master data
 - **Full Text Search** – will provide facility to search the portal content based on full text search approach
 - **Metadata based search** – will provide metadata-based search facility to search NAM platform content
 - **Information Browser** – will provide explorer type interface for browsing all information, which is published on the NAM platform **Personalization** – This includes user specific customization such as display themes, customization on home page
 - **Portal Usage Reports** – will provide various reports related to usage of portal. This will help to analyze user behavior and content of interest to users
 - **Self Service** – This includes user registration, user profile management. Certain services and functionality may be provided only to registered users
 - **Notifications** – Registered users will be able to subscribe to specified type of content categories. Whenever any content of subscribed categories gets published, subscribed users will be notified by means of email or SMS.
 - **Portal Administration** – Administration functionality for user management and application administration will be available

Software Systems Attributes

e-NAM Architecture will be designed in a high availability platform. Multi-level cluster configured High availability services will be implemented on all layers of architecture which includes. Web, Application, database, web services and application connecting payment gateways where the eNAM architecture will be operational all the time. Other High availability services with Hardware and Network devices will be configured at NIC Meghraj by coordinating with respective teams. If the system is not available for all the time, user loses his interest and avoids using the service again presuming that it may waste his/her time in accessing the service without any result.

To provide reliable services through eNAM Architecture, suitable steps will be taken from design to use. eNAM Platform will be provided with the capability to continue its function regardless of external events.

Hardware failure, natural disasters and data corruptions will not be allowed to disrupt or stop NAM platform activities. System may return error occasionally, but it will respond in a normal manner on retry after a reasonable amount of time, typically a few seconds. The portal functions will be capable of operating on alternative information delivery mechanisms. There is a proper backup plan in place to overcome hardware or software failures.

The risks of interruption of operations of eNAM platform will be established in advance and managed. Management includes but is not limited to periodic reviews, testing for vulnerability and exposure, or designing mission-critical services to assure continuous availability through redundant or alternative capabilities. Recoverability, redundancy, and maintainability will be addressed right from design time.

The proposed architecture will address these requirements using clustering, load balancing and redundancy built in the architecture.

eNAM platform shall be up and running and will be available 24x7. It shall trap all errors and prevent users from accessing unauthorized areas of the application. In case of application or a hardware failure, the system will re-initiate immediately. In case of a possible hardware failure or corruption of the database the system administrator will immediately restore the backup. eNAM platform will have a well-defined version and change management plan.

Many of the services of eNAM platform being critical, it is desirable that it have reduced Recovery Time Objective (RTO) and Recovery Point Objective (RPO). RTO is defined as the maximum amount of time that an IT-based business process can be down before the organization starts suffering significant material losses. RTO indicates the downtime tolerance of a business process or an organization in general. The RTO requirements are proportional to the mission-critical nature of the business.

Network level

- The system will be capable of failover network elements such as routers, gateways
 - The system will be capable of failover firewalls
 - The system will be capable of failover load balancers/dispatchers
 - The clusters will be defined in combination with load balancing and failover to enhance the level of system availability and system response time.
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Hardware level

- The system will use load balancing across web servers
- The system will use application server cluster
- The system will use data server cluster
- The system will use RAID enabled data storage

COTS software level

- COTS entities deployed as a part of solution will be capable of high availability configuration
- COTS software will support techniques of clustering, load balancing for achieving desired performance levels

Application software level

Categorize all business processes of NAM as

- The High availability and Clustered environment will be able to maintain RPO (Recovery Point Objective) for Local failover – no loss of completed transactions and RTO (Recovery Time Objective) for local failover – 10 minutes
- Business processes that can have slightly relaxed High Availability requirements with non-zero RTO and RPO
- Business processes which need not have the rigorous HA requirements for e.g. processes related to internal development and quality assurance processes
- Plan Application architecture as per these requirements
- All file names will be relative
- IP addresses will not be hardcoded
- 'local host' will not be binded with anything
- The amount of data saved in 'http session object' will be minimized
- Static variables will not be used
- Write operations will not be performed on external files.
- Client applications that connect to the server application will retry and recover from temporary network failures

General guidelines

- Redundancy: Each element of an application will have a backup that can take over if the primary one fails.
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- Recoverable design: Any individual element is more available if it is stateless, but the application typically is stateful, and state will be preserved across potential failures.
 - Failure detection: To be recoverable by saving transaction information, notifying a user or administrator, and performing appropriate application cleanup
 - Application will be monitored in real time to ensure it is still running and triggering automatic failover.
 - Operations management integration: Applications will incorporate management APIs to raise alerts, enable full monitoring and management, and write error logs that may also be monitored.
 - Connection management: The client part of the application will be designed to handle connection failures and automatically establish connections to alternate providers.
 - Transaction: Application design will explicitly anticipate handling of and recovery from transaction failures.

Scalability

eNAM platform design is to ensure horizontal scalability of application across all layers. Vertical scalability of the application shall be limited to the extent the underlying hardware support with respect to compute and memory.

The proposed platform architecture assumes scalability requirements across application and database layers.

Application Layer

The frontend applications and interfaces are integrated with stateless APIs where the session and related transaction information is retrieved from the caching layer so that additional nodes can be easily added to meet additional load requirements.

Scalability of backend application components are achieved by use of runtime platforms like Kubernetes to orchestrate the application container deployments. Kubernetes platform enables auto scaling of applications based on demand.

Database Layer

Considering the platform must be designed for One Nation use, splitting the user transactions across States, Mandis, etc., is not an option. However, the data layer scalability is achieved by use of

NoSQL DB for high volume bids and for core lot and trade information, the sharding keys shall be based on trade dates.

Advantage of doing the sharding based on time factor enables:

1. Easy extensibility of new shards based on underlying DB hardware restrictions to scale vertically.
2. Business logic within the context of a micro service is coherent within a schema. Any new business requirements are not constrained due to use of one particle shard key (buyer or seller or commodity or market etc.) at this phase of the eNAM platform design.
3. Avoids use of multiple shard key indexes to be maintained for cross reference lookups.
4. Built in design to handle seamless lookup of all transactions across shards using macro batching service to collate the transactions.
5. Standard practice of rolling over (achieving) old data from active db stores. Old data (e.g. T-1 financial year) usually is less referred and data can be stored in one node without replicas.

For Additional challenges on Scalability the following activates will be performed

- a) Daily housekeeping of Applications
- b) Daily housekeeping of Databases
- c) Regular database and application tuning
- d) 24/7 Monitoring of infrastructure

Scalability Realization

Following are few guiding principles limited to that NAM platform will adhere to achieve scalability

- Make software and layout design highly modular.
- The solution will be developed using layered architecture with components spread across different architectural layers including hardware such as servers, storage, routers, physical networks, system software, as well as custom software/ application.
- In the web server layer, provision will be there to add another instance of web server parallel to the existing web servers. The requests to all these servers may be balanced by a Load Balancer.
- The application server instances will be clustered for high availability and scalability

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- In the data layer, to serve the data requests in parallel, multiple instances of database must be deployed. Based on the load and other parameters, one can plan the clustering of underlying data sources.
 - The data archival and purging based on the requirement will also improve the Scalability of the application.

Interoperability

The NAM platform will interact with different Agriculture platforms systems through API's integrations there will be flow of information among the heterogeneous applications and NAM platform. The proposed architecture of NAM platform is built around the web services using secure API integrations and adopts open standards for interacting with various applications to address the interoperability requirement.

Our Technical capabilities will ensure high level secured API through the following process

- **Open APIs:** Also known as Public API, there are no restrictions to access these types of APIs because they are publicly available.
- **Partner APIs:** A developer needs specific rights or licenses to access this type of API because they are not available to the public.
- **Internal APIs:** Also known as Private APIs, only internal systems expose this type of API. These are usually designed for internal use within a company. The company uses this type of API among the different internal teams to be able to improve its products and services.
- **Composite APIs:** This type of API combines different data and service APIs. It is a sequence of tasks that run synchronously because of the execution, and not at the request of a task. Its main uses are to speed up the process of execution and improve the performance of the listeners in the web interfaces

Interoperability Realization

Following are guiding followed for NAM platform will adhere to achieve Interoperability:

- NAM platform will follow standard technologies and techniques, data models and interfaces
 - Standards will be considered from the inception of the NAM platform
 - Website functionality that requires the download and installation of extra technology (e.g. plug-ins) will be avoided.
 - The metadata model will comply with Dublin Core
 - Distributed search of site may use page-level Meta tags, a site map and/or site search tool
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- A site-level metadata profile will exist.
 - External interfaces will be documented
 - Give clear message about specifications, compatibility, and conformance requirement of the application
 - Information about Version and revision number of the implemented specifications needed will be made accessible, so that participating systems can take care of these.
 - Web services will be used to integrate with existing applications
 - Web services will be used to integrate with external applications
 - Web services will be used to integrate with "Centralized Meta Data Repository"
 - Browser based interface to Content Repository will be based on XML
 - NAM platform will work with most common Operating systems, web browsers, access devices like computers, laptops, mobiles

Reliability

Software Reliability is the probability of failure-free software operation for a specified period in a specified environment. Software Reliability is also an important factor affecting system reliability. It differs from hardware reliability in that it reflects the design perfection, rather than manufacturing perfection. The high complexity of software is the major contributing factor of Software Reliability problems.

The modeling technique for Software Reliability is reaching its prosperity, but before using the technique, it must carefully select the appropriate model that can best suit our case. Measurement in software is still in its infancy. No good quantitative methods have been developed to represent Software Reliability without excessive limitations. Various approaches can be used to improve the reliability of software

A good software reliability engineering program, introduced early in the development cycle, will mitigate these problems by: Preparing program management in advance for the testing effort and allowing them to plan both schedule and budget to cover the required testing.

Continuous review of requirements throughout the life cycle, particularly for handling of exception conditions. If requirements are incomplete there will be no testing of the exception conditions.

Software reliability supported tasks support such as:

- Reliability Allocation

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- Defining and Analyzing Operational Profiles
 - Test Preparation and Plan
 - Software Reliability Models

Usability

The NAM platform will be easy to use. The underlying technology will be transparent to users, so they can concentrate on tasks at hand. Screens will be designed for ease of use by non-technical users who do not have any computer knowledge. The GUI design shall be intuitive and task-based without any superfluous design.

Usability is defined by 5 quality components:

- **Learnability:** The NAM platform will be easy for users to accomplish basic tasks the first time they encounter the design
- **Efficiency:** Once users have learned the design, they can quickly perform tasks
- **Errors:** The NAM platform will display friendly messages when errors occur. They can easily recover from the errors.
- **Satisfaction:** There will be high levels of user satisfaction.

Usability realization

The design will adopt the following principles:

- Present the information to the user concisely.
- It will give the correct choices to the users, in an obvious way.
- It will remove any ambiguity regarding the consequences of an action e.g. clicking on delete/remove.
- The design will have the most important thing in the right place on a web page or a web application.
- NAM platform will have common “look and feel” and support ergonomic requirements.
- Relative font size will be used so that a user can easily change overall font size from the browser interface.
- Text equivalents will be given for all graphics.
- Navigability –The user will be able to perform operations without having to navigate through multiple pages/links – No operation will require more than 2 to 3 clicks.

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- Familiarity – The system's interfaces and navigations will be based on other systems that the users are familiar with.
 - Administration – The system will not require any administration tasks at the user level. Interfaces will be available for administration/setup operations.
 - Help - The system will come equipped with Computer based tutorial in English and other languages for users to "self-learn" and "self-solve" any navigability or operational doubts.
 - Standards Adherence – The system will adhere to commonly accepted standards of web-design (such as acceptable size of web pages, small style sheets)

Portability

eNAM platform and its components are developed on Java stack or software that support multiple flavors of underlying CPU hardware architectures (e.g. x86, amd) to support portability of the application.

Additionally, the application shall be packaged as WAR, RPM or Docker Images for easy installation across environments

Extensibility

eNAM platform extensibility is achieved by use of open standards across all layers. Use of XML/JSON formats for REST API design between systems, enables integration with multiple platforms and polyglot programming applications.

Below are additional key factors in the architecture/design that enables extensibility:

1. Use of configuration management system to store application properties.
2. Business rules are externalized to the programs to enable application and are easily extensible to new rules.
3. Use of multiple API endpoints, Object Oriented and Domain Driven Design patterns within an application (i.e. micro service) context enable separation of concerns to easily add new functionality without breaking the existing flows.
4. Externalizing orchestrating flows using workflows, event queues etc., using well defined business rules enables easy adding of new functionality.
5. Design of Master Data module to template for easy addition of new category of users, commodities etc.,

Extensibility realization

Following are guidelines adapted to that NAM platform to achieve extensibility–

- Solution will be developed using Layered architecture
- Solution will follow Object oriented methodology, which inherits extensibility
- User defined attributes
- Business rules
- Configurable parameters

Maintainability

NAM Software maintenance is the modification of a software product after delivery to correct faults, to improve performance or other attributes.

As per ISO/IEC 14764 Maintenance activities can be categorized as:

- **Corrective maintenance:** Reactive modification of a software product performed after delivery to correct discovered problems.
- **Adaptive maintenance:** Modification of a software product performed after delivery to keep a software product usable in a changed or changing environment.
- **Perfective maintenance:** Modification of a software product after delivery to improve performance or maintainability.
- **Preventive maintenance:** Modification of a software product after delivery to detect and correct latent faults in the software product before these become effective faults.
- Maintainability is defined as the ease with which a software system or component can be modified to correct faults, improve performance or other attributes, or adapt to a changed environment.
- NAM platform will have high maintainability.
- Applications/Services on NAM platform will be maintained uniformly. But some applications may need customizations as per the requirement of States. Hence all the applications have been categorized in two types depending upon the change of design permissible:
 - **Core Applications/Services** will not be permitted to be modified / changed by the States (or State APMCs).
 - **Configurable Application/Services** will be configurable according to the needs of the States (or State APMCs).
- The core applications will not have any configurable or customizable components at State. The configurable applications would have parameters (such as Mandi Tax etc.) which can be configured as per the States' requirements. All updates and patches for Core and

Configurable applications are to be deployed from the Centre. This approach will ensure there is only one version of application across all the States.

Maintainability realization

To ensure maintainability of the applications, the following will be insured:

- Modular Software Code: Software Code will be modular and well documented.
- Avoid Complex Coding: Complex "spaghetti code" is quite difficult to maintain safely. Hence it will be avoided.
- Early planning: anticipating what and how programs might be modified at a later stage.
- Modular design: defining subsets and simplifying functionality (i.e., one module performs only one function).
- Object-oriented design: encapsulating both methods and data structures to achieve a higher level of independence.
- Uniform conventions: facilitating error detection and debugging.
- Naming conventions: providing understandable codes.
- Use of Coding standards, comments, and style enhancing readability of the program.
- Use of Documentation standards
- Use Common tool sets
- Configuration Management
- Proper versioning of the software to be maintained.
- All the artifacts related to the software such as code, SRS, User Manual will be well documented and self-explanatory for any programmer to understand. Detailed documentation shall be available at each stage for easy comprehensions of the application system.
- All documents shall be prepared as per the defined documentation standards.
- Backup and recovery policy will be in place for databases. The system administrator shall take regular back up of the database.

Accessibility

NAM Website will be accessible to all, irrespective to the physical capability of the user, his geographical location, level of literacy, technical expertise, limitations of the devices he is using for accessing website, speed of connectivity, language he knows.

NAM platform will have wide reach. Since the major stakeholder of the NAM platform is farmer - having limitations of literacy level, devices and connectivity speed, the accessibility with respect to

these aspects is also an important design consideration along with the accessibility to persons with disabilities. For making NAM platform accessible, it will be made Web Accessibility Guidelines compliant. Web accessibility guidelines are published by the W3C's Web Accessibility Initiative.

Essential components of web accessibility

NAM will adopt several different components of Web development and interaction work together for the Web to be accessible to people with disabilities. These components include:

- Content - the information in a Web page or Web application, including:
- Natural information such as text, images, and sounds
- Code or markup that defines structure, presentation.
- Web browsers, media players and other "user agents"
- Assistive technology, in some cases - screen readers, alternative keyboards, switches, scanning software.
- Users' knowledge, experiences, and in some cases, adaptive strategies using the Web
- Developers - designers, coders, authors, including developers with disabilities and users who contribute content
- Authoring tools - software that creates Web sites
- Evaluation tools - Web accessibility evaluation tools, HTML validators, CSS validators.

Multi-lingual Support

Services on the NAM platform will be accessed by users across India.

- NAM system will support the entry and display of Indian vernacular languages selected by the state
- The application will store data using Unicode representation.
- The database can be developed in a base language in English. This plug-in is then placed between the database and the application. The language of the data is first selected in the application and then data is entered through the form available in the application. This information of the language and the data reaches the plug-in first. The plug-in understands the language and then translates the data into base (English) language and then stores the data in the database. Similarly, when the information is retrieved from the database, it reaches the plug-in first, meanwhile; the plug-in also has the information of the language in which the data in base (English) language needs to be translated into, from the form available in the application. The plug-in then translates this data in the language of the user's choice and displays the same on the form available in the application.

Multilingual User Interface

Following are few principles followed by NAM platform to achieve multilingual user interfaces –

- Unicode will be used for character encoding
- Data server and content management system will support Unicode
- All user interface elements such as strings, constants, UI labels, images, error messages will be externalized, and application will use language dependent mapping using a platform defined standard.
- The application can be launched in the default user interface language, and offer the option to change to other languages
- Language option will be positioned on home page such that it is easily noticeable
- Language option will be provided in respective language
- Maintain consistency between pages of multiple languages

Security

The services of NAM project which will be accessible from NAM platform have been categorized as information services, transaction services and workflow services.

A proper access regime is required to ensure that various stakeholders at Centre / State could log on to NAM platform and perform appropriate activities to deliver updated and relevant information to end users.

Security requirements of the transaction-based services and workflow-based services are high. The portal will include identities of Government officers and other stakeholders, online payment, inter departmental transactions, workflows which are critical with respect to security. Adequate safety measures would be incorporated during the development stage itself to prevent vulnerabilities and build secured code for these services on NAM platform. The system will have protection against unauthorized creation / modification of data and unauthorized viewing of data. System will demonstrate awareness of the codes of practice provided by ISO/IEC 17799:2000.

System Software Level Security

The advice in operating system manuals concerning security will be followed. All known security patches will be applied to all system software products.

Application Software Level Security

The access to various applications will be controlled by active directory authentication services for government users. Since SOA paradigm is used, the web service itself will be secured. The access to various applications by external users will be controlled by maintaining their identities in the database along with proper assignment of roles and access privileges. In short, following are the suggested application level security –

- Implementing security as per the defined security policy
- Public content will be accessible to all users whereas secured content will be accessible to only authenticated users
- Single sign-on will be provided for accessing all services and information
- Open Web Application Security Project (OWASP) standard for Security will be followed

Database Level Security

Following are the database level securities followed for NAM-

- Only authorized users can upload / change the data
- The data backup is performed as part of a scheduled task and is encrypted to ensure safeguard against data theft
- Sensitive data will be stored in a secured manner using one way hashes or AES encryption.

Data Security

The data is a valuable resource and establishing a secure data environment is a key component of the NAM platform's Technical Architecture, particularly since more and more applications use the Internet to access data. Critical data will be protected against any unauthorized access. Data security will be designed to protect data against the following threats:

- Unauthorized use of the database or application
- Accidental modifications and deletions
- Confidentiality and integrity breeches for data in data transport and physical storage
- Disasters

Following guidelines will be followed for securing the data –

- Use generic, protected user accounts for direct database access to streamline administration, ensure scalability, and protect against non-application data access
 - Access to the database will be provided only through application and no direct access of database to users will be allowed

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- The user accounts must be defined only at one directory repository with standard protocol to access it
 - **Manage sensitive data**
 - Sensitive data will be secured on a database server with proper policies and procedures in place
 - It will be ensured that passwords are encrypted both inside application and across the transport layer
 - A backup and recovery plan for databases will be in place
 - **Record information about users and updates made by them on data for audit trail purposes**
 - The account the user logged in with
 - Logged in and logged out time and duration
 - The TCP/IP address of the connected user's workstation
 - The certificate information, in case certificate is being used by the user
 - The old values before the modification
 - The updated values
 - **Transaction logging will be implemented for the recovery of original data is possible and protect the transaction log**
 - Transaction logging records activity on the database and can be used to roll back a transaction.
 - The transaction log will be protected through access control and backup. Only the database will be written to the transaction log. All other access will be read only.
 - The transaction log will be located on a separate physical disk if possible. If it is not possible, RAID will be used to protect the integrity of the log file.
 - **Ensure data integrity by securing data movement or data transport**
 - When high impact, sensitive data is transported through the LAN, WAN, or Internet, it will be ensured that the data is encrypted and protected from alterations. This will be accomplished through Transport Layer Security v2.0 (TLS) or Virtual Private Network (VPN).
 - Other types of data will be encrypted and protected if there is a risk of the data being altered.
 - **Protect source code in data access rules, particularly if it contains password information**
 - If an application needs to store account and password information to access a database or other application service, protect the source code from unauthorized viewing.

- Store passwords in an encrypted format when possible.
- **Protect and encrypt data for sensitive applications**
 - When it is necessary to store sensitive data, it will be stored in encrypted form.
- **Change all default database Passwords**
 - Hackers often attempt a login to a system administrator account using a default password. As soon as a database is set up, all default passwords will be changed.
- **Infrastructure level security**
- Following are the suggested infrastructure level security requirements-
 - The machines used to deliver projects will be operated in as secure a manner as possible.
 - Preventive solution for detecting and preventing threats such as viruses, intruders will be implemented
 - Security audits will be performed as per the defined security policy
 - Data center of the NAM platform will have adequate physical security to limit entry only to authorized persons
 - Must establish, maintain, and effectively implement plans for emergency response, backup operations and post-disaster recovery to ensure the availability of critical information resources and continuity of operations in emergency situations
 - Establish an incident handling capability that includes adequate preparation, detection, analysis, containment, recovery and user response activities and track, document, and report incidents to appropriate officials and/or authorities.

Network Security

Network security for NAM platform will be attained by implementation of SSL and TLS protocols. Machines will be configured to run only the minimum number of network services. Machines will be placed behind a firewall, with access to the Internet only on those ports that are required for the service being delivered. Check on Network traffic will be placed by implementation of firewall and only authorized traffic will be allowed to pass to and from the server hosting NAM platform.

In addition, system will provide the following security features.

- Transactional Central/State services will be accessible only to authenticated users
- Where sensitive information is being passed from a client to a server across the network, it will be passed over https. Secure Sockets Layer (SSL) with encrypted data.

-
- This includes the transfer of usernames and passwords and other personal information. The use of SSL also provides the end-user with an increased level of confidence in the authenticity of the service.
 - Confidential information such as login pages and pages related to transactional services will be served over https Security auditing will be undertaken by third a party appointed by FGPL before launching of the portal. All the security flaws reported during the security audit will be fixed by the development team.

The software will also adhere to security guidelines, standards and policies prescribed by NIC's. As the portal will be constantly enriched for new features and applications during the maintenance phase, it will be referred to security auditing, whenever there are further additions/modifications in the source code. For identifying security breaches a proper audit trail is to be maintained.

Security Layer

NAM platform being an API first with web-based system. It will be secure in terms of authentication and authorization. The security layer will provide various security services to NAM platform across multiple layers. The security layer will be implemented using Identity and Access management tools to manage user identities, roles, security policies, organizations/businesses, authentication, authorization, access control and other additional services like data encryption and SSL. The NAM platform Security Services are primarily authentication, authorization, Portal Access Control, Services Access Control, Secured Pages, Single-Sign on, security event logging and Audit trailing.

Authentication

NAM platform's authentication component will authenticate by challenging users to provide their user id and password.

Following guidelines will be followed for authenticating users –

- a) Authenticate users prior to accessing services
 - It will allow only authenticated users to access system resources and protect resources from inappropriate access.
 - It will authenticate users on the basis for providing accountability.
- b) Use Public Key / Private Key technology for authentication when digital signatures are required.
 - Public Key / Private Key technology is the most widely accepted form of digital signatures.

-
- Digital signatures are central for most electronic business.
 - c) Use token-based or strong password-based authentication where public key certificates are not feasible.
 - Token-based systems are an improvement over passwords.
 - Where token-based identification and authentication is not possible, a password policy based on best practices can provide an acceptable level of security.
 - d) CAPTCHA technique/Mobile OTP etc. will be used for protecting automated form submission during important user input forms.

Authorization

Authorization component will make sure that stakeholders are able to access only the information for which they have privileges to access. An authorized admin/system user will be allowed to define the various available roles in the system. Each user will be mapped to the respective role. Based on this role, the user will be provided access to various available functionalities of the NAM platform.

Portal Access Control

NAM platform ACL (Access Control List) will contain a list of authorizations given to the user such as read, write, delete for a particular object. An ACL lists the type of access to a particular object, each user or a group of users is allowed or denied. To make ACLs shorter and more manageable, users with the same access rights are often put into security groups.

Service Access Control

Securing Services is one of the key challenges in a services-based environment. The immediate security level that can be provided on Services is securing the transport protocol used to transmit the SOAP requests and responses. Service will be made available through HTTP. SSL will be a good way to meet security requirements. SSL provides integrity and confidentiality for the communication between the service provider and service consumer.

Secured Pages

NAM platform will have both public and protected pages based on the information to be delivered. This secure information will be transferred using a secured protocol like HTTPS. Pages like User Login, Transactional pages with credit card information will be considered as secured pages.

Secure Proxy Server

The secure proxy server will intercept stakeholders whenever they request the access to the secured information. URL will be routed to this component, where it will challenge (User Id and Password) the user for authentication if the user accesses the secured information.

Single Sign-on

Within the NAM platform, the stakeholder interacts with the portal and in turn accesses multiple information, back-end applications, portals SSO facilitates seamless user navigation across multiple applications/portals and avoids multiple logins. In case of unsupported applications customized mechanisms will be used to achieve the single sign-on.

Activity Logging

The NAM platform will be able to log and react to (such as storing the event for reporting later or generating an alert) events generated from various source components and take specific actions based on the business requirement.

Audit Trail

The NAM platform will have a mechanism that captures all changes (add, update, delete) to data. These include changes to data that may have occurred outside the application functionality.

Access Points and Access Devices

Following are the suggested access points and access devices related requirements

- Portal will be accessible on all popular browsers such as Internet Explorer, Firefox, Google Chrome,
- Primarily access devices would be desktop and laptop computers. However, the portal will be accessible on other devices such as smartphones.

Delivery Channels

The delivery channels form an important component for success of the NAM implementation. NAM platform will be available / interact with these delivery channels for delivery of information. Without adequate support from the front-end service delivery channels, the backend process automation efforts would be wasted. Therefore, to ensure that the service delivery of the proposed services

happens as intended, several service delivery channels need to be used that directly or indirectly interface with the end beneficiaries.

Currently in the Indian agriculture sector, the major information and service delivery channels for the farmer have been physical interactions with government offices up to the district level, information exchange with fellow farmers and self-learning. NAM platform will provide an interface to integrate with existing service delivery channels and service delivery to happen through several modes which offer transparency, efficiency, and clarity to the information seeker.

Major issues will be addressed like loss, reach and latency of information in service delivery. The requirement is to provide integrated information dissemination systems which can overcome all three issues with their features and benefits.

In the proposed solution, several service deliveries channels have been positioned, these are:

- Physical Channels – Government Offices, Fellow Farmers, Agriculture Clinics and Business Centers, Krishi Vigyan Kendra, Extension Workers, Mass Media (incl. TV, Radio, Newspapers), Print Media (Pamphlets, Gazettes, Notifications)
- Online Channel – Portal (NAM platform), Common Service Centers, Kisan Call Centers, State Call Centers

Interfaces of the NAM platform will be built such that information and services are accessible to these delivery channels easily.

Software Inventory management

All the associated eNam infrastructure license will be well documented from the inception of the project and will shared whenever client Asks or will be submitted periodically every quarterly or annually

The Software Inventory Management report will be shared either by Csv format or some Open source Inventory software

Infrastructure Management

Our IT Infrastructure Management includes

Database Support - Database Support include : Day to day activities, Database Performance monitoring and optimization, Monitoring the Database health, Patch updating, Log file maintenance, Database backup/restore, Multiple server setups , Crash recovery, Preventive maintenance ,Setting up of database replication,

Web Server - Support : Installation and Configuration of JBOSS, Build of New War files HAPROXY and Apache Tomcat servers, Performance tuning of HAPROXY, JBOSS and Tomcat server , Helping Application team on JBOSS configuration, Repair and maintenance ,Haproxy, JBOSS& Tomcat Upgrade, Answering technical queries ,Monitoring of Jboss, Haproxy& Tomcat logs.

Infrastructure support Linux Support : Morning checks of systems/software, Performing backups of data, Applying operating system updates, and configuration changes, Installing and configuring new hardware/software , Adding/deleting/creating/modifying user account information, resetting passwords, etc., Answering technical queries, Responsibility for security, Responsibility for documenting the configuration of the system, Troubleshooting any reported problems ,System performance tuning ,Keeping the network up and running , Reviewing of all the error logs and fixing , Monitoring of servers , Attaching external storage in Linux, Extending of existing volume.

Application Load testing Services - Develop, document, and maintain an application test plan including a plan for unit testing, end-to-end testing, stress testing, performance testing.

Migration Planning and Preparation Services - Implementation and Migration Services are those tasks and activities associated with the installation and migration of new and/or upgraded application components to the test, acceptance, QA, pilot, or production environments

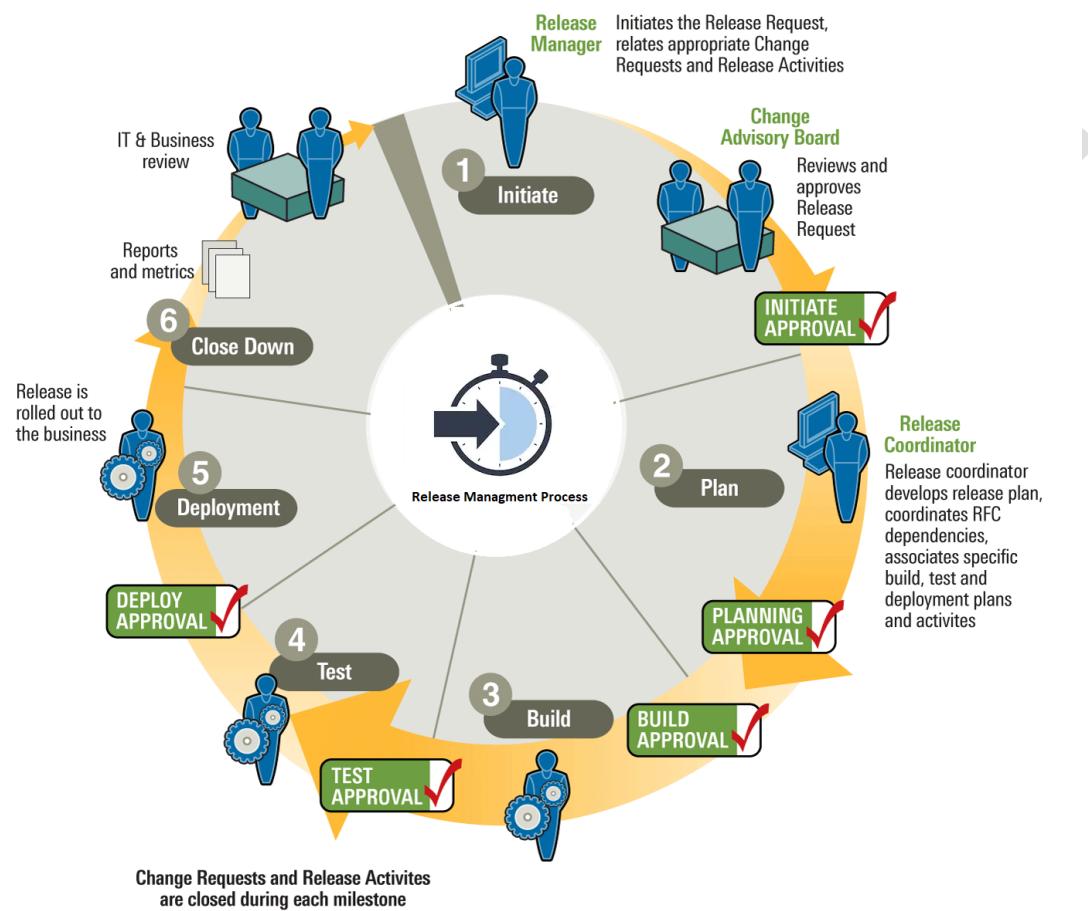
Application Availability

To ensure that the application including its entire functionality is running and is always available, complete Infrastructure will be designed and configured in Multilayer cluster integrated with high availability , the complete Infrastructure will be monitored 24/7 with EMS (Enterprise monitoring software), which includes server monitoring, Server computing vitals check, server Health status , Server Network monitoring , Server Logs monitoring, Application performance monitoring , Application logs monitoring.

The application will be capable to achieve 99.95% in Business hours and 85% in Non-business hours

Release Management

Release Management is all about enabling an organization's systems and services to change to support evolving business needs. It is the process of coordinating the movement of projects into production environments where they can be consumed by end-users. The primary goal of release management is to ensure that the integrity of the live environment is protected and that the correct components are released.



release management down into six sub-processes that enable release management to be performed effectively, efficiently, and safely to facilitate the flow of changes into the operations environment.

- **Release management support** provides guidelines and support for the deployment of releases including the roles that are involved in other parts of the release and deployment management process
- **Release planning**: defines the scope and content of releases according to release management policies, assigns authorized changes into release packages and defines a schedule for building, testing, and deploying the release

- **Release build:** deals with the actual development of all required release components including the issuance of all necessary work orders and purchase orders for components sourced from vendors and ensuring that all release components are ready for validation and testing
- **Release deployment:** manages the deployment of release components into the live production environment and the transition of documentation and training to end-users and operating staff.
- **Early-life (post-release) support:** the initial period after the deployment of a new release when the release and deployment management teamwork with the incident management team to resolve operational issues and remove errors and deficiencies caused by the release.
- **Release closure:** formally closing release activities, verifying all documents and records are properly updated and reporting release outcomes and feedback to project teams.

Change Management

Change management allows the eNAM environment to manage, monitor, and optimize the change management process in the project, a process involving several different elements and stages that include multiple units and activities.



The disruption processes encompass a sequence of steps that lead to the successful implementation of localized or Project wise transformations, which, in turn, lead to the execution of a customer-centric digital strategy.

Change management Process enables NAM to structure and monitor the process in order to identify opportunities, create a plan for software implementation, manage assets and resources, drive change, manage communications, monitor and evaluate data, and optimize auditing.

MIS Reports

The Portal will provide an interface to administrative/management level users to obtain the transaction history, summary and detailed reports on daily transactions, pending applications. The portal also provide a dash-board view, employee wise, location-wise, region-wise to assess the performance in terms of number of applications received, number of applications processed, pending MIS reports generated from the portal will act as a decision support system for the senior officials of the State and Central Departments.

Our MIS report engine for NAM can quickly build custom reports from various Management Information Systems in the organization. Access MIS Reports using a web browser and securely share them with others. Export reports in multiple formats. Easily create summary and detailed reports from all levels and departments in organization. Managers and executives can monitor their departments and teams through MIS reporting and improve business processes quickly.

NAM Tailor made MIS Process

- Quickly create MIS Reports
- Monitor information in real-time
- Build MIS Reports directly from web browser
- Rapid Deployment
- Secure Access and share

1.2 Proposed Technology Architecture for NAM Requirements

For eNAM Platform of Platforms

Proposed eNAM Platform of Platforms (PoP) shall be architected and designed with the following core principles:

Microservices based architecture

- a) All applications shall be designed with API first approach with a published API interface using open api standard (i.e swagger) specifications.
- b) Applications shall be organized around business capabilities so that each application is independently deployed with its own data schema, loosely coupled such that data is abstracted with well-defined APIs that are secure and scalable.
- c) This enables applications to independently evolve while ensuring easy maintainability and testability of the applications.

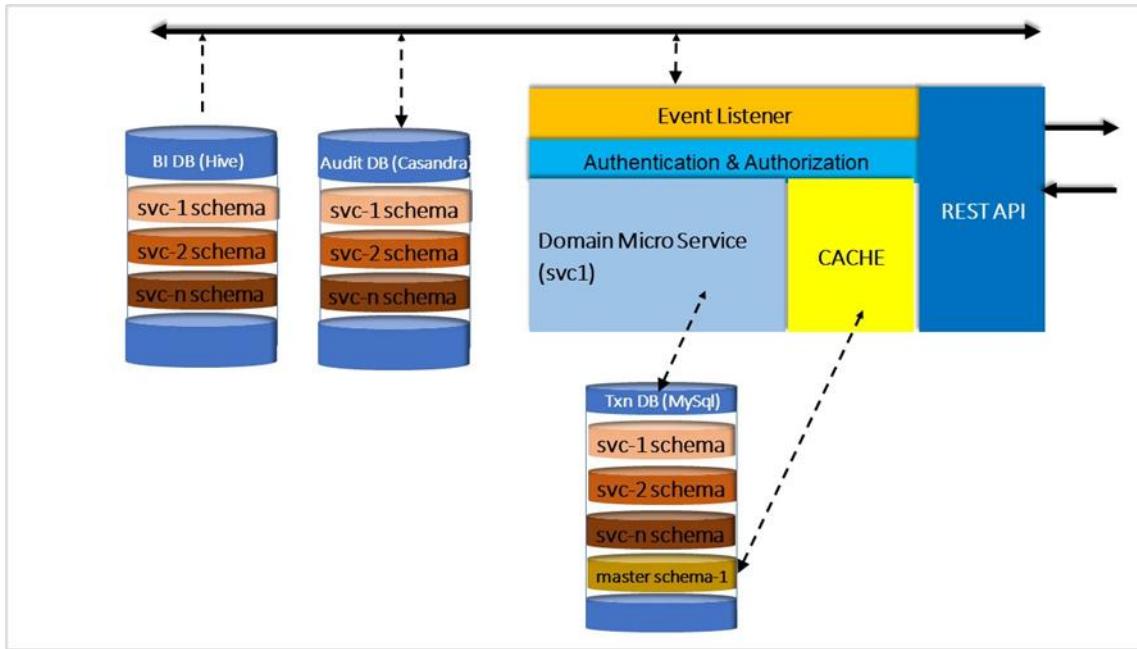
Event driven orchestration

- a) eNAM Platform of Platforms being a greenfield system, must be agile to enable integration with new services and systems easily.
- b) Business workflow shall be orchestrated using a series of domain events between microservices (i.e. business domain services). This will enable to evolve the new platform in an incremental way while keeping the sub systems loosely decoupled.
- c) Events shall also enable to build multiple interfaces with microservices i.e synchronous vs asynchronous calls. Having this capability in the architecture shall enable handling scarce resources like client connections more efficiently.
- d) Business flow **orchestration** shall be done using one of the following ways:
 - Messaging queues for asynchronous requests.
 - Macro business services calling domain level micro services for synchronous request.

Data as a Service

- a) Transaction integrity of the platform is paramount and there shall be only one Single Source of Truth that is non-repudiable for a given domain service. This is primarily achieved using RDBMS (MySql) data store.

- b) While this objective is achieved, eNAM as a Platform of Platform must have access to data across applications without impacting performance. Having the below layers of data shall enable the platform to scale easily:



RDBMS DB (MySQL)

- a) Enables high volume and moderate latency data access.
- b) RDBMS (MySQL) enables ACID capabilities for the highest level of data integrity.
- c) Creating multiple schemas for each application enables hosting the DB's on multiple servers to support high concurrent requests.
- d) Sharding of MySQL where required shall be available as a custom framework or using MySQL features. Having support for multiple secondary shard key indexes shall be a determining factor between the two options.

In Memory Cache (Redis)

- a) Enables high throughput and streaming data access.
- b) Domain services shall cache the required data from rdbms to compensate for rdbms' moderate latency
- c) Data integrity in the cache layer is achieved with predefined expiry time and/or dirty check logic to delete cache data.

No Sql DB (Cassandra)

- a) Enables high volume and low latency data access.
- b) Applicable for audit data, analytical data that grows horizontally with low latency read/write capability with eventual consistency of data with multi replication factor within the cluster.

Data Indexing (ElasticSearch or Solr)

- a) Enables easy search capability without overloading RDBMS indexes
- b) The platform design shall consider seamless access to these data stores following certain disciplines while designing each application. For e.g., seamless indexing of the applicable of the data while storing to RDBMS store, on demand smart caching of transaction or master data by readonly services, Single owner for a given schema, i.e one microservice owns the schema data for all insert/update/delete actions, etc.,
- c) Populating some of the secondary stores as part of asynchronous flows to achieve high throughput with low response times across business transactions. E.g., indexing, audit or bi event writes etc.,

Registries & Master Data Management

eNAM Platform of Platforms would be required to integrate with multiple online systems and stakeholders. This warrants the eNam PoP support multiple "types" of master data. For e.g.,

Registries:

- a) Onboarding of users (e.g. farmers, traders, eNAM operators, business users), entities (e.g. apmc's, logistic companies, assaying organizations etc.,), systems (eCommerce platforms, farm gate, GrAMs etc.,)
- b) eNAM PoP shall manage it's authoritative data set as registries (e.g, Farmer Registry, Trader Registry, Mandi Registry etc.) at a domain level microservice for all life cycle management of this data.
- c) This enables major reuse across all platform modules for e,g eNAM Mandi, eNAM Virtual, Trading modules etc.,

Master Data:

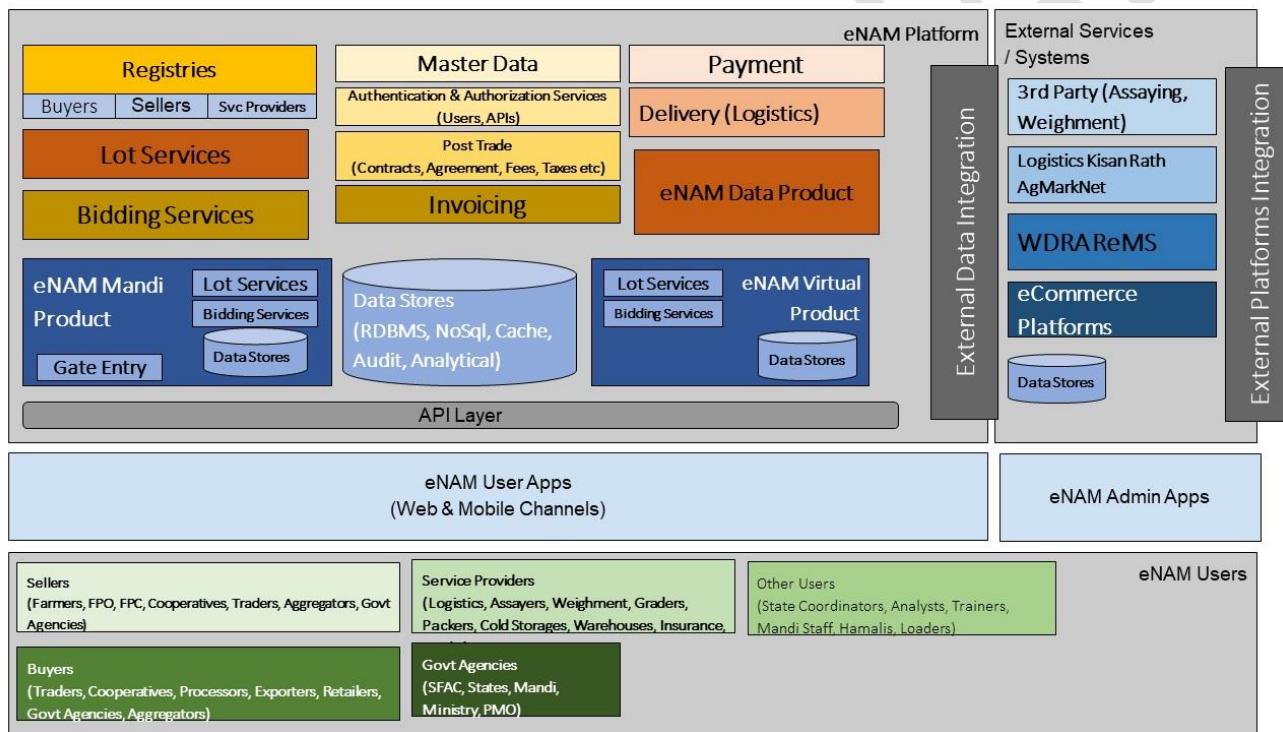
- a) Time sensitive master data mapping - for e.g., village to taluk to district to state can change due to reorganization at district/state levels, village to mandi mappings, fees/commission charges, etc., change over time and would require previous mappings to be technically valid.

- b) General master data like commodity list, unit definitions, trading/holiday calendars, etc.
- c) Separating registry/master data with transaction data (e.g. actual trades, logistic, assaying etc,) enables eNAM PoP to achieve maximum reusability and to organically evolve for new integrations with ease.

Security & Privacy

- a) Proposed eNAM Platform shall be designed with API first principle, all the access to the API endpoints shall be secured with multiple controls to cover all scenarios:
 1. User to System interfaces
 2. System to System interfaces
 3. System to User interfaces
 4. User to User interfaces
- b) Users of Single Sign On with user credentials, Authorization Tokens, API License Keys, Session Keys with two factor authentications (e.g. OTPs) shall be leveraged to achieve secure access to all endpoints/services.
- c) Additionally, all transactional, sensitive data shall be transferred on TLS 2.0 channel with additional payload encryption using AES + PKI infrastructure with additional adequate salting of the keys.
- d) Highly confidential data at rest shall be stored in encrypted format.
- e) To protect privacy of the users, all analytical information shall be anonymized in consultation with the business users.

1.3.1 Logical Architecture



1.3.2 Solution Architecture

Overview

Proposed eNAM Platform should be modularized to separate core services so that eNAM mandi and eNAM virtual products can leverage maximum reusability of common data, service, and underlying infrastructure.

To build an eNAM Platform of Platforms that shall provide integration capabilities with external systems, the proposed design assumes identifying core reusable business services across services i.e. Mandi vs Virtual.

Some of the core services to evolve the platform into modular design includes:

1)Registries

Core aspect of a platform design is to have authoritative information about all the stakeholders of the platform. Creating a registry of users, entities and systems enables multiple products and services to easily interact and to achieve cohesive user experiences.

Sharing of common data across also enables building seamless integration with systems.

2)Lot Management Services

In the context of eNAM, platform lot is the most primitive unit that can be acted upon. A lot can be further broken into sub lots but this relationship is tracked with the parent child relationship.

All lifecycle management around the lot shall be handled by lot management services endpoints.

Lot management services include lot creation, splitting/merging of lots, auto expiry or roll over of the lots etc., Most of the lot functionality is assumed to be common between eNAM Mandi and eNAM Virtual.

3)Bidding Services

Bidding is the core part of the eNAM to enable best price discovery for all the stakeholders. This is the module that is of high volume and low latency (response time) expectations.

Bidding services shall also include declaring the winning bid in a more efficient way with the use of

4)Post Trade Services

All post trade activities related to settlement, agreements, fees etc. are grouped for reuse across various products of the platform.

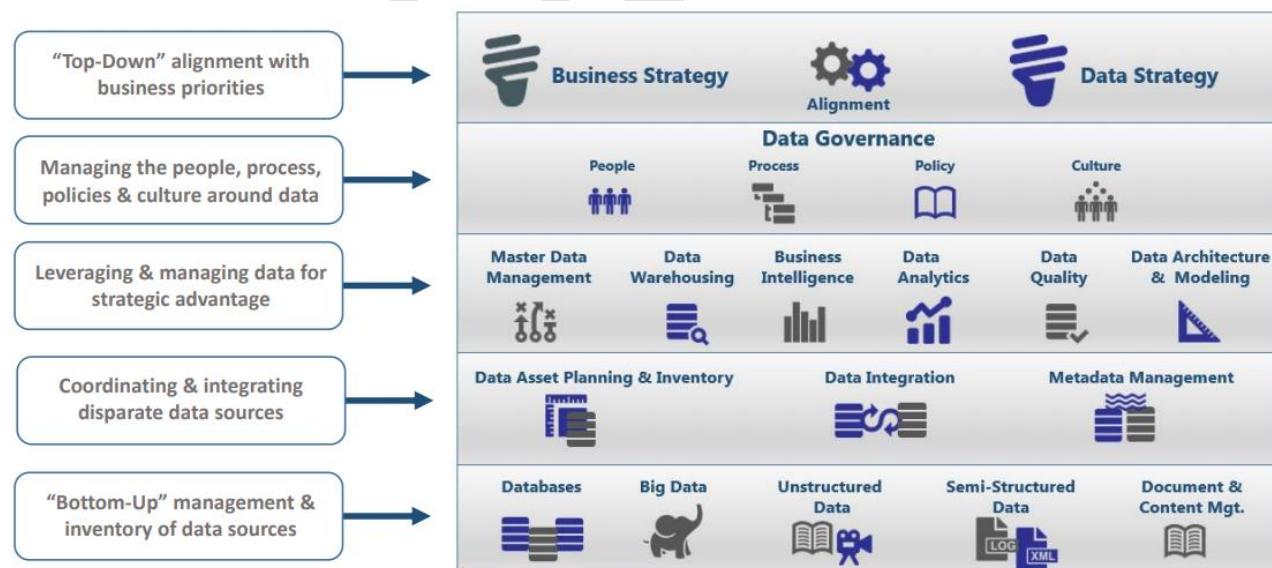
Master Data Modules

An efficient Master Data Management can provide significant value to the National Agriculture Market application in creating consistent key data assets such as stakeholder, commodity, Buyers, services, application rule, application role, and the list goes on. But getting Master Data Management "right" requires a strategic mix of Data Architecture, business process, and Data Governance.

| LGD Master | User Master | Role Master | Commodity Master | Currency Master | Fee Master | Packaging |
|--|---|---|--|---|--|---|
| <ul style="list-style-type: none"> • State Master • District Master • Sub District Master • Village Master • PinCode Master | <ul style="list-style-type: none"> • Seller • Buyer • Service Providers • Manufacturer • Exchanges • Exporter • Govt. Agency | <ul style="list-style-type: none"> • Super Admin • State Admin • Market Admin • Service 1 • Service 2 • Service 2 | <ul style="list-style-type: none"> • Group • Parent • variety • Regional Name • Unit Master • HS code Master | <ul style="list-style-type: none"> • USD • RS | <ul style="list-style-type: none"> • Commodity Fee • Development Fee | <ul style="list-style-type: none"> • Loose • Bag • Crates • Boxes • Containers • Tray |



National Agriculture Market Data Strategy



Smart Caching

Having a smart caching layer enables all **master** (buyer, seller, mandi) and **transactional** related data (e.g., lot information) enables: make all business decisions with minimal joins across database tables, decouple rdbms layer dependencies to achieve faster service response times and enables implementing decoupled/stateless microservices.

Concept of smart caching is to enable below implementation options so that various applications can easily pick based on the application and business process flow requirements:

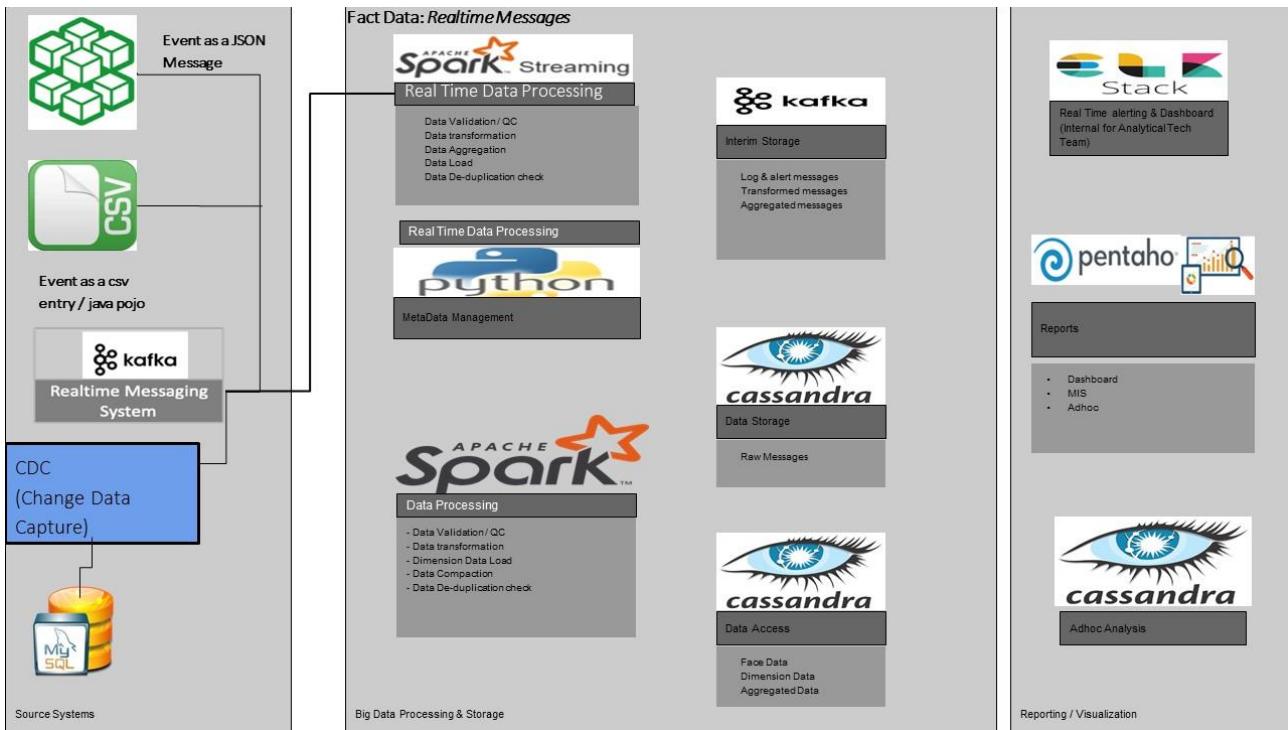
- 1) Any miss lookup to the cache should seamlessly be handled by the caching layer to fetch the required data from the respective backend source configured for that key/value store. This will ensure subsequent lookups are serviced from the cache layer.
- 2) Every cache entry should be enabled with auto expiry time to evict the entry from the cache layer. The expiry time can be best determined based on the business flows. This will ensure memory management is self-managed for optimal performance at all times.
- 3) Cache layer should be at the application cluster level so that all the applications have common access to the cache. Each application (i.e microservice) should directly access the respective cache store.
- 4) Every business application (i.e microservice) shall respond to evict the cache entry before doing any new updates to the primary persistence store (RDBMS transactional or master data tables). This will ensure stale data is effectively removed in line with the business transaction flows. Additionally, the cache entry shall be evicted at the end of business life cycle state to ensure memory is effectively managed.
- 5) Every cache entry is always backed up with a persistence store entry to ensure zero loss of data.
- 6) Cache service shall be backed up with a replica to ensure High Availability of data.

Having a robust in-memory caching layer and ensuring business services have extremely low latency access to data shall be core architectural principles to scale the applications.

Reporting & Data Analytics

eNAM Platform of Platforms requires a flexible and scalable reporting and intelligent business data analytics system to meet the demands of all stakeholders.

The proposed solution approach assumes having a streaming based solution enables that integration flexibility to an evolving system.



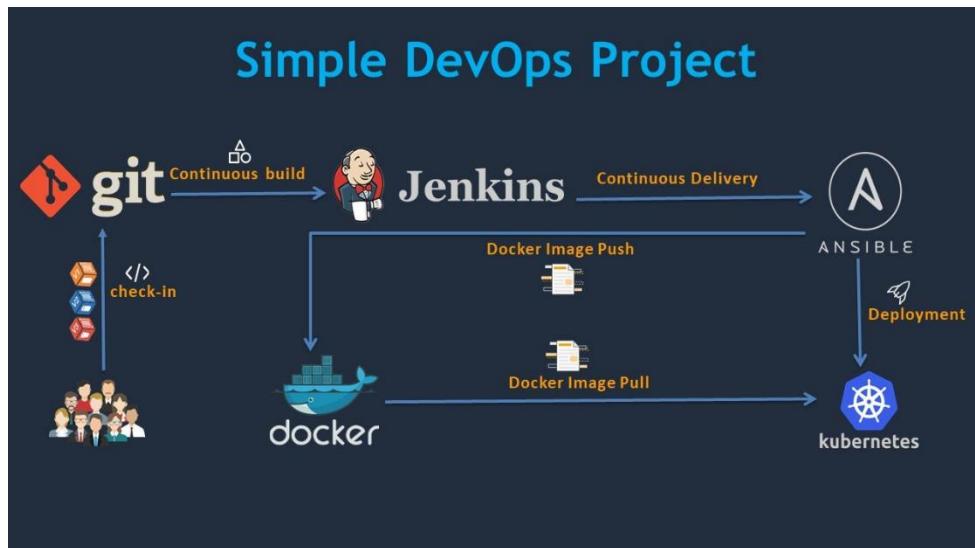
Deployment Architecture

Deployment architecture for the NAM system will implement a centralized deployment architecture that aims to achieve the following features:

Kubernetes: The proposed eNAM platform applications shall be packaged as docker images so that elasticity of Kubernetes cluster can be leveraged to host the eNAM services. The built-in capabilities to auto scale the application load between lean and peak season shall enable optimal use of the underlying hardware infrastructure.

Kubernetes enables automation adding additional services for scale, discovery of microservices between eNAM platform application suites, monitoring of the application using ELK and equivalent stacks shall ease the operational practices.

Additionally, Continuous Integration and Continuous Deployment (CICD) technology solutions like Jenkins shall enable the software delivery mechanisms to do functional and performance regression automation runs to ensure stable builds are moved from lower to higher environments.

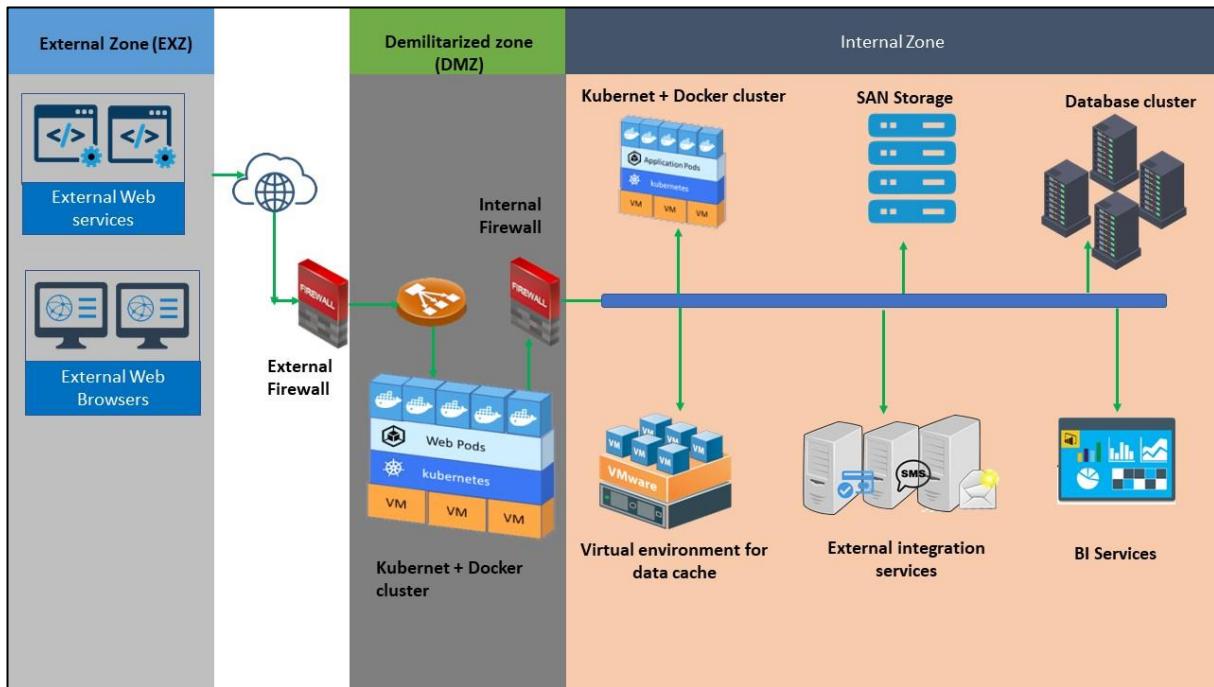


Clustering: To enable high availability and to improve overall performance of the NAM system, clustering of various nodes (application servers, directory servers, and database servers) has been envisaged as part of the deployment architecture. Multiple server instances (both hardware and software) form a cluster. Load balancing, master-slave are some of the approaches that can be implemented to achieve distribution of load across the nodes of the cluster. High availability is achieved as the application still operates if one or more nodes of a cluster are down, thereby avoiding any system downtime.

Following benefits can be achieved thru clustering:

- **Scalability:** The proposed configuration will provide upgrade capability in terms of processors, memory, and disk storage, which will be achievable with minimum downtime to processes and accessibility by users. Keeping in view the size of the user base that includes users from Central (GPL, and View only), State, APMC levels, and the number of individual users. The deployment architecture will be horizontally scalable at different node levels (Application Server, Database Server, and Directory Server). Nodes can be added to the existing deployment with minimum downtime.
- **Load Balancing:** Request load can be shared between servers thereby increasing throughput and reducing bottlenecks
- **High Availability:** The architecture will be designed to provide a highly available environment. Proposed architecture will be able to address the availability needs of over 95% availability during working hours and over 85% availability during non-working hours.
- **Fault Tolerance:** Application state is conserved even if one node in the cluster crashes.

- Reliability:** Industry standard open source software will be installed on equipment manufactured by reputed companies committed to product improvement and new product development.



- Security:** The equipment should have good security features, both physical (lockable,) and operational (security/administration systems).
- Backup:** Appropriate archiving system will be enabled as per NIC backup policy requirements. In the event of serious failure, backed up data must be restored in quickest possible time to ensure continuity.

Firewall & Load Balancer

Firewall intercepts all requests coming to the NAM system on all the ports. Only one public IP Address will be placed in the DMZ (Demilitarized zone). All requests will be routed to the DMZ IP by the firewall. Only specific ports will be opened (HTTP, HTTPS, SSH). The firewall routes requests to the respective port listeners in the system.

Load Balancer: Intercepts all incoming requests from clients. HTTP requests are forwarded to the Apache HTTP Server cluster. This approach enables high availability and scalability. Routing decision is made by the load balancer to distribute incoming requests to HTTP server instances so that the request load is shared equally among the nodes in the cluster.

-
- **Hardware Load balancer:** The F5 load balancer (implements Layer 7 to service HTTP requests) acts as a reverse proxy and distributes network traffic to the Apache HTTP Server cluster. The load balancer forwards incoming requests to one of the nodes in the cluster based on a configured algorithm that is of industry standard like the following:
 - Round robin
 - Weighted round robin
 - Least connections
 - Least response time

Load balancers can further distribute requests based on application specific data such as HTTP headers, cookies, or data within the application message itself, such as the value of a specific parameter.

Load balancer ensures reliability and availability by monitoring application health and only sends requests to servers and applications that can respond in a timely manner.

Web (HTTP) Server

HTTP Server: HTTP Server intercepts all HTTP and HTTPS requests. It will be installed in a clustered environment where we have two instances of HTTP servers each running on separate hardware machines. Apache HTTP Server will be used to implement the HTTP Daemon. HTTP Server forwards HTTP and HTTPS requests to the JBoss Application Server cluster. Clustering will be implemented for the HTTP server as below:

HTTP Server Cluster: All incoming HTTP requests are routed by the firewall to port 80. An Apache HTTP server cluster consisting of HTTP servers running on an individual machine listening on port 80 and intercepts all incoming HTTP requests. The HTTP server forwards all such requests to the Application server cluster. Here each HTTP server implements the mod_cluster load balancer which uses a communication channel to forward requests from the httpd to one of a set of application server nodes

Both Apache HTTP daemon and the JBoss cluster will need to be configured with mod_cluster configuration.

Application Server

Application server will host the NAM application developed using the Liferay and Java based open source frameworks. Multiple instances of Tomcat and JBoss application server will be integrated in a clustered environment. Each instance is installed on a separate server machine.

Application Server Cluster: The NAM platform (application) will be deployed onto a JBoss and tomcat instance as a .war (web application archive) file on each node of the cluster. Application server cluster consists of multiple JBoss and tomcat server instances each running on an individual server machine. A cluster can have any number of such Jboss and tomcat instances running on individual machines.

Load balancer architecture:

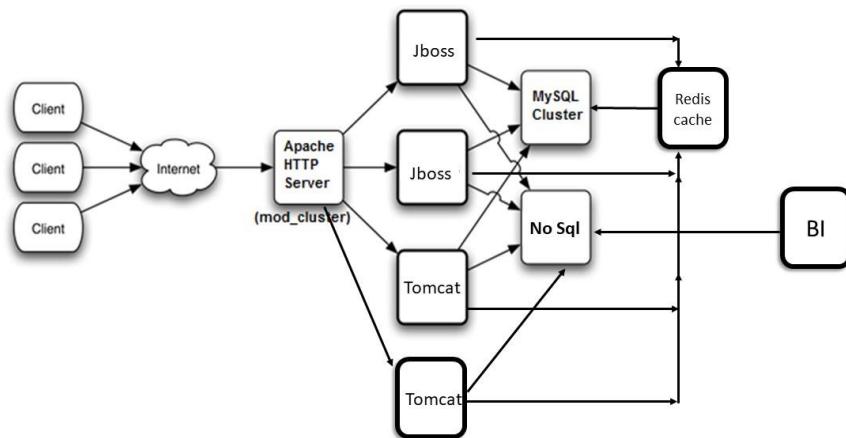


Fig: JBoss (WildFly) load balancing architecture

Above image shows the load balancing architecture of the JBoss (WildFly) application server. If any one of the JBoss AS nodes fails, the service is still available through other JBoss servers.

Clustering in JBoss:

Clustering in JBoss is implemented using a combination of JGroups and PartitionedHashMap (this is an implementation of Memcached). This combination provides the underlying communication, node replication and caching services, for JBoss AS clusters.

Memcached is a widely used cache, which can be distributed across a number of server nodes. It is a hashmap storing key/value pairs. Its main methods are set (K, V) which adds a key/value pair, get (K) which returns a value for a previously inserted key and delete (K) which removes a key/value pair. Memcached is started on a given host and listens on a given port (11211 being the default). Memcached does not provide any redundancy (e.g. via replication of its hashmap entries). When a server is stopped or crashes, all key/value pairs hosted by it are lost.

To address this limitation of Memcached, we will use an enhanced implementation of Memcached that is Partitioned HashMap. Partitioned HashMap processes know about each other and can therefore make intelligent decisions as to what to do when a cluster membership change occurs. For example, a server to be stopped can migrate all of the keys it manages to the next server.

Partitioned HashMap has a level 1 cache (L1 cache). This allows for caching of data near to where it is really needed. For example, if we have servers A, B, C, D and E and a client adds a (to be heavily accessed) news article to C, then Memcached would always redirect every single request for the article to C. So, a client accessing D would always trigger a GET request from D to C and then return the article. JGroups caches the article in D's L1 cache on the first access, so all other clients accessing the article from D would get the cached article, and we can avoid a round trip to C. Note that each entry has an expiration time, which will cause the entry to be removed from the L1 cache on expiry, and the next access would have to fetch it again from C and place it in D's L1 cache. The expiration time is defined by the submitter of the article.

All management information and operations are exposed via JMX

Typical use case:

Clients access a web application via Apache and forward HTTP requests for dynamic content via mod-cluster to one of the nodes in the cluster. This is usually a servlet/JSP/JSF container such as JBoss, and the servlet then handles the request and returns an HTTP response.

The servlet has to access the DB, and in a typical scenario for webapps, 10% of the requests to the DB are writes and 90% are reads.

Because access to the DB is slow (due to the round trip to the DB server, plus the disk access), and because many clients might access the DB at the same time, therefore creating a bottleneck, the servlet uses Partitioned HashMap to cache the result of its access to the DB.

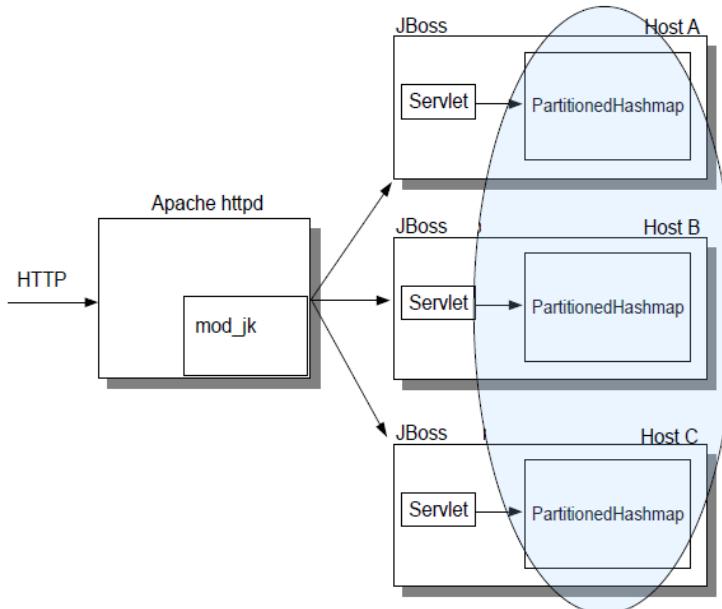
This can be done as below:

Read(X)

- Read from the cache. If X was found in the cache, return it and don't access the DB
- If not, read from the DB and place the result into the cache
- On the next read for X, it will be found in the cache (if not expired yet)

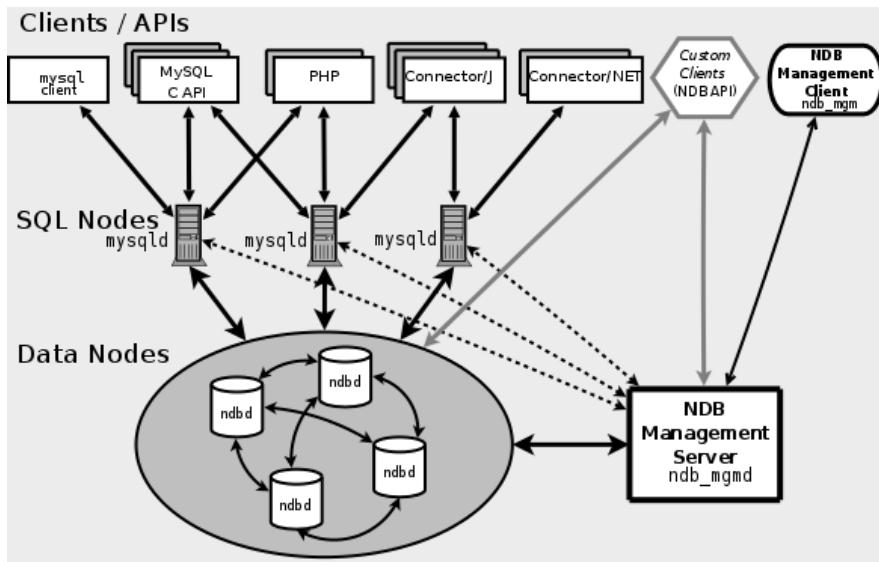
Write(X)

- Write X to the DB
- Insert X into the cache



Database Server

Database (RDBMS): Relational data source is implemented using MySQL Cluster CGE (Carrier Grade Edition) that will host the live, production database. Standby instances will be used as a backup in case there is a failure of the Primary instance. Standby database instances will also be implemented using the MySQL Cluster at the DR site. This ensures a production-ready standby instance in case of a failure of the primary node. Clustering at the database level will be implemented as described below:

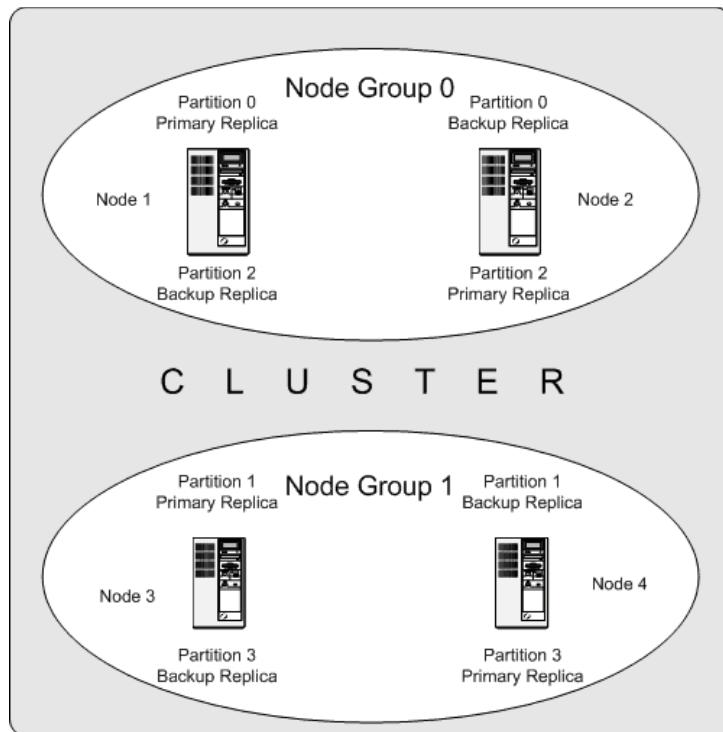


MySQL Cluster Components

Following are the components of a MySQL Cluster:

- (Data) Node. Stores a copy of the partition assigned to the node group of which the node is a member. Each data node is located on a separate computer.
- Node Group. A node group consists of one or more nodes, and stores partitions, or sets of replicas. All node groups in a MySQL Cluster must have the same number of data nodes.
- Partition. This is a portion of the data stored by the cluster. There are as many cluster partitions as nodes participating in the cluster. Each node is responsible for keeping at least one replica assigned to it.
- Replica. This is a copy of a cluster partition. Each node in a node group stores a replica. Also sometimes known as a partition replica. The number of replicas is equal to the number of nodes per node group. A replica belongs entirely to a single node. A node can (and usually does) store several replicas.

The following diagram illustrates a MySQL Cluster with four data nodes, arranged in two node groups of two nodes each. Nodes 1 and 2 belong to node group 0, and nodes 3 and 4 belong to node group 1.



The data stored by the cluster is divided into four partitions, numbered 0, 1, 2, and 3. Each partition is stored—in multiple copies—on the same node group. Partitions are stored on alternate node groups:

- **Partition 0 is stored on node group 0. a primary replica (primary copy) is stored on node 1, and a backup replica (backup copy of the partition) is stored on node 2.**
- **Partition 1 is stored on the other node group (node group 1). This partition's primary replica is on node 3, and its backup replica is on node 4.**
- **Partition 2 is stored on node group 0. However, the placing of its two replicas is reversed from that of Partition 0. For Partition 2, the primary replica is stored on node 2, and the backup on node 1.**
- **Partition 3 is stored on node group 1, and the placement of its two replicas is reversed from those of partition 1. That is, its primary replica is located on node 4, with the backup on node 3.**

Following are the features provided by MySQL cluster that are in-line with the data requirements of the NAM application.

Performance Features:

Auto-Sharding: Database is automatically and transparently partitioned across nodes, allowing scale-out of read and write queries, without requiring changes to the application.

Multi-Master Replication: Each data node can accept write operations. Coupled with auto-sharding, this gives very high write scalability.

Real-Time Responsiveness: Low latency with in-memory tables and indexes, asynchronous checkpointing to disk & binding of threads to CPUs

Availability Features:

ACID Compliant: Transactional MySQL Cluster provides full ACID (atomic, consistent, isolated, durable) transaction support.

Foreign Key Constraints: MySQL Cluster automatically enforces referential integrity between tables.

Distributed, Shared Nothing Architecture: Each node in the cluster is redundant and can be located on separate hosts to ensure continuous availability in the event of a process, hardware or network failure.

No Single Point of Failure: Each node has its own disk and memory, so the risk of a failure caused by shared components such as storage, is eliminated.

Synchronous Replication: Data within each data node is synchronously replicated to at least one other data node. If a data node fails, then there is always at least one other data node storing the same information.

Automatic Sub-Second Failover: MySQL Cluster's heart beating mechanism instantly detects any failures and automatically fails over, typically within one second, to other nodes in the cluster, without interrupting service to clients.

Self-Healing Recovery: Failed nodes are able to self-heal by automatically restarting and resynchronizing with other nodes before re-joining the cluster, with complete application transparency

Geographic Replication: Replicates a cluster from one data center to another, enabling Disaster Recovery and reducing the effects of network latency. Each cluster can accept write operations with internal conflict handling to ensure consistency between clusters

Multi-Site Clustering: Data nodes can be split across data centers allowing synchronous replication between sites with automatic failover in the event of a node failure.

Management, Monitoring Features:

MySQL Cluster Manager: MySQL Cluster Manager simplifies the creation and management of the MySQL Cluster database by automating common management tasks.

MySQL Enterprise Monitor: Provides at-a-glance views of the health of the cluster, alerting potential problems before they impact the system

Mail Server

- NAM application will be integrated with an SMTP based mail server used to send emails to various stakeholders accessing the NAM platform. Postfix is a free and open-source mail transfer agent (MTA) that routes and delivers email. Postfix mail server is highly compatible with the Ubuntu Linux OS which is the proposed underlying operating system for the software stack used to run the NAM platform. Following are the features of the Postfix mail server
 - **Wide Acceptance:** Postfix is an industry standard mail server that is widely used across industries, educational, and private institutions
 - **Performance:** Postfix is a high-performance email server. A million different messages per day can easily be disseminated by Postfix. Postfix implements reduced process creation overhead, reduced file system overhead, without compromising reliability.
 - **Compatibility:** Postfix is designed to be mail-compatible for easy migration. Postfix also attempts to be easy to administer
 - **Safety and robustness:** Postfix is designed to behave rationally under stress. When the local system runs out of disk space or memory, the Postfix software backs off, instead of making the problem worse. By design, no Postfix program keeps growing as the number of messages increases. Postfix is designed to stay in control.
 - **Flexibility:** Postfix is built from over a dozen little programs that each perform only one specific task: receive a message via SMTP, deliver a message via SMTP, deliver a

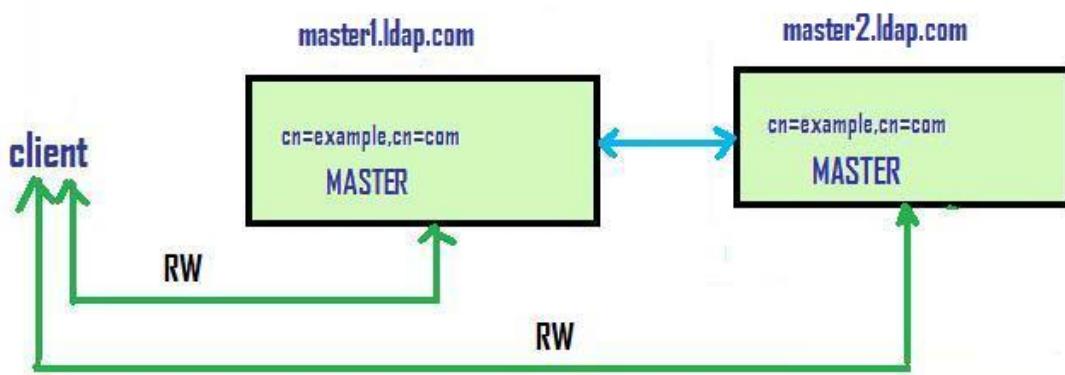
message locally, rewrite an address, and so on. Sites with specific requirements can replace one or more little programs by alternative versions

- **Security:** Postfix uses multiple layers of defense to protect the local system against intruders. There is no direct path from the network to the security-sensitive local delivery programs - an intruder has to break through several other programs first. Postfix does not even trust the contents of its own queue files, or the contents of its own IPC messages.

Directory Server

Directory server will be implemented using OpenLDAP that is open source implementation of the LDAP protocol. OpenLDAP will be used for authentication, authorization and enables implementation of a Single Sign On environment in the NAM platform. To ensure high availability and failover, we will setup the OpenLDAP directory server in a clustered environment with each OpenLDAP instance running on a dedicated machine. Ubuntu Linux will be the underlying operating system.

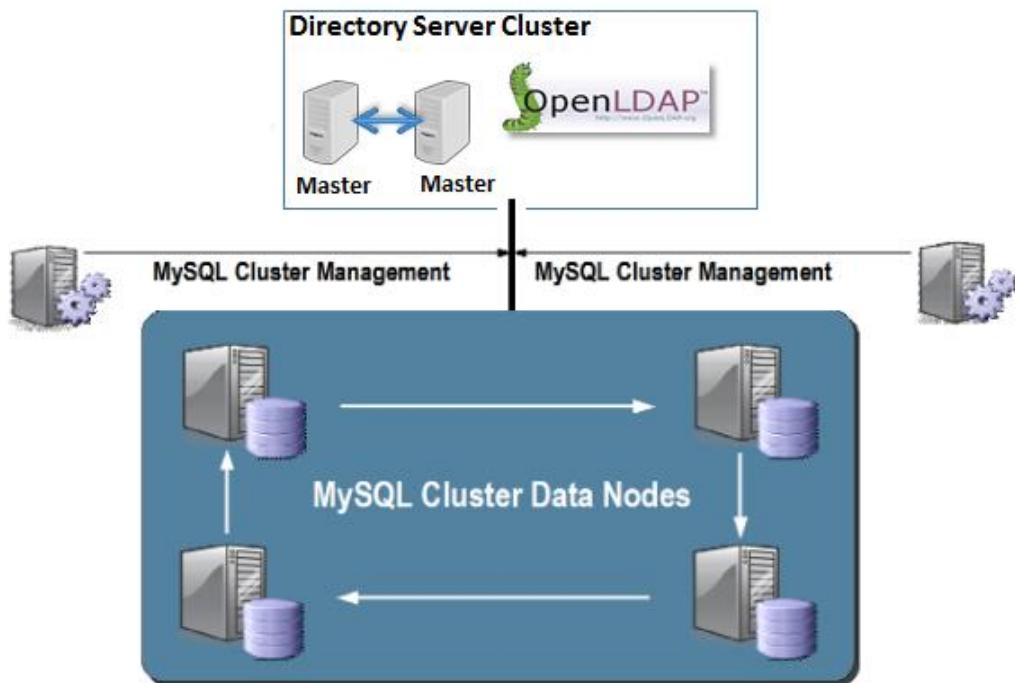
OpenLDAP Server will implement directory services for the NAM application. A clustered environment will be implemented where there will be two instances of OpenLDAP (master-master configuration) each running on an individual machine with Ubuntu Server as the underlying OS. In master-master mode, any update on one OpenLDAP instance will automatically be propagated to another instance, and both instances are always in sync.



LDAP replication feature allows LDAP to be backed up/synched to other LDAP server. Replication occurs periodically at what is called replication cycle time.

As an add-on to the above OpenLDAP deployment architecture, we will integrate the MySQL cluster with the OpenLDAP cluster, thereby ensuring even higher performance, scalability and availability.

MySQL Cluster can be used as a data store for the OpenLDAP directory responsible for authentication and authorization of users. Integrating OpenLDAP with MySQL Cluster provides high rates of directory lookups and updates.



Management Server

A network monitoring and management server will be implemented to maintain the entire network infrastructure of the NAM system. Zabbix will be used for this purpose. **Zabbix** is a free and open-source enterprise grade network monitoring and network management platform. Following are the features of the Zabbix software:

Event Management and Notifications:

Zabbix is based around a "publish and subscribe" message bus. Processes within the software can publish events, and other processes can subscribe to them. In addition, Zabbix can receive events in the form of SNMP Traps, Syslog messages, TL/1 events or custom messages sent as XML to port 5817. Events can be configured to generate alarms. Alarms can also generate events of their own,

such as when an alarm is escalated in severity. Alarms clear from the system over time, unlike events that persist as long as desired.

The Alarm subsystem can also integrate with a variety of trouble ticketing systems, such as Request Tracker, OTRS, Jira, Quickbase and Concurseive.

The software also contains an Event Translator where incoming events can be augmented with additional data and turned into new events.

Events can generate notifications via e-mail, SMS, XMPP and custom notification methods.

Discovery and Provisioning:

Zabbix contains an advanced provisioning system for adding devices to the management system. This process can occur automatically by submitting a list or range of IP addresses to the system (both IPv4 and IPv6). Devices can also be expressly added to the system, as well as a combination of the two.

The underlying technology for this configuration is XML, so users can either use the web-based user interface or they can automate the process by scripting the creation of the XML configuration files.

The provisioning process is asynchronous for scalability, and has been shown to provision networks of more than 50,000 discrete devices as well as networks of single devices with over 200,000 virtual interfaces, each.

Service Monitoring:

The service assurance features of Zabbix allow for the availability of network-based services to be determined. Outage information is stored in the database and can be used to generate availability reports.

In addition to being able to monitor network services from the point of view of the Zabbix server, remote pollers can be deployed to measure availability from distant locations.

Data Collection:

Performance data collection exists in Zabbix for a number of network protocols including SNMP, HTTP, JMX, WMI, XMP, XML, NSClient, and JDBC. Data can be collected, stored, graphed as well as checked against thresholds.

Backup Server

The NAM platform is deployed in a clustered environment consisting of Application Server, BI Server , redis cache and Database Clusters. All the Server backups will be pushed to NIC backup servers as per NIC Policies

Backup of the MySQL cluster can be performed using the MySQL Cluster Management Client.

The cluster needs to be configured for backup setting the configuration parameters necessary for backup (Backup Data Buffer Size, Backup Log Buffer Size, Backup Memory, Backup Write Size, Backup Max Write Size)

All the Backup Process will be planned in Non Business hours where Production environment performance will not be disturbed

Storage Area Network (SAN) & Tape Library

Proposed storage solution for the NAM deployment architecture would be SAN storage. SAN (storage area network) is a high-speed network of storage devices that also connects those storage devices with servers. It provides block-level storage that can be accessed by the applications running on any networked servers. SAN storage devices can include tape libraries and disk-based devices, like RAID hardware.

SAN offers better flexibility, availability and performance than direct-attached storage (DAS). Because a SAN removes storage from the servers and consolidates it in a place where it can be accessed by any application, it tends to improve storage utilization. Storage utilization improvement allows organizations to defer purchases of additional storage hardware, which saves money and requires less space in the data center. SANs often provide better performance than DAS. Also, because SANs usually offer multiple connections to and from the data center's servers, they also improve availability. In addition, separating the storage from the servers frees up the computing resources on the servers for other tasks not related to storage.

SANs are particularly helpful in backup and disaster recovery settings. Within a SAN, data can be transferred from one storage device to another without interacting with a server. This speeds up the backup process and eliminates the need to use server CPU cycles for backup. Also, many SANs utilize Fiber Channel technology or other networking protocols that allow the networks to span longer distances geographically. That makes it more feasible for companies to keep their backup data in remote locations.

Firewall & Intrusion Prevention System in HA (High Availability) mode

The NAM system will implement a Host-Based Intrusion Detection system to monitor incoming requests to the NAM platform. HIDS look for unusual activity by examining logs created by the operating system, looking for changes made to key system files, tracking installed software, and examining the network connections a host makes. We will implement OSSEC that is an open source HIDS and can be easily installed on the proposed underlying OS that is Ubuntu Linux. OSSEC is a full platform to monitor and control your systems. It combines the aspects of HIDS, log monitoring and SIM/SIEM together in a simple, powerful and open source solution. OSSEC has a powerful correlation and analysis engine that can analyze log files. File integrity checking, centralized policy enforcement, rootkit detection, real-time alerting and active response system.

The following are the advantages of using HIPS:

- System activity will be monitored continuously, and administrators will be notified upon any suspicious activity
- Suspicious executable or processes will be blocked from running by default
- Allows system administrators to determine which traffic and applications to permit / block
- Protect Files and Computer Settings of OS
- Helps keep the critical applications up and running

NAM Usage Considerations

Following table shows the maximum expected user base and peak level activity on the NAM platform. Keeping below statistics in view, NAM systems will be designed to support double the number of expected users. In addition, the NAM architecture is designed to be robust and highly scalable at software and hardware levels. Hardware nodes can be added to the system on a need basis.

Exception & Error handling

Exception & Error handling is a well-known mechanism for introducing forward error recovery in software systems. Many important object-oriented programming languages, such as Java, C++, and C# have incorporated this mechanism. In traditional software development, a large part of the code of a reliable software system is dedicated to detection and handling of exceptions. Exception handling is a very popular technique for incorporating fault tolerance into software systems. It

allows developers to structure the redundant code that is added to deal with the exceptional conditions that may occur, separating it from the code responsible for the normal operating flow.

Errors are broadly classified into two types:

- **Recoverable Errors** - Recoverable errors are the errors that client programs can recover from to take appropriate alternate execution paths. Such errors are the result of failure to meet a particular business rule
- **Non-Recoverable errors** - These are the errors that client programs cannot recover from. These kind of errors are the result of some unexpected errors during runtime such as programming errors such as null pointers, resources not available etc.

Analyzing through the business artifact application modules provides many opportunities to discover business errors associated with services. To identify some of them we will follow the below process of the identification of the error.

- **Business error scenarios** – Detailed description of condition that flags the business operation as invalid.
- **Error text** – Provides a brief description of the business error that service consumers will receive for a business error.
- **Error code** – Code that can be looked up for additional info about the error
- **Suggestions** – Feedback to the service consumer such as examples of valid inputs, or displaying specific information related to the error etc.
- **Service area** - Identifies a service area that receives all notifications related to service system errors.
- **Transform provider error codes** - It is possible that different service providers return service errors using different semantics. The range could involve anywhere from popular SOAP faults to very proprietary structures. Appropriate transformation rules can be applied here so that re-usable enterprise services return errors in a more consistent manner that enterprise applications could easily parse and implement appropriate handlers
- **Filter sensitive information** – When internal service components throw fatal errors, the stack trace often contains sensitive information such as protocols used, server ips, etc. Appropriate filtering rules are to be established in this layer to filter any sensitive information in the stack trace. This strategy becomes all the more important when service responses are to be given out over the trusted networks.
- **Trapping application errors** - Any kind of technical errors experienced by the service components such as resource unavailability or some runtime exceptions etc. are to be

transformed into simple technical error messages. If native components did not log these errors, then mediation layers could pass all the stack trace info into logging but only return a generic text message back to the service consumer

Example of Error Handling API Responses

1 //when invalid orgId posted related to WDRA

```
{  
  "status": "F",  
  "errorCode": "Err-4007",  
  "errorMsg": "Err-4007: Invalid Or Missing Org Id[must be 2]"  
}
```

2 //when invalid oprId posted related to warehouse

```
{  
  "status": "F",  
  "errorCode": "Err-4008",  
  "errorMsg": " Invalid Or Missing Warehouse/Opr Id"  
}
```

3 //when the user info is incorrect

```
{  
  "status": "F",  
  "errorMsg": " Invalid Credentials"  
}
```

4 //when the depositorSeller is posted with unset(empty) attributes

```
{  
  "status": "F",  
  "errorMsg": "Failed To Post Lot",  
  "processStatusList": [  
    {  
      "status": "F",  
      "errorMsg": " Missing Seller/Depositor Reg Number [sellerRegNo]\n  
Err-4010: Missing Seller/Depositor Full Name [sellerFullName]\n  
Err-4013: Invalid Or Missing Seller's Gender\n  
Err-4014: Missing Seller's Address [sellerAddress1]\n  
Err-4033: Invalid data , must provide value [sellerBankAccNo]\n  
Err-4033: Invalid data , must provide value [sellerBankName]\n  
Err-4033: Invalid data , must provide value [sellerBankIFSC]\n  
Err-4016: Invalid Or Missing State Id [sellerStateId]\n  
Err-4017: Invalid Or Missing District Id [sellerDistrictId]\n  
Err-4035: Invalid Or Missing Tahsil Id [sellerTahsillId]\n  
Err-4018: Invalid Or Missing Village/City Id [sellerVillageCityId]\n  
Err-4019: Missing Seller's Contact Number [sellerContactNo]\n  
Err-4015: Missing Seller Address Pin Code [sellerPinCode]\n  
Err-4011: Invalid Seller's Relation Type Id [sellerRelId]\n  
Err-4012: Missing Seller's Relation Member Name [sellerRelMemName]\n"
```

```

    }
]

}

```

Example Error Code List

| API Code | Details | Error Code |
|-----------------|---|-------------------|
| 1 | General (unknown) error. | Err-500 |
| 2 | Customer account not found (possible bad subdomain) | Err-401 |
| 3 | Customer account inactive | Err-401 |
| 4 | Customer account suspended | Err-503 |
| 5 | Customer account banned | Err-418 |
| 6 | Paid customer account inactive due to non-payment | Err-402 |
| 7 | User not found | Err-401 |
| 8 | User not active | Err-401 |
| 9 | Invalid auth (bad username/password) | Err-401 |
| 10 | Permissions error. User/Company does not have access to this information. | Err-403 |
| 11 | Maximum number of daily API requests exceeded | Err-400 |
| 12 | Requests too fast | Err-400 |
| 13 | Resource type requested does not exist (e.g. if you requested 'miletson' instead of 'milestone'). | Err-400 |
| 14 | Resource requested does not exist (e.g. if you wanted task 25 and it doesn't exist) | Err-404 |
| 15 | Action not available for resource (e.g. if they wanted to perform task 'reopen'). | Err-400 |
| 16 | HTTP method not available (e.g. if you try to call DELETE client without the id). | Err-400 |
| 17 | Parameter not recognized (e.g. when they try to filter on 'statusid' when it's not possible). | Err-400 |
| 18 | Validation error (e.g. missing required field/parameter, or bad field/parameter). | Err-400 |

| | | |
|----|--|----------|
| 19 | Database Error (something went wrong on our end) | Err-500 |
| 20 | Service offline. (system down, try again later) | Err-502 |
| 21 | Missing Seller/Depositor Reg Number [sellerRegNo] | Err-4009 |
| 22 | Missing Seller/Depositor Full Name [sellerFullName] | Err-4010 |
| 23 | Invalid Or Missing Seller's Gender | Err-4013 |
| 24 | Missing Seller's Address [sellerAddress1] | Err-4014 |
| 25 | Invalid data , must provide value [sellerBankAccNo] | Err-4033 |
| 26 | Invalid data , must provide value [sellerBankName] | Err-4033 |
| 27 | Invalid data , must provide value [sellerBankIFSC] | Err-4033 |
| 28 | Invalid Or Missing State Id [sellerStateId] | Err-4016 |
| 29 | Invalid Or Missing District Id [sellerDistrictId] | Err-4017 |
| 30 | Invalid Or Missing Tahsil Id [sellerTahsillId] | Err-4035 |
| 31 | Invalid Or Missing Village/City Id [sellerVillageCityId] | Err-4018 |
| 32 | Missing Seller's Contact Number [sellerContactNo] | Err-4019 |
| 33 | Missing Seller Address Pin Code [sellerPinCode] | Err-4015 |
| 34 | Invalid Seller's Relation Type Id [sellerRelId] | Err-4011 |
| 35 | Missing Seller's Relation Member Name [sellerRelMemName] | Err-4012 |

1.3.3 Integration Architecture

Overview

In this proposed eNAM Platform of Platforms, the principle of integration is one of the core design principles. The following integrations are detailed out in this design:

- 1) Services/Systems/Users Integration
- 2) Hardware Integration

Systems/Services/Users Integration

The vision of eNAM Platform of Platforms is to enable easy integration with other external systems, services, products, and platforms.

This integration is enabled with the core architecture/design principles of keeping the eNAM Platform to:

- 1) Modular using domain services. The modular micro services enable sharing of the required information easily.
- 2) Capability to integrate with synchronous and asynchronous interfaces using event driven micro services patterns. Having this pattern gives capabilities to reconcile and share information in an efficient way between systems.
- 3) Master data management
- 4) Capability to enable integration for various interactions with external systems, services, products, platforms and users requires different authentication and authorization models. The proposed security access framework will have password, license keys, secret keys, api keys, whitelisting of trusted networks etc.,

Use of custom workflow to enable easy onboarding of external systems/services/users, robust monitoring and reconciliation processes shall be key success factors for the evolution of eNAM platform.

Having a standard APIs with versioning shall enable forward integration with new evolving features and technologies for this platform.

Integration Architecture description

Following diagram depicts the integration architecture of the NAM platform

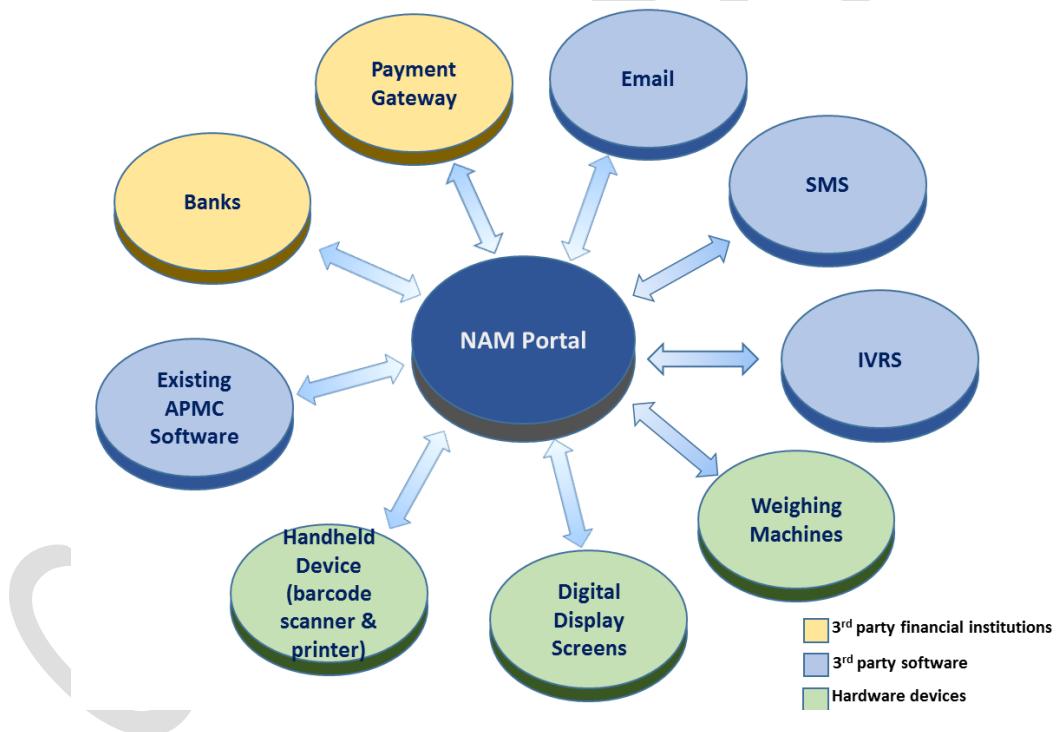


Fig: External Systems Integration with NAM platform

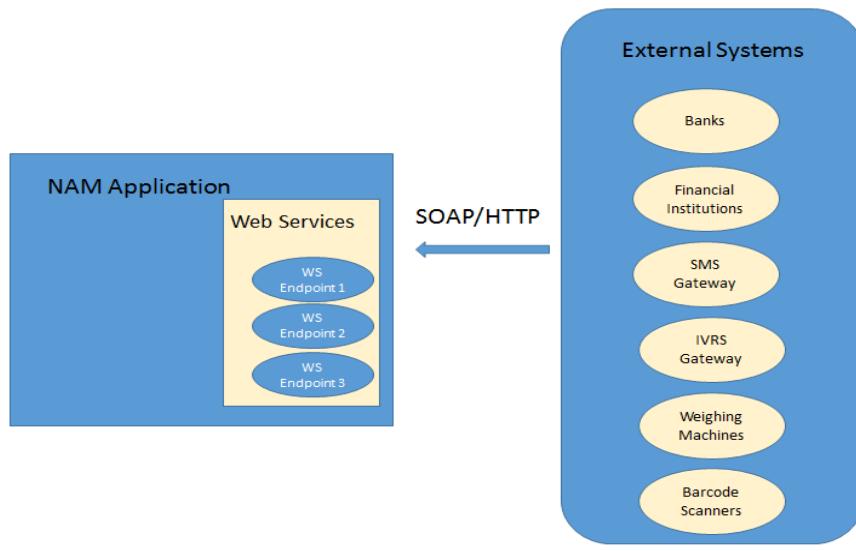
NAM system will be capable of integrating with the following external systems as depicted in the above diagram:

3rd party Financial Systems

-
- **Banks:** Using web services provided by the respective financial institutions like Banks, NAM application will implement web-service clients to consume the web services. Based on the requirement, NAM application will be capable of implementing both SOAP/XML and RestFul web service clients. For SOAP based web services, the Bank is supposed to provide a WSDL document based on which the NAM system will web service clients.
 - **Payment Gateway:** NAM platform will integrate with a 3rd party payment gateway. Gateway will be chosen to accommodate different payment modes by farmers (credit cards, debit cards, kisan credit card, NEFT). Payment can be made online by buyers for e-trading on the NAM platform.

3rd party Software

- **Email:** NAM application will integrate with an SMPT email server. Email Server will be implemented using PostFix email server.
- **IVRS:** NAM application will integrate with a 3rd party IVRS gateway and implement the API provided by the IVRS vendor to implement the Grievance and Redressal Management
- **SMS:** NAM application will integrate with a 3rd party SMS provider to implement SMS messaging. SMS messages will be sent to registered users' mobile phones for various activities like alerts, notification messages, authentication purpose, SMS auctioning will also be implemented where buyers can participate in an auction by sending an SMS message. When an auction completes, results will be sent to as SMS to buyers that participate in an auction.
- **Barcode Scanners:** NAM application will implement web services that can be invoked by a Barcode scanner. This can be used to collect entry and exit information of a farmer and the farmer's produce to a Mandi or a warehouse. Barcode scanners are expected to have the ability to implement web service client to communicate with the web service of the NAM system.
- **Weighing Machines:** Some electronic weighing machines will be able to send the weight details to the NAM application browsed thru a mobile device which integrates with the NAM system by using web services. For such devices, web services will be provided with well-defined methods and input/output parameters to send weight information for a particular lot belonging to a registered farmer.



Hardware Integration

Integration with external hardware modules is the key to enable enriched user experience of the eNAM platform on the field. The platform and business processes demand vendor neutral integration to encourage a vibrant ecosystem.

The hardware components like weighment, assaying, printers, scanners, geo location tracking devices, etc., are a few sample integrations that would require connectivity using USB, Serial COM, Bluetooth, Wifi, Wired network, QR/BarCode scanning interfaces.

Additionally, these integrations should enable various host systems where the integration can happen. For e.g, Embedding Linux OS (POS terminals), Linux/Window systems and Android devices.

To enable this vibrant ecosystem to contribute to the eNAM platform at national scale level, requires smart integration strategies that are scalable and address all combinations of Host Platform vs Connectivity described above.

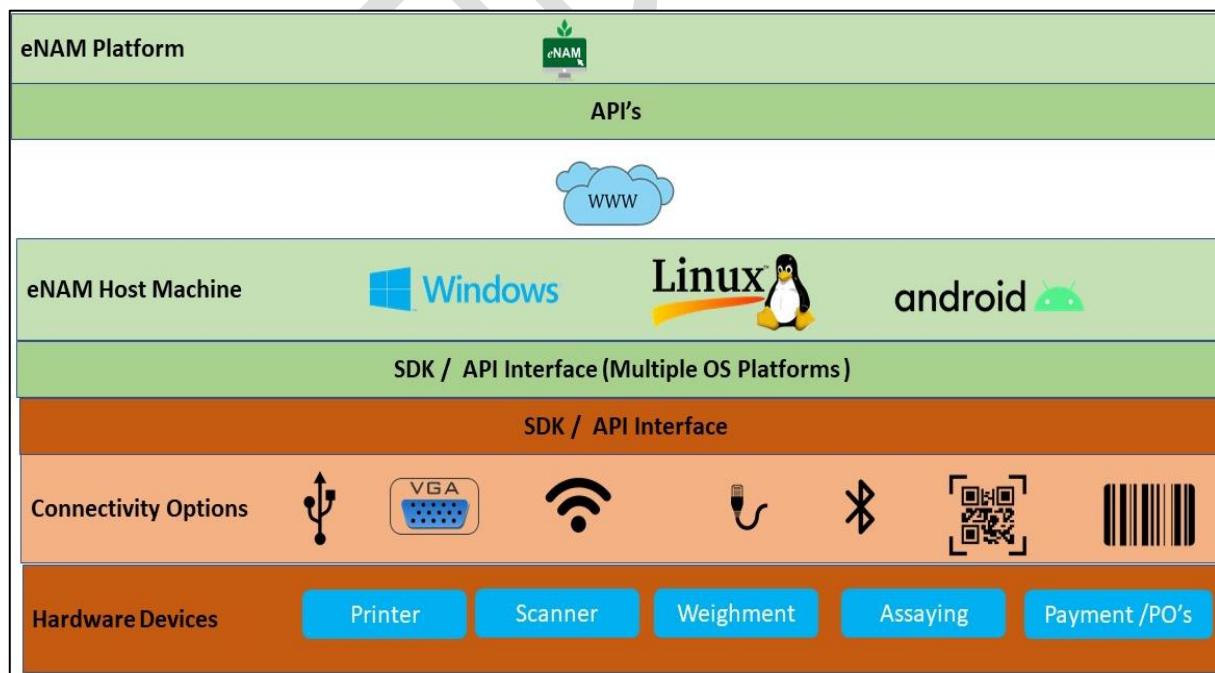
The key design principles proposed to scale the hardware integration are:

- 1) Creation of SDK/API interface to support various host platform

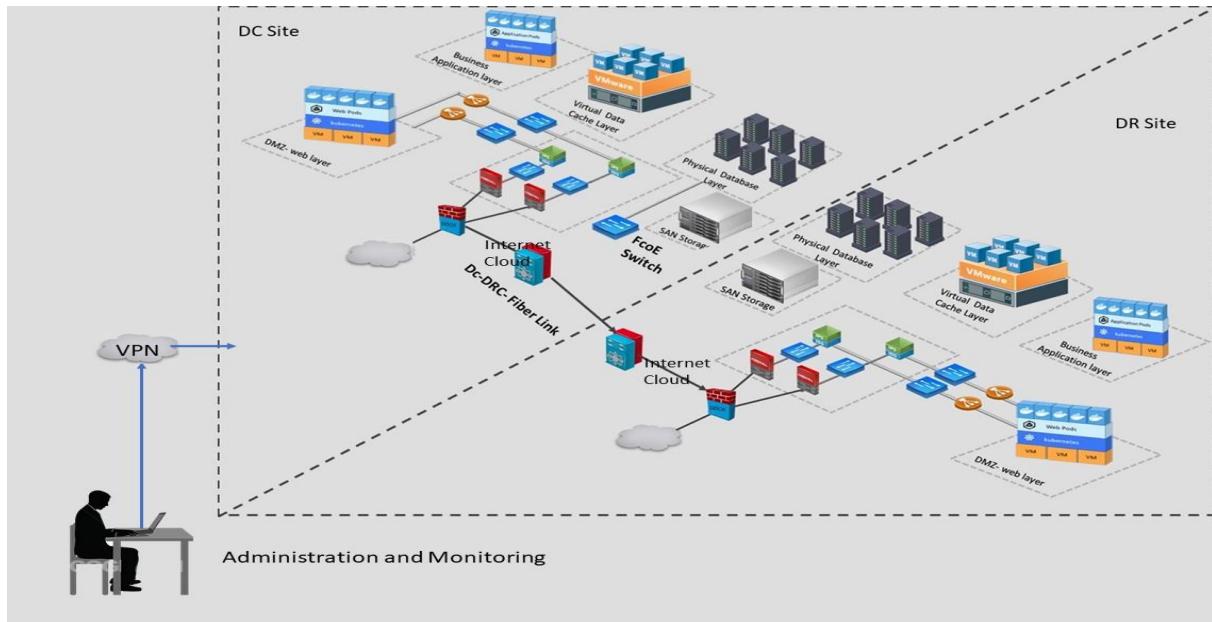
- 2) eNAM team shall define interface for each of the core domain services that shall give one time integration to the eNAM applications
- 3) The integration has to happen at domain level rather than underlying hardware technology. For e.g., print/scan shall define interface related to print/scan, weighment interface shall define the interface to support various weighment systems,
- 4) Signed QR code can also be an key integration to easily read and get the data from the authorized systems for e.g., all approved assaying systems can enable signed QR code with details for eNAM application (mobile app) to easily read and transfer the details as part of the business transaction API.
- 5) Underlying hardware connectivity and operating systems etc are abstracted with the SDK/API interface layer as plug n play. Domain services should enable getting the required information, similar to user operating systems connecting various i/o devices like usb, wifi, bluetooth keyboards/printers!

The above solution assumes, eNAM platform shall enable various to cater to both:

- 1) Assisted user use cases, like eNAM Mandi, eNAM Virtual
- 2) Self-service user use cases, i.e., eNAM virtual, external systems like warehouses, FPOs etc.,



Network Architecture Recommendations



DC - DRC Routers

- Core Routers each at DC & DR with the required components/modules, considering redundancy and load balancing are recommended
- FGPL will examine the requirement of a VPN Router with redundancy for implementing IPsec3DES implementation if the core routers do not support such requirements.
- FGPL will provide any other routers required at DC / DRC as per the proposed architecture.
- Call Manager / Gatekeeper router needs to be included if IP phones are being proposed for branches having MPLS VPN.
- The DC – DRC routers will be provided by FGPL and the price along with support charges will be quoted.

DC-DRC Switches

- Core Switches each at DC & DRC with the required components/modules considering redundancy and load balancing are recommended. Each of the switch should have a minimum of 48 100/1000 ports.
- The NOC/Work area switch should have a minimum of 24 100/1000 ports.
- The DC – DRC switches will be provided by the FGPL.

DC-DRC Firewall, IDS/IPS

-
- Necessary IDS/ IPS should be provided for monitoring the traffic of all the VLANs at DC & DRC.
 - Necessary devices for log capture from Servers, network equipment and other devices needs to be provisioned.
 - The DC – DRC security appliances will be provided by FGPL.

Network Equipment level redundancy

- Real-time redundancy at the network equipment level in DC, and DRC would be needed so that there will not be any single point of failure.

LAN Components and Cabling

- Structured Cabling needs to be done at DC & DRC. CAT 06, 4 pair UTP cables supporting gigabit performance will be needed
- Cabling at DC and DRC should conform to level 3 international standards
- All Fiber termination on the cable as well as panel has to be of the SC - style and conform to the EIA/ TIA 568A or the latest standards
- The cabling should include all the materials and related civil work including cable pulling, UTP and Fibre termination and manual labour for fixing the racks and panels
- Horizontal and vertical cable managers should also be provided to enable the implementation of aesthetic dressing of the horizontal and backbone cables

Designing IP Schema.

- FGPL must design suitable IP Schema for the entire Wide Area Network including DC / DRC, branches and other offices with a provision to interface with sponsors wherever needed. The NSP must maintain the IP Schema with required modifications from time to time within the scope of the project.

Sub-Networks

The proposed architecture of the Data Centre (DC) and Disaster Recovery Centre (DRC) is divided into different sub-networks. These networks must be separated from other networks through switches and firewalls. The logical separations of these sub-networks are to be done using VLANs.

Network Security Management

-
- The NSP should implement a DNS server so that the URL can be used instead of accessing web a server using IP address directly. The required Hardware and Software for the DNS server at DC / DRC needs to be provisioned.
 - Secure network resources against unauthorized access from internal or external sources should be provided by FGPL
 - Mechanism for tracking the security incidents and identifying patterns if any should be provided by FGPL. The tracking mechanism should, at a minimum, track the number of security incident occurrences resulting in a user losing data, loss of data integrity, denial of service, loss of confidentiality or any incident that renders the user unproductive for a period of time.
 - Security logs and audit information should be provided according to FGPL's information systems security policies and procedures.

1.3.4 Security Architecture

Security features will be implemented, and standards will be followed in all aspects of the NAM system. Design, development, and implementation of the NAM system will adhere to the latest security approaches listed below.

User Level Security: Restricted areas of the application will only be accessible through pre-defined user access rights. Following aspects of user level security will be implemented:

- User authentication thru Single Sign On
- Role based access to services, transactions, and data
- Digital Certificates when there will be a need to transfer documents between NAM and financial institutions like banks

Application Level Security: Role based access, encryption of user credentials and storing of user credentials for external and internal users in separate repositories will be implemented.

Database level Security: Database level security will be implemented by following the approach listed below

1. Securing the database server: The application server and the database server reside on different machines; this will provide improved isolation to the database and minimize the accessibility to external applications or users. Only the MySQL port 3306 will be open thus preventing external access thru any other ports. Other services running on the same machine as the database will be granted the lowest possible permission that will still allow the service to operate.

Server's physical location should be safe enough to prevent theft, flooding, or harm by wild animals. Some operating system hardening procedures will be implemented, such as the following:

- operating system's firewall configuration
- Consider the safety of your server's physical location
- Disabling unnecessary services

2. Disable or restrict remote access: Preferred mode of access should be directly into the local machine. If remote access is used, only defined hosts will be allowed access to the server. This is done through TCP wrappers or iptables. In addition, the following restrictive grant syntax should be considered:

```
mysql> GRANT SELECT, INSERT ON mydb.* TO 'someuser'@'somehost'.
```

3. Disabling the use of LOCAL INFILE

Disabling the use of the "*LOAD DATA LOCAL INFILE*" command will help to prevent unauthorized reading from local files. This can prevent SQL Injection vulnerabilities in applications.

4. Change root username and password: The default administrator username on the MySQL server is "**root**". Hackers often attempt to gain access to its permissions. "**root**" should be renamed to something else and provided with a long, complex alphanumeric password.

5. The "test" database should be removed: MySQL comes with a "test" database intended as a test space. It can be accessed by the anonymous user and is therefore used by numerous attacks. This database will be removed.

6. Remove Anonymous and obsolete accounts: The MySQL database comes with some anonymous users with blank passwords. As a result, anyone can connect to the database. All such accounts will be removed.

7. Lower system privileges increase database security with Role Based Access Control: Permissions given to various parties will be lowered. To protect the database, it will be made sure that the file directory in which the MySQL database is actually stored is owned by the user "mysql" and the group "mysql".

```
shell>ls -l /var/lib/mysql
```

The mysql binaries, which reside under the /usr/bin/ directory, should be owned by "root" or the specific system "mysql" user. Other users should not have written access to these files.

8. Lower database privileges: Only administrator accounts need to be granted the SUPER / PROCESS /FILE privileges and access to the mysql database. Usually, it is a good idea to lower the administrator's permissions for accessing the data. Review the privileges of the rest of the users and ensure that these are set appropriately. Grant the SHOW DATABASES privilege only to the users you want to use this command.

9. Patching: Patching will be performed on a regular basis to keep both the operating system and database updated.

Network Level Security: Network traffic will be encrypted using SSL & secured connectivity between the NAM and Mandis, FGPL, Buyers, Sellers, and other stakeholders.

Infrastructure Level Security: Application infrastructure will be hosted in a DMZ & firewall and IPS will be installed to detect malicious activities.

IP Based security: a comprehensive security solution in an IP environment will provide three critical components:

- IP Address Management (IPAM)
- DNS security solution
- Security solution that will address the expanding use of DHCP (Dynamic Host Configuration Protocol)

SSL security: HTTPS protocol will be implemented for the browser-based NAM application. SSL (using SHA2 algorithm) certificates from a certifying authority will be integrated with the application

Digital Signatures: For communication with Banks and Financial institutions, digital signatures will be implemented using java security API and Bounty Castle API.

Data Encryption: Sensitive data like passwords will be encrypted, thereby adding an additional layer of security to data, and preventing misuse.

Validations: validations will be performed at both UI and server side to enhance the security and prevent unauthorized access.

Password rules: Users will need to reset their passwords at regular intervals, and rules will be enforced for password content.

Security Requirements from the Portal

Role based content: Portal administrator can control the content accessible by users of various roles. Based on the role, users will have access to relevant content. Also, for same content different roles can have different permissions like read only, read and edit,

Single Sign On: SSO allows network users to provide a single set of credentials for all network services. SSO for the NAM platform is implemented using the OpenLDAP directory server.

OpenLDAP's SSO provides the following services:

- Authentication: Verification that a user or server is who they claim to be and providing a mechanism for passing this information to hosts on the network. Kerberos is used for this purpose.
- Account Management: Information about the user such as username and group membership.
- Shared File Systems: several options are available. Auto-mounting is affected by pam_mount.
- Authorization: authorization information is a combination of group membership information held in the LDAP directory and local file system permissions.

Standards

Following standards prescribed for various activities of project/product development will be adhered to in building the NAM System

- CMMI Level 5 standards will be incorporated in all phases of the project lifecycle (Requirements, Design, Development, Testing, implementation, and Maintenance).

-
- Open Web Application Security Project (OWASP) development guidelines and standards will be followed during development to prevent application-level security issues, from SQL injection through modern concerns such as phishing, credit card handling, session fixation, cross-site request forgeries, compliance, and privacy issues
 - Guidelines for development of Indian Government Websites (OGPL) will be followed as below:
 - Publish government data, documents, apps, tools, and services from multiple departments within a government
 - Utilize web 2.0 open-source technologies to develop low-cost, cloud-based infrastructure
 - Engage citizens with open data-based applications and services to improve their lives
 - Create data-rich community spaces around topics of national priorities and international interest
 - W3C level 2 and Localization standards will be followed in implementing the application.
 - The Open Group standards for enterprise application architecture will be adopted
 - ISO/IEC 27031:2011 standards will be followed in deployment and infrastructure architecture setup to ensure business continuity.
 - Suggests a structure or framework (a set of methods and processes) for any organization – private, governmental, and non-governmental.
 - Identifies and specifies all relevant aspects including performance criteria, design, and implementation details, for improving ICT readiness as part of the organization's ISMS, helping to ensure business continuity.
 - Enables an organization to measure its ICT continuity, security and hence readiness to survive a disaster in a consistent and recognized manner. General Requirements

MSPL Operation Activities performed:

- Causal analysis for repeat issues
- End-user incident resolutions
- Routine system management
- Security administration
- Alignment with Best Practices
- New Functionality Evaluation
- Periodic performance reporting and alignment with business goals

Application Management as a Service provides application support by:

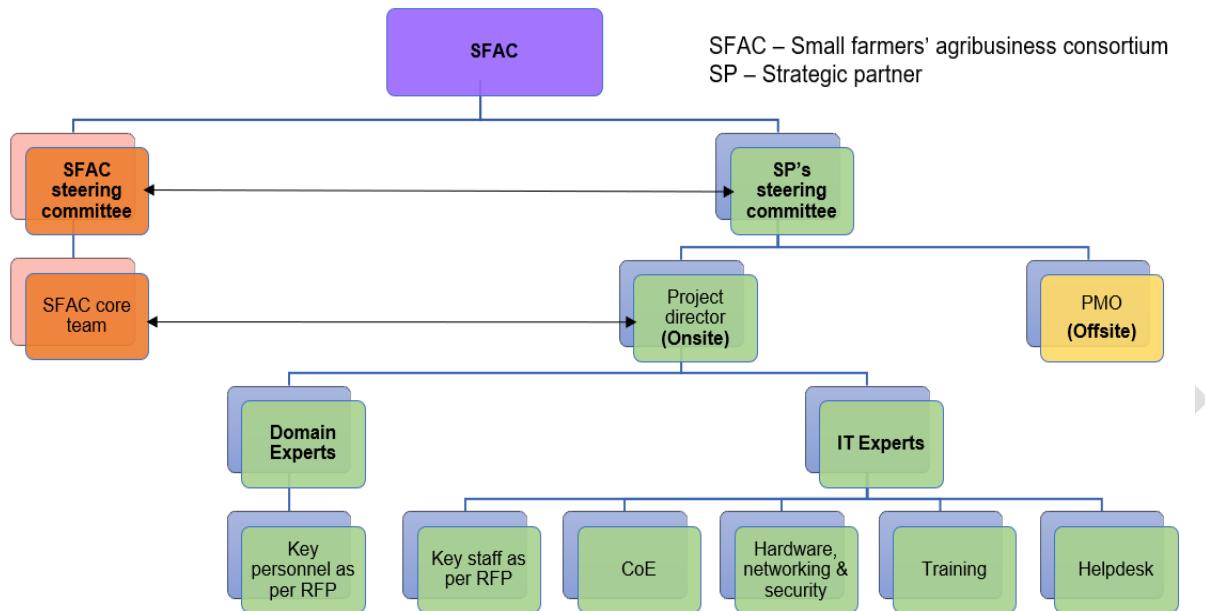
-
- Proactively monitoring and resolving issues before they impact productivity and availability
 - Enhancing functionality and performance levels with a comprehensive knowledge base
 - Improving application performance during peak demand periods
 - Increasing user satisfaction and efficiency with documented, more reliable applications
 - Minimizing performance and continuity risks using a global IT talent pool with comprehensive skills

The following are the deliverables:

- System study documentation
- Work on various assigned tickets and close them as per the agreed SLAs.
- Root cause analysis document (RCA) as applicable.
- Requirement traceability matrix documentation
- Customization list
- Functional design Document for all the missing components and new developments
- Technical Design Documents for all the missing components and new developments
- Database instance documentation
- Test Scripts, Test cases & results
- Code promotion documentation
- Change Requests for all changes made to system
- Provide Key metrics and weekly, Monthly and quarterly status reports
- Minutes of Discussions with Business
- Health check reports.

Project Management

1 Governance structure



2 Project Execution Methodology

The Strategic Partner follows a strong project management methodology and processes to ensure the timely and quality delivery. As time is an essence and it is important to remain competitive in terms of the estimation & sizing of the small, medium or complex software solutions. We follow the best of state-of-the-art processes which ensure efficient solution and timely delivery. Below is the methodology depicted for the SDLC followed.

3 Engagement Approach

The Strategic Partner will set up a dedicated team for development and testing. Our flexible and modular engagement model enables the project team to operate in a highly productive and cohesive manner.

As part of inception phase, The Strategic Partner and Stakeholder will also constitute a steering committee that will involve senior management empowered to make necessary decisions to ensure continuous success of the engagement. Steering committee will be responsible to manage the overall relationship and escalation of issues at engagement as well as organization levels. We

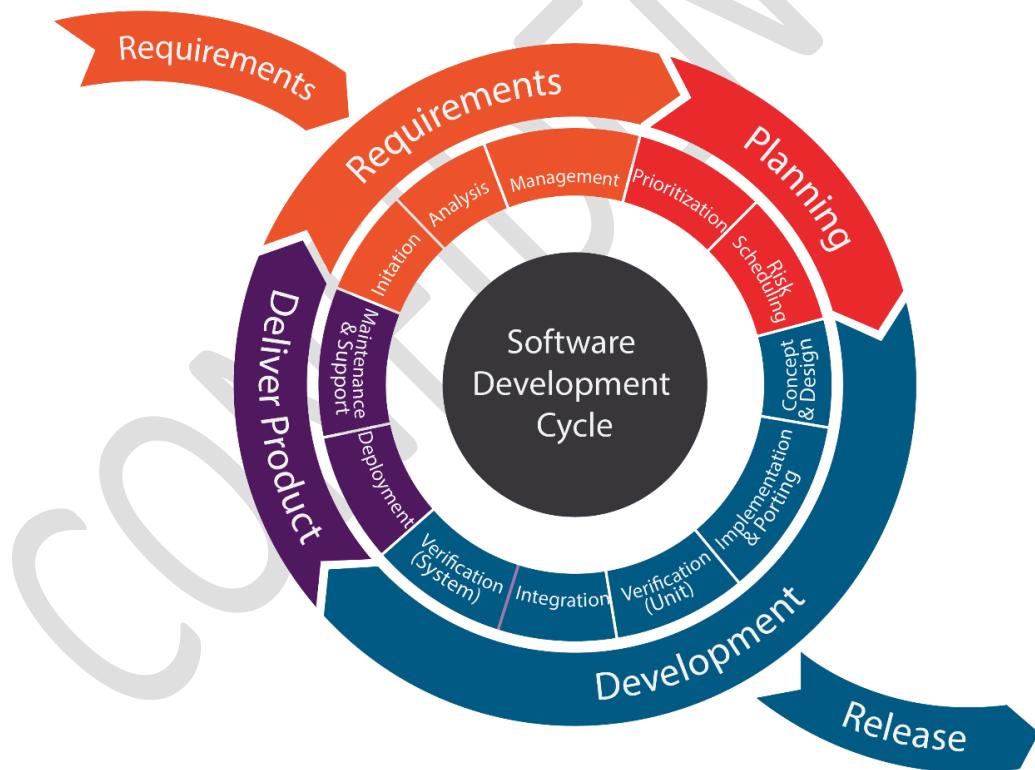
propose a recurring Monthly meeting of the steering committee for the initial period of the engagement.

Following is the proposed team structure to ensure effective execution and successful delivery.

The Strategic Partner Delivery Lead and Account Executive are part of our Global Delivery Model and are non-billable.

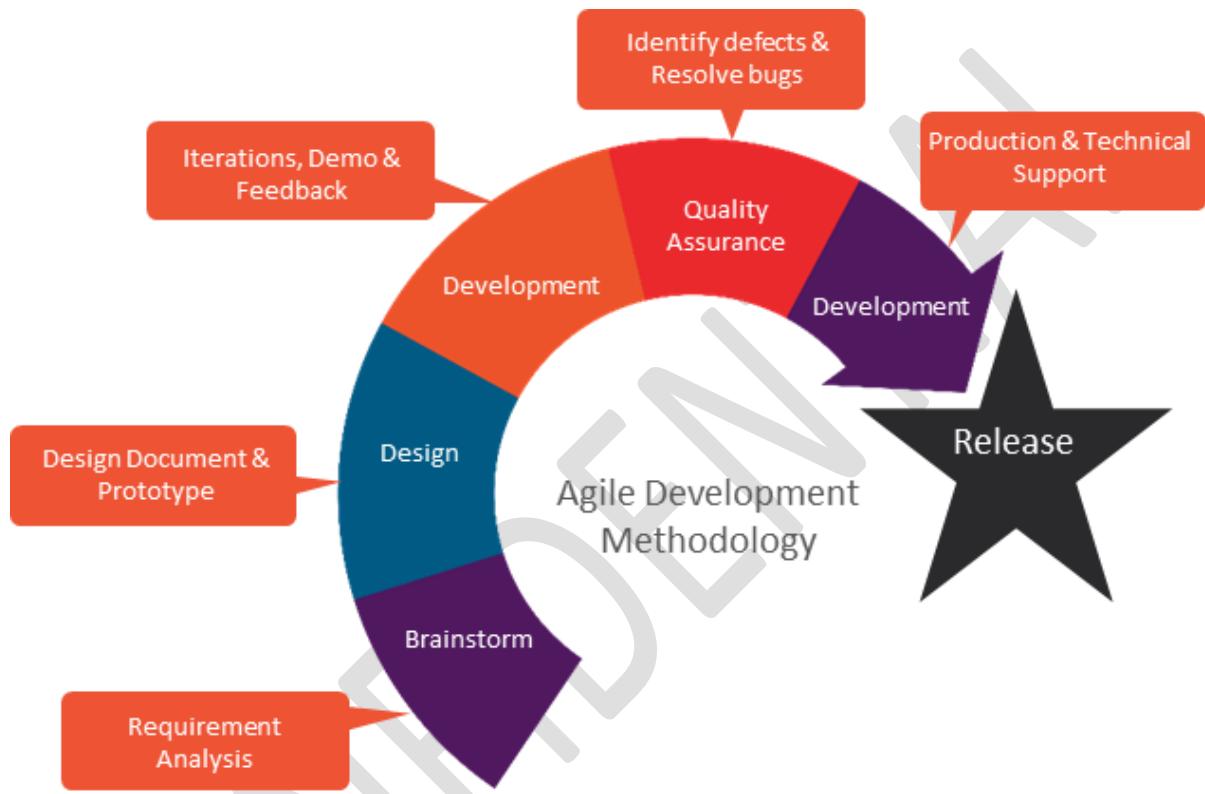
4 Development Methodology

The development in the project follows the development guidelines setup for the project managers to identify the suitable approach based on the project nature and the client's needs



5 Agile Development

Agile can be used with any type of the project, but it needs more engagement from the customer and to be interactive. Also, we can use it when the customer needs to have some functional requirement ready in less than three weeks and the requirements are not clear enough. This will enable more valuable and workable piece for software early which also increase the customer satisfaction.



SCRUM is an agile development method which concentrates specifically on how to manage tasks within a team-based development environment. Basically, Scrum is derived from activity that occurs during a rugby match. Scrum believes in empowering the development team and advocates working in small teams (say- 7 to 9 members). It consists of three roles Scrum Master, Product owner and Scrum Team

6 Project Initiation

The initial stage in the life cycle of a project is initiation, this is where the project comes into form. Designated goals and other processes that will facilitate a project's success are defined at this stage. The project scope along with strategies to achieve deliverables is established



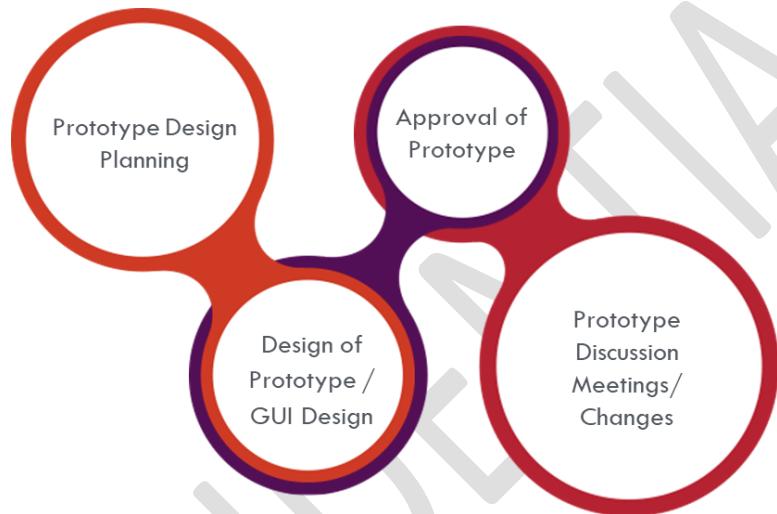
7 SRS Creation & Prototype

A software requirements specification (SRS) is a detailed description of a software system to be developed with its functional and non-functional requirements. The SRS is developed based the agreement between customer and contractors. It may include the use cases of how user is going to interact with software system.



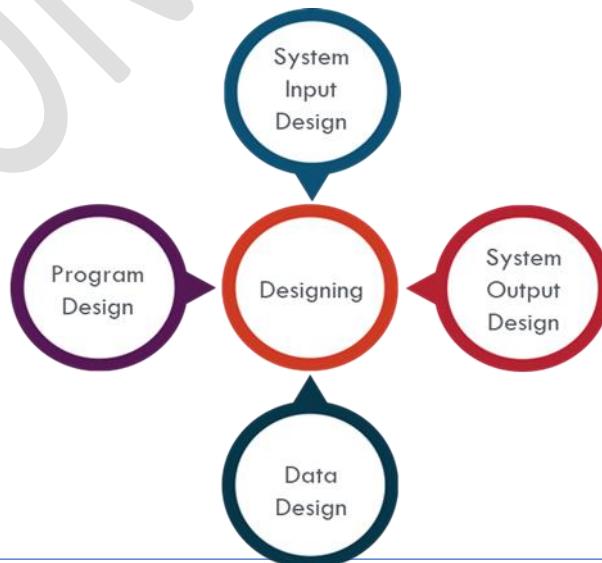
The software requirement specification document consistent of all necessary requirements required for project development. To develop the software system, we should have clear understanding of Software system. To achieve this, we need to continuous communication with customers to gather all requirements.

While interacting with the client it is better to create a prototype so that the client can visualize that will be delivered and thus can provide proper feedback and inputs



8 Application Designing

Application design is a very crucial phase in the software development life cycle and The Strategic Partner take utmost care. Design is done in such a way that it caters to existing requirement with

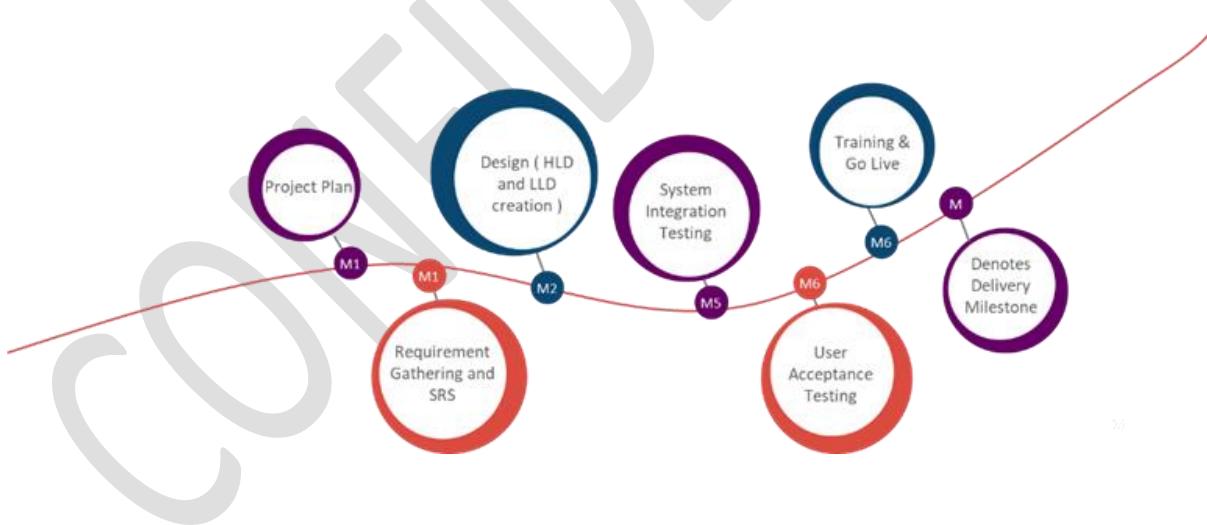


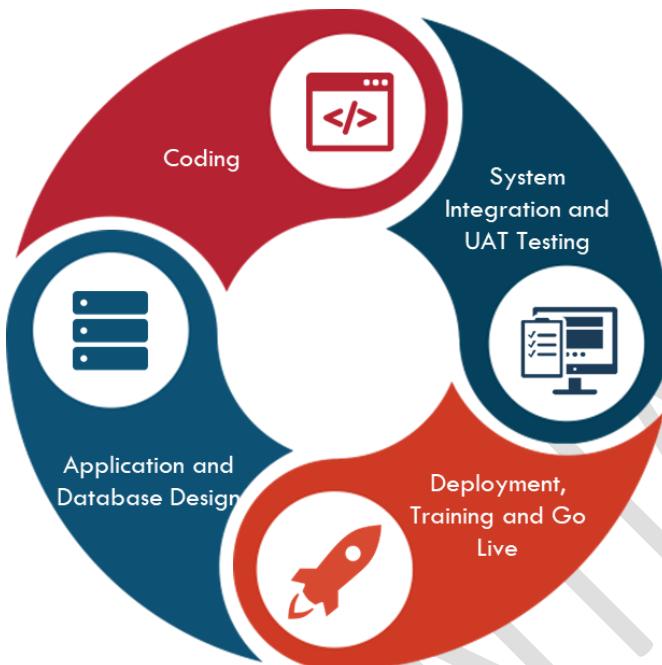
scalability and robustness's. While we are in design phase we ensure that the solution designed should have an orientation to the latest market and technology trends.

Below is list of factors being considered in the design phase.

- Compatibility
- Extensibility
- Fault tolerance
- Maintainability
- Modularity
- Reliability
- Reusability
- Robustness
- Usability
- Security

9 Software Development Process





10 Unit Testing & Integration Testing

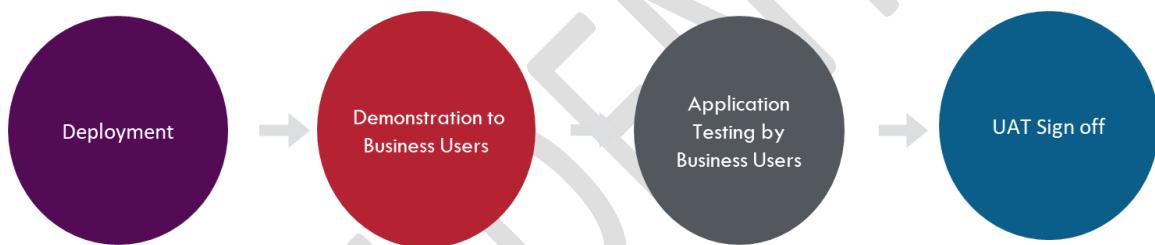
Unit is a smallest testable portion of system or application which can be compiled, linked, loaded, and executed. This kind of testing helps to test each module separately. The aim is to test each part of the software by separating it. It checks that component are fulfilling functionalities or not. This kind of testing is performed by developers.

Integration means combining. In this testing phase, different software modules are combined and tested as a group to make sure that integrated system is ready for system testing. Integrating testing checks the data flow from one module to other modules. This kind of testing is performed by testers.

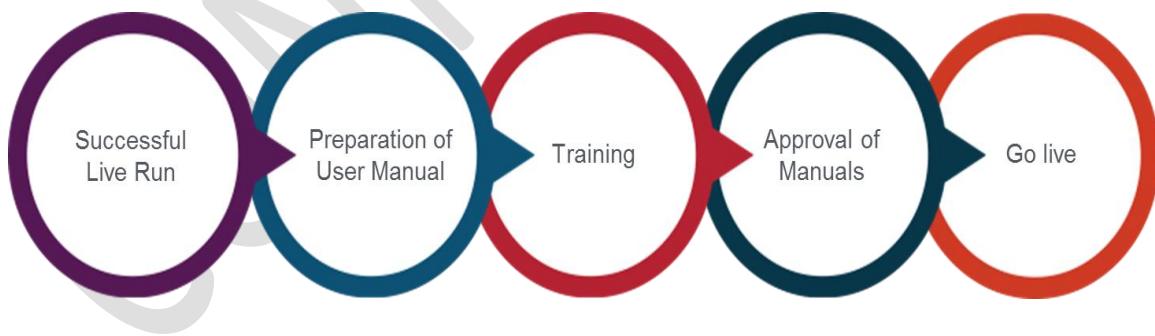


11 UAT (User Acceptance Testing)

User Acceptance testing is a test conducted to find if the requirements of a specification or contract are met as per its delivery. Acceptance testing is basically done by the user or customer. However, other stockholders can be involved in this process.



12 Go Live & Training



A training schedule will be prepared by The Strategic Partner and CLIENT mutually. In case of training to number of Users like Faculty Staff or Students of CLIENT, Trainer will be called at central place and common training will be provided. Trainers amongst the Users will be identified by CLIENT. Training will be provided by means of Live Demonstration to these trainers who will further provide the training to the other Users of CLIENT.

For CLIENT Section Users like Account Section Users, Establishment Section Users, etc. training will be provided by means of Live Demonstration, Training Sessions and Testing with Sample data. During the training sessions soft copies of user manual will be provided by the Strategic Partner .

After the Successful training to the End-user the software is now ready for go-live and the formal Release of the Project is done.

13 Application Security

Open Web Application Security Project (OWASP) standards will be adopted to secure the application from various vulnerabilities. The Top 10 Vulnerabilities that needs to be more importantly address among other are listed below

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Risk Management

Risk Management is the systematic process of identifying, analyzing, and responding to project risks. It includes maximizing the probability and consequences of positive events and minimizing the probability and consequences of adverse events to project objectives. A risk management plan defines how a project team will handle risks to achieve that goal.

Risk Management Methodology

Risk is an expectation of loss, a potential problem that may or may not occur in the future. It is generally caused due to lack of information, control or time. Loss can be anything, increase in

production cost, development of poor-quality software, not being able to complete the project on time. Software risk exists because the future is uncertain and there are many known and unknown things that cannot be incorporated in the project plan.

Risk can be of two types:

- (1) internal risks that are within the control of the project manager
- (2) external risks that are beyond the control of project manager.

Risk management is carried out to:

Risk Identification – Identify risks by using the Risk Assessment Questionnaire and Project Planning Risk Assessment Checklist, augmented to include other project specific risks, as appropriate.

Risk Categorization – Group the risks into categories by using the Risk Assessment Questionnaire. The project manager can create additional categories, as required.

Risk Impact Assessment – Enter all risks into the Risk Response Plan document. For each risk identified, assess the risk event in terms of likelihood of occurrence (Risk Probability) and its effect on project objectives if the risk event occurs (Risk Severity = Impact Score). This information will be used to prioritize the risk using established threshold criteria.

Risk Prioritization - Risks that meet the threshold criteria will be so noted in the Risk Response Plan. These Risks will be prioritized.

Risk Response Planning – For each risk in the Risk Response Plan that is above the Risk threshold:

- Determine the options and actions to reduce the likelihood or consequences of impact to the project's objectives
- Determine the response based on a cost/benefit analysis (cost vs. expected effectiveness)
- Describe the actions to be taken to mitigate the risk
- Describe the Signs and Symptoms that may be indicators of Risk Event occurrence
- Describe the actions to be taken when the risk event occurs (contingency plan)
- Assign responsibilities for each agreed-upon response
- Assign a "due date" where risk responses are time-sensitive
- Incorporate this information into the Risk Response Plan.

Risk Response Tracking:

-
- Document the dates and the actions taken to mitigate the risk
 - Document the actions taken when the risk event occurred (contingency plan)
 - Document any subsequent actions taken
 - Incorporate this information into the Risk Response Plan

Risk Monitoring - Establish systematic reviews and schedule them in the project schedule, ensuring the following reviews:

- Ensure that all requirements of the Risk Management Plan are being implemented
- Assess currently defined risks as defined in the Risk Response Plan
- Evaluate effectiveness of actions taken
- Identify status of actions to be taken
- Validate previous risk assessment (likelihood and impact)
- Validate previous assumptions
- State new assumptions
- Identify new risks
- Track risk response
- Establish communications.

Risk Control

- Validate mitigation strategies and alternatives
- Take corrective action when actual events occur
- Assess impact on the project of actions taken (cost, time, resources)
- Identify new risks resulting from risk mitigation actions
- Ensure the Project Plan (including the Risk Management Plan) is maintained
- Ensure change control addresses risks associated with the proposed change
- Revise the Risk Assessment Questionnaire, Project Planning Risk Assessment Checklist and other risk management documents to capture results of mitigation actions.
- Revise Risk Response Plan
- Establish communications.

Risk and issue management

The strategic partner considers proactive Risk and Issues management as a critical component of project management. Nothing derails a project more badly than an unforeseen adverse event (risk) to which a response was never planned and no measures were undertaken to reduce the probability of the event occurring. Similarly, an unresolved issue can equally impact the project, thus diminishing the chances of success.

The strategic partner will implement a comprehensive risk and issues management process to effectively identify, monitor and control risk and issues in a timely manner to prevent adverse impacts.

Risk identification will be carried out through the project through brainstorming, lessons learned from earlier projects, meetings, SMEs involvement etc. Subsequently, qualitative and quantitative analysis will be conducted for impact and probability and adequate risk responses will be planned.

A risk register will be maintained and monitored throughout the duration of the project. Additionally, key risks and issues with mitigation actions will be reported formally via the monthly project report.

P – Probability of risk occurring is Low/Medium/High (L/M/H)

I – Impact on project/business is Low/Medium/High (L/M/H)

Risks identified

| S.No | Risk Factor | Risk Question/Description |
|------|--------------------|--|
| 1 | Late Approval | Project funding approval is delayed by several weeks, resulting in a delay to the commencement of the project due to mobilization and security on boarding requirements. |
| 2 | Resources | Existing resources are unable to meet project time commitments sufficiently due to other works or unforeseen external influences. |
| 3 | Change Management | Changes and/or variations are not approved in a timely, or the approval process causes delays in the project schedule. |
| 4 | External suppliers | External suppliers do not supply equipment or Subcontractors within standard published lead-time. |

| S.No | Risk Factor | Risk Question/Description |
|------|-------------------------------|---|
| 5 | Scope/Design Changes | Changes in scope definition by client requirements, technology, or scope. |
| 6 | Inaccurate Budgets | Budget blowouts and lack of funding to cover all required deliverables. |
| 7 | Related or Dependent Projects | Other projects either dependent or related are not funded or executed in a timely fashion impacting the outcomes of this project. |
| 8 | Plans and Documentation | Lack of approved specifications, high- and low-level designs, management plans and project methodology documentation to execute the works as and when required. |
| 9 | Construction Delay | Buildings not ready for Technology fit-out |
| 10 | Environment | Unforeseen rain and weather conditions impact the site works. |
| 11 | Technology | Solution & Provisioning |
| 12 | Resource Risk | Domain Knowledge |
| 13 | Schedule Risk | Identification of Utilities |
| 14 | Schedule Risk | ROW APPROVAL |
| 15 | Technology | Solution & Provisioning |

Roles & Responsibilities

| | |
|--|---|
| <p>Project Manager (Strategic Partner): The overall coordinator of the risk management program.</p> | <ul style="list-style-type: none"> • Maintaining the risk management plan • Maintaining the risk management database and distributing updates • Briefing the team on the status of risks • Tracking efforts to reduce moderate and high risk to acceptable levels • Providing risk management training • Facilitating risk assessments and • Preparing risk briefings, reports, and documents required for Project Reviews |
|--|---|

| | |
|---|--|
| Project Manager (Client) | <ul style="list-style-type: none"> Responsible for mitigating the risk which is identified and report by the PM (Strategic Partner) |
| Project Team: Responsible for identifying, monitoring and managing risks | <ul style="list-style-type: none"> Coordinate with concerned personnel to review and recommend to the Project Manager changes on the overall risk management approach based on lessons learned. Quarterly, or as directed, participate in the update to project risk assessments made during the previous review period. Review and recommend any changes to the risk assessments made and the risk mitigation plans proposed. Report new risks to the Project Manager via e-mail Ensure that risk is a required topic at each Project Meeting Accomplish assigned mitigation tasks and report status/completion of mitigation actions to the Project Manager for entry into the database. |
| End Users | The end users will participate in the project through the SMEs. The end users may identify risks and should pass the information through the SMEs or Project Team. All risk identification, tasking, and reporting will be handled through the project team member(s) assigned to the End User. |

Risks Rating & Scoring Techniques

The project manager (MSI) will rate each identified risk (e.g., Impact Score = High, Medium, Low) based on the likelihood that the risk event will occur and the effect on the project's objectives if the risk event occurs. This will be a subjective evaluation based on the experience of those assigned to the project's risk management team

Default rating/scoring system is as follows:

Impact Score can be rated as 1, 2, 3, 4, 5 (1 = Very Low, 5 = Very High).

Probability can be rated as 0, 0.25, 0.5, 0.75 or 1 (0 = Very Low, 1 = Very High).

Risks Score

Risk Score is defined as Impact Score x Probability and is shown in the following chart. Priority is based on Risk Score.

| Probability | Impact | | | | |
|-------------------------------------|----------------|-----------|--------------|-------------|--------------|
| | Negligible (1) | Minor (2) | Moderate (3) | Serious (4) | Critical (5) |
| Very likely to occur (1) | 1 | 2 | 3 | 4 | 5 |
| Probably will occur (0.75) | 0.75 | 1.5 | 2.25 | 3 | 3.75 |
| About 50% chance of occurring (0.5) | 0.5 | 1 | 1.5 | 2 | 2.5 |
| Unlikely (0.25) | 0.25 | 0.5 | 0.75 | 1 | 1.25 |
| Very unlikely to occur (0.1) | 0.1 | 0.2 | 0.3 | 0.4 | 0.5 |

Green = Low Risk

Yellow = Medium Risk

Red = High Risk

- The project team shall develop response plan for each item rated as **High** risk. These risks are watched closely.
- The project team should create a response plan for any Medium risk item where they deem it necessary. However, in general no response plan is required for Medium risk items. Medium risks are monitored on a regular basis.
- No action is required for Low risk items. They will be kept in watchlist to ensure they are closed.
- All Risk items with a response plan are to be entered into the Risk Response Plan document.
- Risk logging & tracking shall be done using standard project management tool

1.3 Proposed Software Architecture

| S No | Solution Component | Technology |
|------|--------------------------------------|--------------------------------------|
| 1 | User Interface | HTML5, Angular JS |
| 2 | Web & Content Management Framework | Liferay |
| 3 | Development Platform | Open JDK 10 or greater |
| 4 | Java Frameworks | Spring Boot, Spring MVC, |
| 5 | Development IDE | Eclipse/IntelliJ |
| 6 | Scheduler | Quartz Scheduler |
| 7 | IVRS | Voice XML, IVR Gateway |
| 8 | Relational Database with Clustering | MySQL 8.x |
| 9 | Object Relational Mapping (ORM) tool | Hibernate, Spring JDBC |
| 10 | No SQL Database | Cassandra (Audit), Hive (Analytical) |
| 11 | Cache Store | MemCache, Redis |
| 12 | Search Engine | Apache Lucene, Solr |
| 13 | ETL, Reporting | Pentaho |
| 14 | Stream Processing | Kafka / Spark |
| 15 | Application Server | Tomcat 9 |
| 16 | Operating System | Ubuntu Server |
| 17 | Application Packaging | RPM, WAR, Docker |

| | | |
|-----------|---|------------------------------|
| 19 | Load Balancer | haproxy, nginx |
| 20 | Run Time Container | Kubernetes |
| 21 | Continuous Integration and Continuous Deployment (CICD) | Jenkins |
| 22 | Source Code Repo | SVN / GIT |
| 23 | Messaging | Rabbit MQ (Kafka) |
| 24 | SMS Gateway Integration API | Provided by NIC |
| 25 | Reports Engine | Jasper Reports |
| 27 | Rules Engine | Drools, Custom Config |
| 28 | Single Sign On | OpenLDAP |
| 29 | SSL Certificates | SHA2 Certificates |
| 30 | Digital Signatures | Token Certificates (#PKCS12) |
| 31 | Encryption / Decryption | Bounty Castle API |
| 32 | Logging | Apache log4j, slf4j |
| 33 | DR Backup Software | AS proposed BY NIC |
| 34 | Monitoring, Alerts, Notification | ELK, Zabbix |
| 35 | Issue Tracker | OS ticket |

1.4 Recommended Hardware Infrastructure

| SI No | Product Group | Product ID (PID) | Description | Qty |
|-------|--------------------------------|---------------------|---|-----|
| 1 | Server Base | UCSC-C460-M4 | UCS C460 M4 base chassis no CPU/DIMM/HDD/PCIe/memory risers | 1 |
| 2 | CPUs | UCS-CPU-E78894E | Intel Xeon Platinum 8260(2.4GHz/24-Core/35.75MB/165W) | 16 |
| 5 | Memory Riser Boards | UCSC-MRBD2-12 | Memory riser board with 12 DDR4 DIMM slots | 10 |
| 6 | DIMM Kits (2 DIMMs per kit) | UCS-ML-1X644RU-G | 64 GB DDR4-2133-MHz LRDIMM/PC4-17000/4R/x4/1.2v | 14 |
| 7 | Memory Mirroring Option | N01-MMIRROR | Memory mirroring option with Memory Performance Mode | 2 |
| 8 | Hot-Pluggable Sled-Mounted SSD | UCS-SD800G12S4-EP | 800 GB 2.5 inch Enterprise Performance 12G SAS SSD (10X endurance) | 4 |
| 9 | RAID controller | UCSC-MRAIDC460 | Cisco 12G SAS Modular 12-port RAID controller | 1 |
| 10 | Flash-Backed WriteCache | UCSC-MRAID12G-4GB | onboard Flash-Backed WriteCache (FBWC) 4 GB | 1 |
| 11 | HBA for external drives | UCSC-SAS9300-8E | Cisco 12G SAS 9300-8e HBA for external JBOD attach | 1 |
| 12 | Network Interface Cards (NICs) | UCSC-PCIE-IQ10GF | Intel X710 quad-port 10G SFP+ NIC | 1 |
| 13 | Host Bus Adapters (HBAs) | UCSC-PCIE-Q2672 | Qlogic QLE2672-CSC, 16Gb Dual Port Fibre Channel HBA with SR Optics | 1 |

| SI No | Product Group | Product ID | Description | Qty |
|--------------|---------------------------|-------------------|--|------------|
| 14 | UCS Storage Accelerators3 | UCSC-F-FIO-5200PS | UCS 5200 GB Fusion ioMemory3 PX Performance line for Rack M4 | 1 |
| 15 | SFP Modules | SFP-10G-SR | 10GBASE-SR SFP+ Module 850 nm, multimode, SR, LC connector | 12 |
| 16 | Slide Rail Kits | UCSC-RAIL-4U | Rail Kit for UCS C460 M4 | 4 |
| 17 | Cable Management Arm | UCSC-CMA-4U | Cable Management Arm for C460 M4 | 4 |
| 18 | Bezels | UCSC-BZL-EX | bezel for UCS C460 M4 rack server | 4 |
| 19 | Cisco One | C1UCS-OPT-OUT | Cisco One Data Center Compute Opt Out Option (1-9) | 4 |
| 20 | Operating System | RHEL-2S2V-3A | Red Hat Enterprise Linux (1-2 CPU, 1-2 VN); 3-Yr Support Req | 1 |
| 21 | OS Media | RHEL-6 | RHEL 7 Recovery Media Only (Multilingual) | 1 |
| 22 | Cisco SMARTnet Support | CON-PREM-C460M4 | ONSITE 24X7X2 C460 M4 Rack Server | 5 |
| 23 | KVM Cable | N20-BKVM | KVM cable for server console port | 1 |
| 24 | Power Supplies | UCSC-PSU2V2-1400W | 1400W AC Power Supply (200 - 240V) | 4 |
| 25 | Power Cords | CAB-250V-10A-ID | Power Cord, SFS, 250V, 10A, India | 4 |

| Production Server Details | | Full DR Server details | | Benchmark Server details | |
|----------------------------------|---------------|-------------------------------|---------------|---------------------------------|---------------|
| Description | Values | Description | Values | Description | Values |
| No of Virtual | 75 | No of Virtual Machine | 75 | No of Virtual Machine | 75 |

| Machine | | | | | |
|---|-----------|--|-----------|--|-----------|
| Total vCPU for 50 VMs | 3750 | Total vCPU for 50 VMs | 3750 | Total vCPU for 50 VMs | 3750 |
| Total RAM for 50 VMs | 8850 | Total RAM for 50 VMs | 8850 | Total RAM for 50 VMs | 8850 |
| @ 192 vCPU / Phy Server No of PHY server for above VMs | 14 | @ 192 vCPU / Phy Server No of PHY server for above VMs | 14 | @ 192 vCPU / Phy Server No of PHY server for above VMs | 14 |
| No of Physical Server | 14 | No of Physical Server | 14 | No of Physical Server | 14 |
| Buffer 1 FULL PHY Server | 3 | Buffer 1 FULL PHY Server | 3 | Buffer 1 FULL PHY Server | 3 |
| TOTAL PHY SVR | 31 | TOTAL PHY SVR | 31 | TOTAL PHY SVR | 31 |
| SAN STORAGE (Phy Svr) | 32 TB SAN | SAN STORAGE (Phy Svr) | 32 TB SAN | SAN STORAGE (Phy Svr) | 32 TB SAN |
| SAN STORAGE (VM Svr) | 30 TB SAN | SAN STORAGE (VM Svr) | 30 TB SAN | SAN STORAGE (VM Svr) | 30 TB SAN |

1.5 Third Party Products

i. IVRS

The solution we understand that **FGPL** is looking to customise its IVRS solutions to improve grievance submission process through IVRS interface. The solution should have provision to acknowledge the complainant by issuing Grievance registration number through IVR interface. The application must be intuitive and scalable.

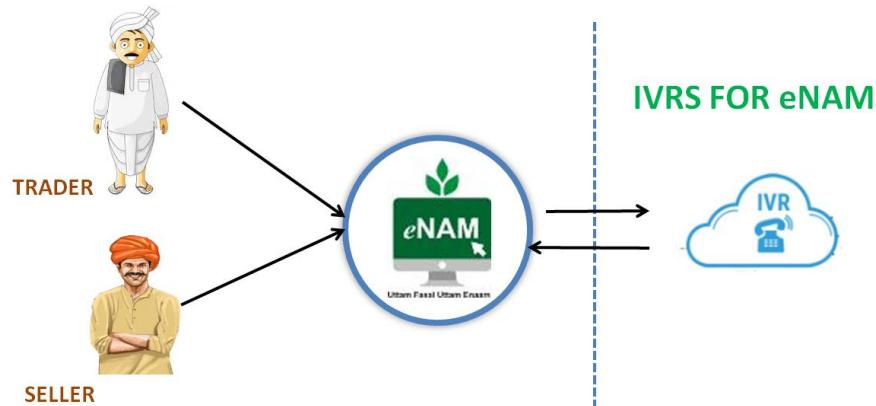
In this respect we propose to:

- Build IVRS solution with multiple levels
- IVRS will be built in multiple languages
- Add more options according to FGPL need
- Develop custom reports on usage (Example: call history etc.)

IVRS solution will have multi-level menu which can trigger workflows (self-service), record inputs (feedback etc) or transfer call to agents. IVRS will be deployed on hosted server. If existing server fails, failover will be used to switch IVRS solution to another server. All transactions under processing while the crash occurred will need to be restarted. Automatic call backs will also be initiated based on requirement.

Recommended Hardware:

- I5 quad core processor
- 4GB Ram
- PCI Express Slot and PCI slots
- Cent OS 5.4
- Asterisk Software

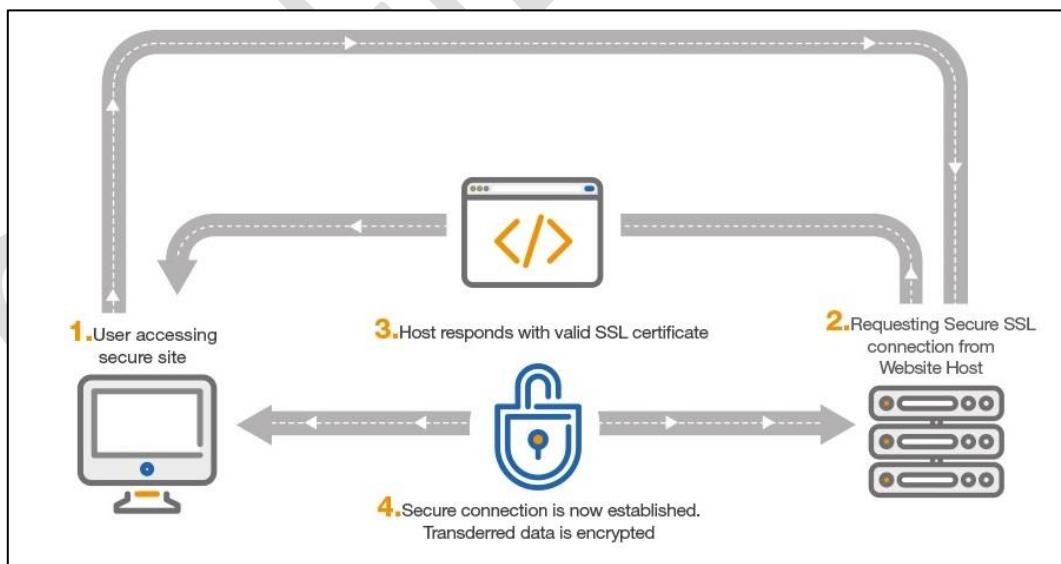


ii. SMS Gateway

To integrate SMS Gateway for Disseminating transaction information like Registration, Winner Declaration, Invoice generation, SMS to the Farmer when fund reached to escrow account, we will use NIC provided gateway structure and this will also facilitate OTP based user validation service as per the business requirement.

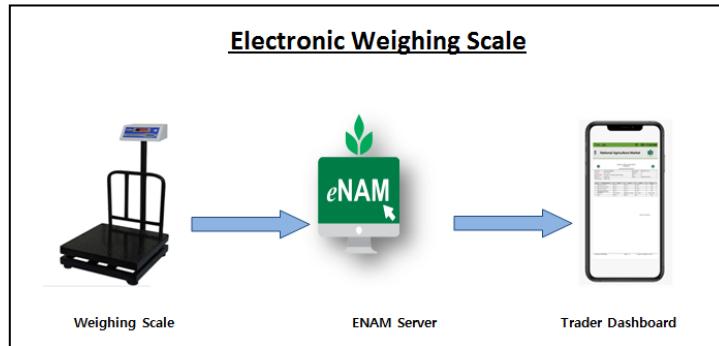
iii. SSL Certificate

Domain SSL (Digital Security Certificate) will be used to encrypt communications between end users browser's and NAM Portal.



iv. Electronic Weighing Scale

It is envisaged that electronic weighing machines will be placed at all Mandi's where ENAM is integrated. Weighing machines need to have RS-232 interface along with USB port for transfer of data.



This electronic weighing scale is placed in the Mandi where Farmers Produce get weigh on electronic weighing scale the output information is sent to NAM server and from there it can be seen in Traders dashboard.

v. Assaying:

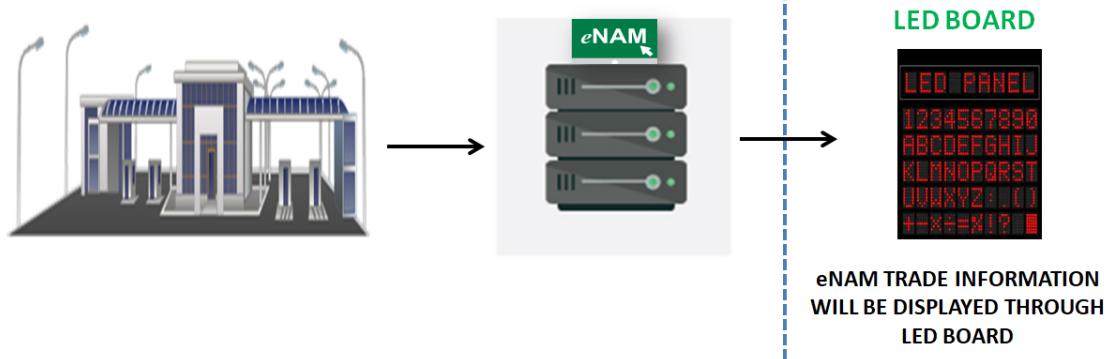
Assaying is done in Mandi to determine quality and the price of a produce. Assaying is defined as a process to analyze the physical sample of a produce to determine its composition and its properties

Agricultural markets assaying will help the buyer know the contents of the product such as protein, grain weight, fiber strength, etc besides its moisture content. Often, a produce with higher moisture

We will integrate the assaying labs for agricultural produce at the market level is of utmost importance to enhance the marketability of the produce and to enable the farmers to realize price commensurate to the quality of their agricultural produce. These labs will give the high accuracy with instant results.



vi. LED Sign Boards



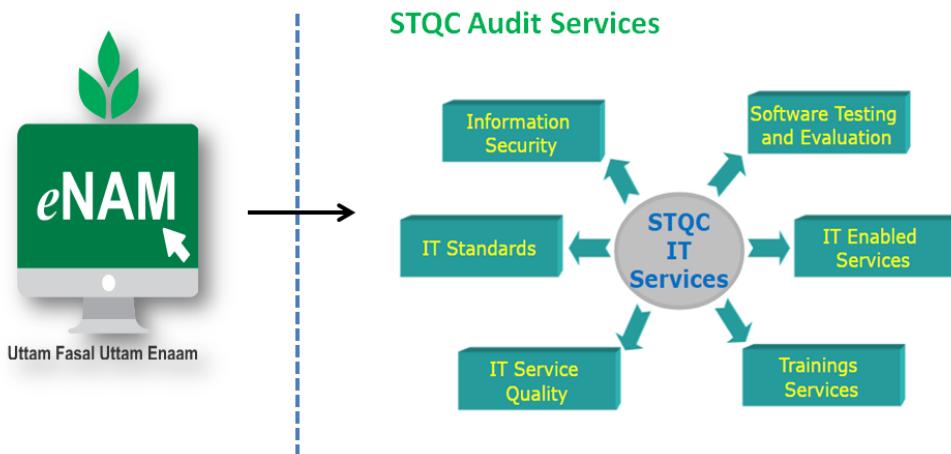
To give facility of LED Sign Boards for Mandis, Where Farmers, Traders and Commission agents can see the daily market prices, notifications, announcements for Farmers and Farmer related NEWS can be displayed at LED Sign boards in Mandis.

LED advertising signs can operate 24/7 and up to 100,000 hours. They are perfectly visible even in direct sunlight while at night, by lowering the brightness, they do not lose image quality. LED Sign boards can have different types and sizes according to the Mandi requirement we can place the LED sign boards for Information displaying.

vii. STQC Audit Services:

Standardization Testing and Quality Certification (STQC) Directorate is an attached office of the Ministry of Electronics and Information Technology, Government of India, provides quality assurance services in the area of Electronics and IT through countrywide network of laboratories and centers.

The services include Testing, Calibration, IT & e-Governance, Training and Certification to public and private organizations.

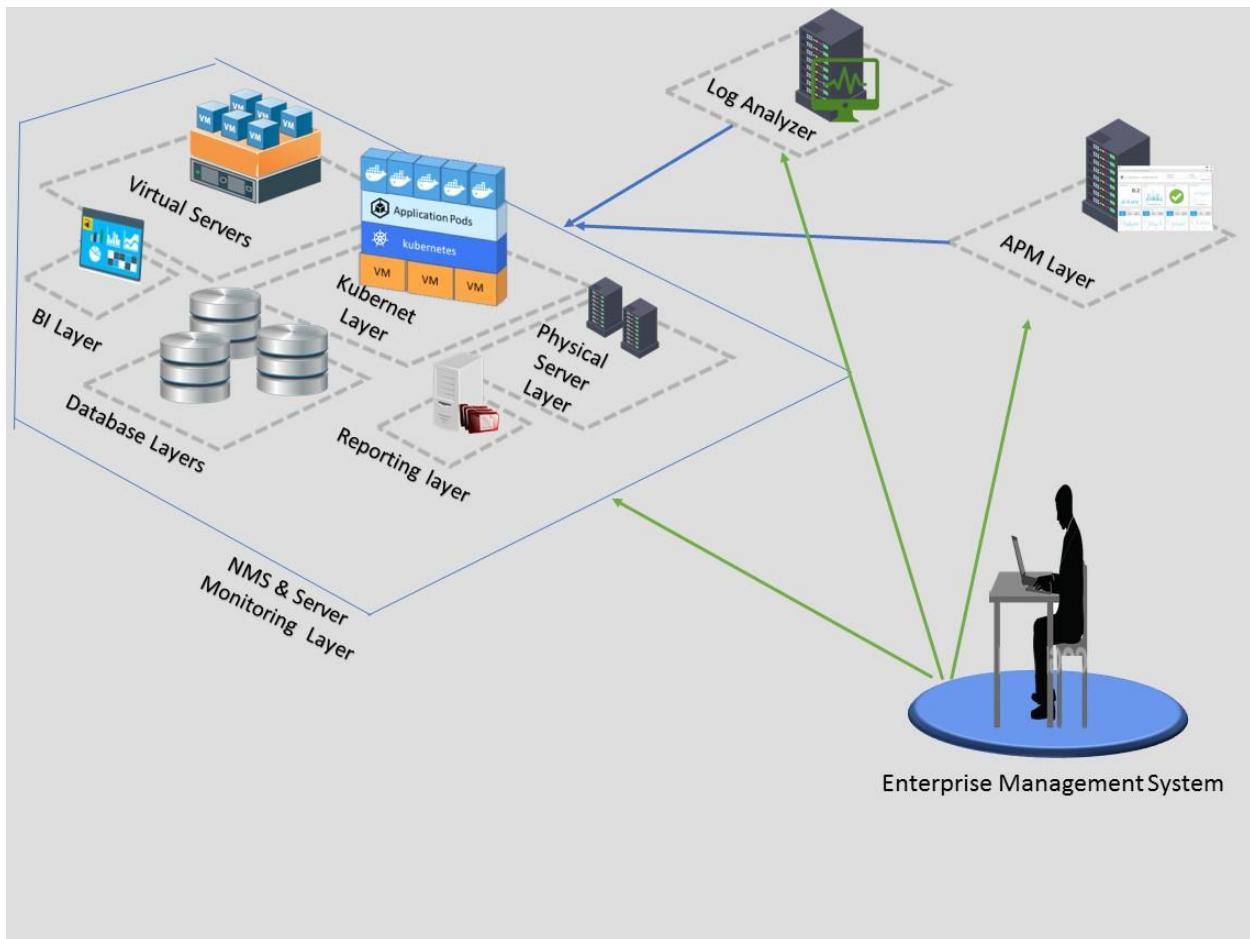


STQC laboratories are having national/International accreditation and recognitions in the area of testing and calibration.

In the area of IT & e-Governance, STQC provides Quality assurance services for Software testing, Information Security and IT Service Management by conducting testing, training, audit and certifications.

viii. Enterprise Management System

Enterprise Management System is made up system which when implement in an integrated manner with an aim to coordinate and bring about cooperation within a function of an enterprise. eNAM Enterprise Management System (EMS) is made up of integrated (NMS) Network Management System , (APM) Application performance management , Log Analyzer and additional tools required to monitor the performance indicators of SLA.



ix. Network Monitoring System & Server Monitoring

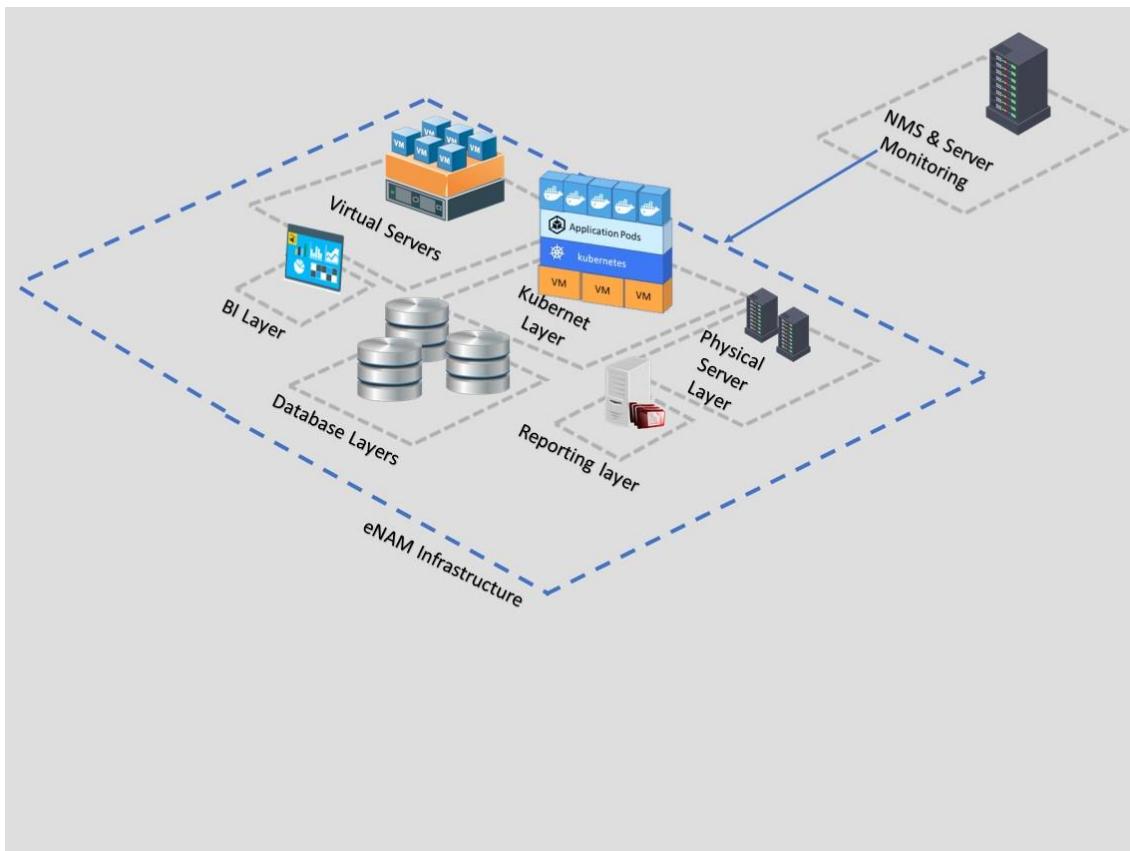
Network Monitoring System

NMS is a comprehensive network management platform that offers purpose-built applications and tools designed to simplify the management of networking devices and resources. Detect, diagnose and resolve network performance issues before they turn into costly downtime.

Network monitoring offers the following:

- Avoiding bandwidth and performance bottlenecks
- Identifying applications or servers using up your bandwidth
- Instantly identifying sudden spikes caused by malicious code
- Remote Management - via web browser, Pocket PC, or any Windows client
- Comprehensive sensor selection
- Multiple location monitoring

- Full support for common network usage data acquisition - SNMP, Packet Sniffing, Net Flow and more



Server Monitoring:

Applications Manager Server Monitoring feature helps you in monitoring business-critical servers. Server Monitoring involves monitoring of the server availability and performance, and server responsiveness. This helps you to detect and fix server problems such as server downtime and poor server response time even before users are affected. Monitor applications, servers, and services in your network to ensure that they are available all the time. Improve availability and performance of NAM Server Infrastructure and gain in-depth visibility into Server problems.

The concept behind server monitoring is straight-forward: server monitoring is the regular collection and analysis of data to ensure that servers are performing optimally and providing their intended function. The data used for server monitoring encompasses key performance indicators (KPIs), network connectivity, and application availability. For example, monitoring a Windows server would examine: Server operating system KPIs (CPU, memory, network and disk performance

metrics) Network Share availability is analyzed in order to minimize, or ideally prevent, server outages or slowdowns. The selection of the data points and how they are analyzed will vary based on the server and its function, however the general data collection and evaluation methodology is consistent no matter the operating system or server function.

x. Application Performance monitoring

The integration of application monitoring tool for all NAM server and application monitoring needs. From server and infrastructure components that support business to all business critical applications responsible for uninterrupted service delivery, Applications Manager offers proactive application monitoring services to measure the performance statistics in real time for comprehensive monitoring of NAM IT Operations.

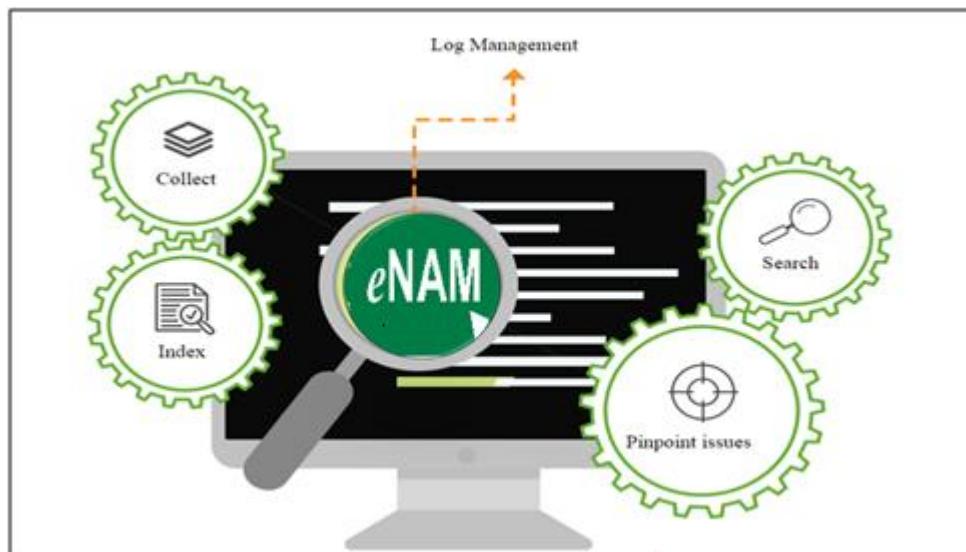


Application Servers are designed to develop web services and applications. In real time, the functioning and performance of such servers get affected when the services/applications running in the server fail. Application Server monitoring includes Web Logic Monitoring, Web Sphere Monitoring, Tomcat Monitoring, JBoss Monitoring. Identify and resolve application performance issues before they impact end users.

xi. Log Analysis

eNAM customized Log analysis tool will help to monitor the real time data of Servers, applications and Database.

Log analysis tool will dive deep into network events, logs, and security events. Use Log Server to provide the evidence necessary to track down security threats, and quickly resolve vulnerabilities with built-in alerts and notifications.



CONFIDENTIAL

1. App / eMAIL-based notifications

1.1 Trader Alerts and Notifications

- a) Trader should have the provision of selecting the notification alert feature.
- b) Trader should have the provision of selecting the preferred commodities and alert when any of the opted commodities are arrived in the mandi.
- c) Trader should have the provision to get the notification regarding the information of the lots of the preferred commodity which are under bidding.
- d) Trader should have the provision to get the notification whenever any LOTS belong to FPO Lots, WDRA Lots, ReMS Lots are under bidding. Need some flash kind of feature when trader login the application.
- e) Trader should get the notification on Mandis Online as per his choice
- f) Trader should get the alert on the Pending Invoices after the trade is completed
- g) Price Alerts based on the preferred commodities
- h) Trader should get the notification regarding the Incentives / Discounts that are applicable and implemented by the state bodies
- i) Trader should get the Advertisements / New Feature alerts
- j) Trader should get the Weather forecast Notification
- k) Trader should receive the notification if he is the top traded in the week / monthly and yearly with in the Mandi / State
- l) Trader should get the alert notification to update the bank details if they are missing. This alert should be visible soon after the trader login the application
- m) Trader should get the notification on the MSP price for the preferred commodities he selected in the application
- n) Trader should get the notification regarding the status of the Inter-mandi / state licensing approval

1.2 Farmer Alerts and Notification

- a) Farmer should have the provision to activate / deactivate the notifications
- b) Farmers should get the advance demand notification from the different traders and Govt. Agencies



- c) Farmer should get the notification of the Price of the commodities that are under preferred list and preferred mandis. This can be within the state and out of the state also.
- d) Farmer should get the payment settlement message after successful online payment
- e) Farmer should get the Weather forecast updates
- f) Farmer should get the notifications related to any Incentives / discounts that are offered by the state / central government
- g) Farmer should get the notification on the MSP price for the preferred commodities he selected in the application
- h) In case of Interstate Trade, farmer should get the alert notification if the trade is happened by not lifted / picked up by the Trader with defined time
- i) Farmer should get the notification regarding the overall surplus commodity information within the Mandi / State so that farmer can store the produce in the warehouses
- j) Farmer should have the GPS based tracking system to know the nearby locations of Assaying, Weighment, and Cold Storages...etc.
- k) Farmers should have the provision to know the information of the nearby FPO group's information. This search can be modified based on the state / location filter
- l) Farmers should have the provision to access the Commodity outlook profile (Yield Vs Trade). Price trends of the Commodities based on the Climatic zones of the Nation

1.3 Management Alerts and Notification

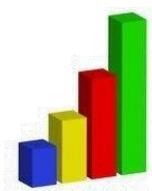
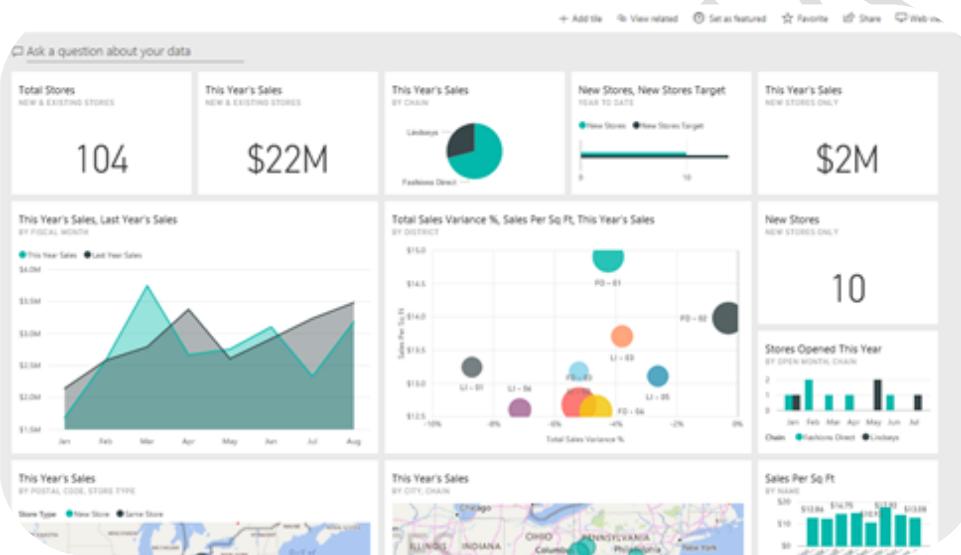
- a) Application should have the provision to activate / deactivate the notifications
- b) No. of times commodity traded below MSP. App/e-Mail based alert facility to be provided to mandi secretaries for trade of commodity below MSP.
- c) Weekly summary of details to mandi secretaries in which mandis have not e-traded during the week/ fortnight/ month
- d) Secretary need to get the notification message regarding the highest bid price against each commodity traded in that Mandi. This message has to be sent to the secretary at end of the day.
- e) Secretaries should get the notification on the MSP price for the preferred commodities he selected in the application
- f) Secretaries and State Admins should get the Interstate Licensing and Requests for the approval



- g) Secretaries should get the notification on weekly basis regarding the top 5 traders who have done the highest e-Payments.

2. BI and Analytics

- a) Application should have the user friendly and customized BI dashboard which will be used by all the key stakeholders of the eNAM. The main slices that are required in the dashboard are as below:



All the below mentioned slices are to be built based on Lot Wise, Mandi Wise, State Wise, Day Wise, Financial Year Wise, Calendar Year Wise and Stakeholder Wise

- Commodity Arrivals Vs Traded
- Arrivals Vs Assayed
- Arrival Vs Assayed Vs Traded
- Commodity Wise Assayed Lots
- Arrival Lots Vs Traded Lots Vs Assayed Lots
- Arrival Lots Vs Traded Lots Vs ePayment Lots
- Trade Qty Vs Trade Value (MT & Numbers)
- ePayment Lots Vs Mode of Payment
- ePayment Lots Ageing
- ePayment Settled Vs Unsettled

- Stakeholder Registration Vs Traded
- Stakeholder Registration Vs Bank Details and Govt. Id Not mapped and Mapped
- Inter Mandi and Interstate Trade Summary (Detailed and Summary)
- Average Bids Per Lot
- Traded Lots Vs Pending Lots
- Arrival Lots Vs Traded Lots Vs Exited Lots
- Top 10 performances in the Mandi and State (Farmer and Trader)
- Stakeholders Registration Web Vs Mobile
- Bid Analysis
- Top 10 performed Lots in Qty and Value
- Mandis with Zero Trade
- Arrivals Vs No Trade
- Incentives and Discounts
- Secondary Trades
- Sale Agreements Vs Sale Bills
- Stakeholder Wise Commodity Details Mapping (Selling & Buying)
- Feedback Analytics

1. PROJECT GOVERNANCE

Governance means all the processes that coordinate and control an organization's resources and actions. Its scope includes ethics, resource-management processes, accountability and management controls.

The Project Governance and Delivery Review offer a structured methodology and process that helps to mitigate risk and maximize deployment success. The Consultant reports to the FGPL Project Director and works with the project team as a reviewer and assessor. The engagement is proactive and should span the life cycle of the project.

Purpose

The purpose is to:

- Establish and maintain the **formal and informal processes** for managing the relationship between the Authority and the Strategic Partner
- Define the principles that both Parties wish to follow to ensure the **delivery of the Services**

- Ensure the continued alignment of the interests of the Parties
- Ensure that the relationship is maintained at the correct level within each Party
- Create the flexibility to revise and maintain this Agreement during the Term
- Set out the procedure for escalating disagreements
- Enable contract administration and performance management.

Project Governance Flow Chart



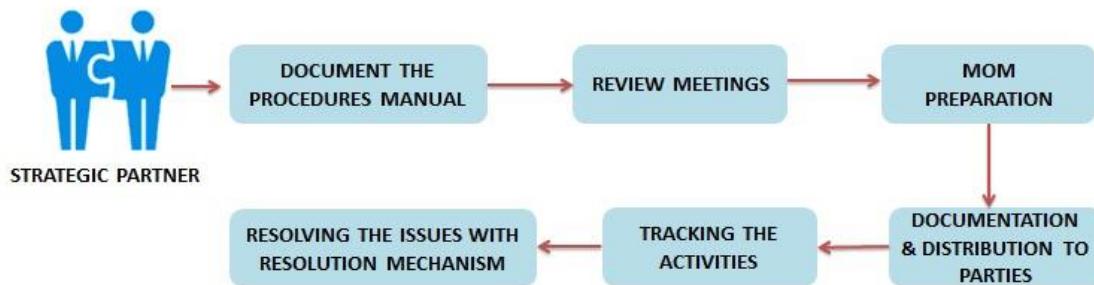
Governance Procedures

The Strategic Partner shall document the agreed structures in a procedures manual

- All meetings and proceedings will be documented, and such documents shall be distributed to the Parties and copies shall be kept as a record.
- All actions, responsibilities and accountabilities arising out of any meeting shall be tracked and managed
- The Parties shall ensure as far as reasonably practicable that they shall resolve the issues amicably
- If the disputed matter is having a material effect on the operation of the Services (or any part of Services) the Parties will use all their reasonable endeavours to reduce the elapsed time in reaching a resolution of the said disputed matter.

- If the Parties are unable to resolve the said dispute despite their reasonable endeavours, the said dispute shall be resolved as per the Dispute Resolution Mechanism.

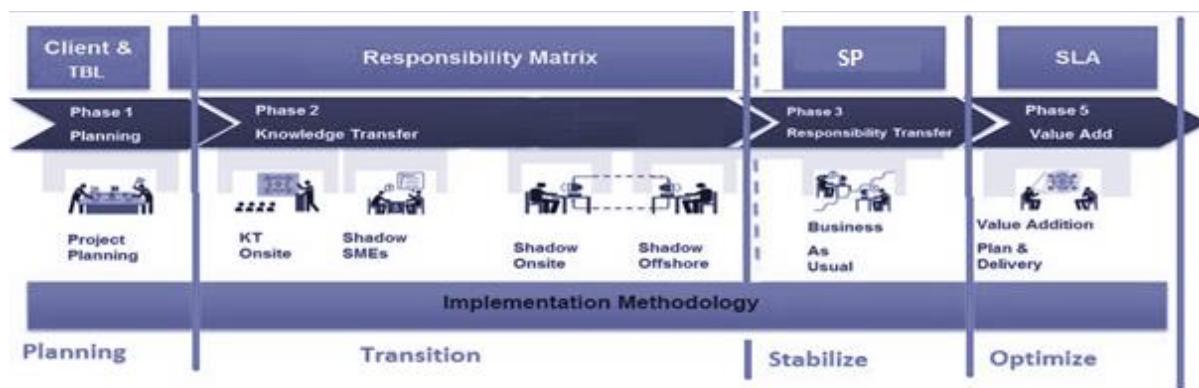
Governance Procedures:



Takeover plan and Methodology

By employing our global delivery model, Strategic Partner provides real results faster. This model uses a custom mix of onsite, offsite and offshore resources to provide cost-effective solutions for application maintenance. We use proven project Management practices to facilitate communication between our clients, to manage project workflow and to perform detailed design and analysis phases. Development and construction phases are carried out at our offsite/offshore development centres.

This methodology is powered by the Strategic Partner Global Delivery Service, which gives us the flexibility and ability to deliver a unique mix of services, onsite at the customer location, offsite / offshore development centres. This methodology consists of the following four phases: Plan, Transition, Stable and Optimize.



Planning

This phase focuses on developing a road map for overall outsourcing of the engagement, a project plan that spells out the roles and responsibilities of strategic Partner and the client, a detailed work breakdown structure, and the tools and techniques supporting processes like quality assurance, change management, risk management, reporting/communication and measurements.

Transition

During this phase, our team utilizes transfer processes for the collection and understanding of application management and business knowledge by the onsite and offshore staff so that the customer's environment is understood. We create business processes and management procedures. Baseline service level information is obtained as a basis for measuring the engagement progress. Resources from Strategic partner offshore development centers will travel to customer sites to acquire business knowledge expertise. The transition concludes with the transfer of responsibility for application support and/or maintenance from the client to Strategic Partner. The cut-over tasks are focused on completing a seamless transition of service from the customer to Strategic Partner with no interruption of service. Cycles are monitored, initial metrics are captured and reported and the workload is executed for the client.

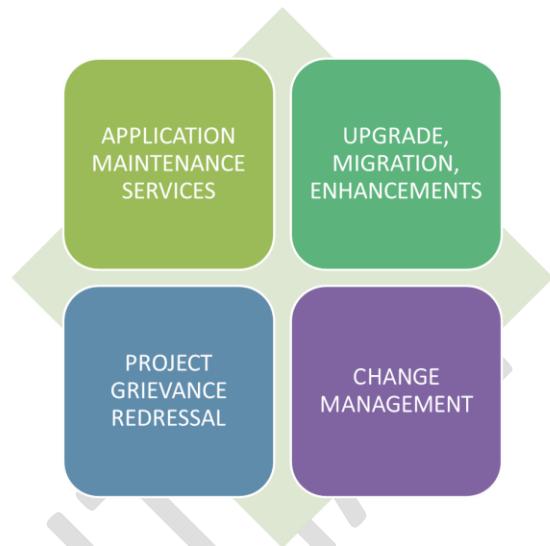
Stabilize

This is the post-evolution period when the complete workload is executed, additional workload is gradually shifted from onsite to offshore, process refinement occurs, metrics are analyzed, and a stable state of operations is reached. The Strategic Partner team gains additional experience in both the application management and business knowledge of the customer's environment and uses this knowledge to identify improvements throughout the customer's portfolio of applications.

Operations Plan and Methodology:

Operations are broadly classified as:

- a) Application Maintenance services
- b) Upgrade, Migration, Enhancements
- c) Change Management
- d) Project Grievance redressal



a) Application Maintenance services:

Based on the business understanding, Strategic partner proposes L1 and L2 support to NAM

L1 support:

Deploy an offshore development team to maintain the complex applications and reduce maintenance costs.

Strategy

- Strategic partner provides a scalable organization structure aligned with the client's IT needs, with multi-level communication for faster turnaround and issue resolution
- Deployment of an offshore development team to maintain the complex applications and reduce maintenance costs
- Built a secure and reliable communication link between the ODC and the client site to provide consultants with access to the same application environment
- Eliminated support and maintenance redundancy and provided global coverage for issues

Benefits

- Total cost of maintenance of the applications will reduced
- Improved time to deliver solutions
- Freed the client's IT resources for more strategic initiatives
- Enhancements to existing Oracle Financials functionality completely offshored in a period of months

-
- 24/7 support for the applications provided based on the TBL Delivery Model
 - Continuously meeting service expectations

L2 Support:

- Level 2 maintenance and support escalations from Level 1 Support for portal and custom application solutions.
- Enhancements in applications for the existing modules
- Program management services
- Process improvement services: requirement engineering, demand management, configuration management, documentation management.

b) Up-gradation, Migration and Enhancement:

There would be a mandatory requirement for upgrading to latest version to keep itself in tune with the changing technology and business needs.

RICE Components:

(Reports, Interfaces, Customizations and Extensions) components, forms, concurrent manager host programs per year were also converted and tested in new environment.

Business Benefits

- Product support for both application and database
- Better and improved controls using new features and user interface
- Support for disaster recovery based on the hardware configuration
- Increased agility in responding to new priorities by utilizing a portfolio approach to application ownership
- Increased satisfaction with software performance and technology updates among end-users
- Incorporation of IT strategy with management business strategy for improved customer satisfaction

c) Change Management

Change management is defined as the methods and manner in project describes and implements **change** within both its internal and external processes. There are changes in the processes, reporting structure, delegation of powers, administrative set-up, roles and responsibilities of the employees etc. The employees need to be delegated more authority. De-layering of the

decision making levels leads to Re-engineering and appropriate sizing of the decision-making machinery. All the changes in the system may not be welcomed by the stakeholders. Implementation is complex for the following reasons.

- Inherent difficulties
 - Long implementation
 - Underestimation of effort
 - Benefits accrue in the end whereas effort required upfront
- Large number of stake holders
 - Who are the drivers: consultants, departments, ICT authority, partner
 - Degree of support from top management for investment and involvement in implementation
- Design issues
 - Processes consistent and transparent versus flexibility
 - Integrating with legacy systems
 - Technical performance
 - Privacy, security and standardization
- Management of change
 - Extent of process reform
 - Varying comfort level with IT/screens
- Key components of successful change management are:
 - Leadership
 - Focused and coherent strategy, including defined objectives and implementation plans
 - Buy-In from stakeholders, which includes
 - Consultation
 - Incentives
 - Training; and
 - Monitoring and evaluation.

| Essential Elements of Change Management | |
|--|---|
| Stakeholder Management | Make sure all stakeholders are identified, relationships are managed; stakeholders get information about progress, programme needs, and benefits tracking, their feedback is received and incorporated in the Programme |
| | |
| | |
| | |
| Communication | Provide planned communication throughout the organization and |

| | |
|----------------------------------|---|
| Management | execute this along effective means and channels. Make sure that communication reaches the target audience in time and provides just enough information for that audience so that they are informed on and excited about the change and effectively implement it |
| Training | Provide training materials, trainers and logistics; ensure the target audiences are trained in the new ways of working (including data, processes, systems/tools and governance) just in time and just enough |
| Monitoring and Evaluation | Identified detailed information on assessed activities Developing Performance monitoring system to regularly collect data Reviewing, Analysing and Reporting Accountability ,Learning and decision making Process |

d) Project Grievance

- ❖ Helpdesk Facility has to be provided for submitting the grievance in GRMS through multiple channels like Web / SMS / e-mail / IVRS interface and using paper forms which will be scanned and uploaded at APMC helpdesk, 24*7 Kisan Call Centre, Common Service Centres, Information kiosk, etc. available in the vicinity of the farmers
- ❖ Strategic Partner would also need to set up a help desk working during business hours that will answer queries in the State language and English. The help desk can be centrally set up by the Strategic Partner.
- ❖ The Helpdesk staff should be able to log a ticket based on the user queries related to any component of system or operational part as defined under the scope of work and assign them a unique number
- ❖ The helpdesk staff shall assign severity level to each query, assign the queries to the appropriate personnel for resolution e.g. System/ Network/ Database/ Security administrators for queries/issues related to any of the corresponding areas.
- ❖ The helpdesk staff shall track each query to resolution, escalate the queries, to the Project Manager if necessary and provide feedback to users on the current status of their ticket.



- ❖ The helpdesk must always maintain high user satisfaction levels
- ❖ The helpdesk must maintain the SLA statistics & submit monthly report to the Customer
- ❖ Help Desk Coordinators shall generate reports using a call logging and reporting tool which should have the following reporting capabilities:
 - Call Analysis
 - Call Trend
 - Call History Report



Operation Smoothness:

We would deploy a working helpdesk system which will be integrated further with the GRMS through API integration for a holistic ticketing-based service desk management system. The following are the list of activities performed to ensure smooth operations:

- Provide First Level Extended Support for Infrastructure and Applications
- Receipt, analysis, classification, recording of incidents, events and problems
- Catch, Log and Dispatch calls
- Password resets
- Remote Logging-in to the point of failure and applying relevant SOP for resolution through various mode of interaction like email, chat
- Pro-active monitoring of application and services using enterprise tools
- Analysis and Reporting
- Integration with customers for information exchange, ideation and user story.

The following are the list of main and sub activities:

| Main Activity | Sub-Activity |
|--|--|
| Service Request Detecting & Recording | Answering calls |
| | Creating/populating tickets |
| Service Request | Use Knowledge Base/SOP's to troubleshoot incidents |

| Main Activity | Sub-Activity |
|--------------------------------------|---------------------------------|
| Classification & Matching | Classify & prioritise incidents |
| Service Request escalation | Escalation to L2 |
| | Updating of tickets |
| Customer Communication | Follow-up on ticket status |
| | Customer interface |
| | Customer follow-up |
| Service Request closure | Ticket closure |

A. Resource Roles & Responsibilities

In addition to above one dedicated project manager will be monitoring the overall project, detailed roles and responsibilities of project manager are as below:

- Project Manager
- State Coordinator
- Mandi Analyst / Mandi -SPOC

Responsibilities of Project Manager

- To ensure active participation from the Departmental users
- To coordinate with other government agencies and Department

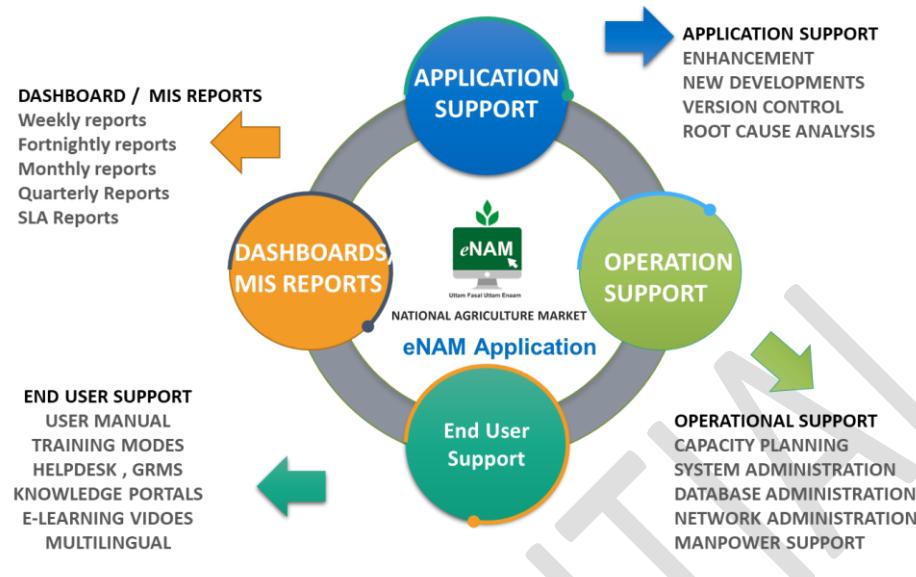
- Review and approve the solution design, implementation approach, and other reports as submitted by the selected bidder.
- To provide acceptance and Sign off SRS document
- To conduct review meetings at defined regular intervals to monitor the overall progress of the project.
- Provide feedback on changes to be in the solution to improve usability of the application software.
- Report problems/ bugs in solution to the selected bidder for immediate action/ rectification.
- Approval and disapproval of change requested including the finalization of efforts estimation, cost estimation, milestone and payment
- Prioritize the change requests as per project objectives.
- Co-ordination with the DC Operator and other stakeholders of the project.
- To ensure timely project milestones sign offs.
- To provide sign off/ acceptance of SRS, UAT, Commissioning Certificate, Acceptance of successful performance after completion
- Facilitate UAT, security audit and performance audit
- Appoint agency for third party audit of web portal & application s/w if needed
- To approve and oversee the proposed training plan
- Set up and administration of escalation mechanism
- Review and approve the payments to the bidder as per SLA



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- Any other help/ assistance/ co-ordination required for the successful implementation and operations of the work/ project

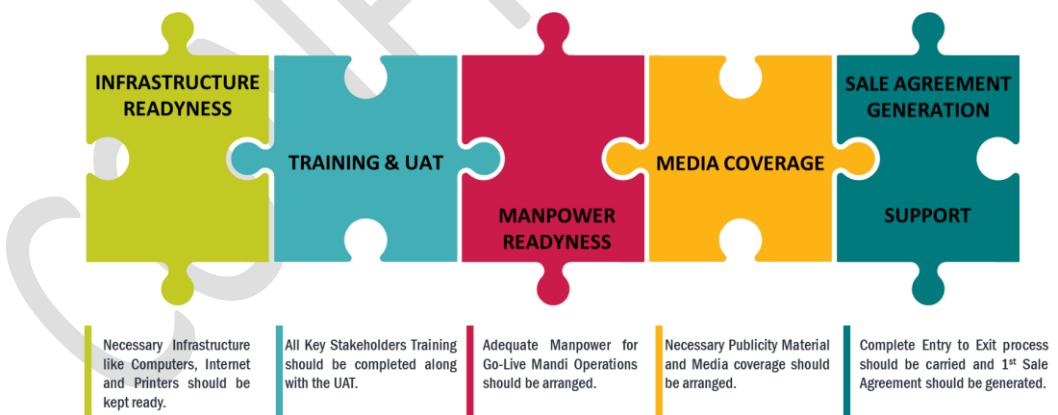
2. Application Support

To improvise e-NAM Platform, Government of India has initiated to integrate the Platform of Platforms (POP), Virtual Trade with eNAM ecosystem which will facilitate a Holistic Agri-value chain services to the Indian Agriculture.



Support During Rollout and Integration

- Master data collection and data sanitation support
- Ground Level Support to New Mandis for successful adoption of the e-NAM platform.
- First Sale Bill is generated as proof of trade completion on the platform.
- Interacting with the stakeholders to enlist their consent and participation in implementation.
- Identify access management.



3. Communication Management

Communications management is the systematic planning, implementing, monitoring, and revision of all the channels of communication within an organization, and between organizations.

Communication strategy in eNAM Project allows employees to refer to a standardized plan to interact with managers, colleagues and clients. A communication strategy ensures that everyone involved has adequate information to communicate about it, maintaining consistency in the workplace and preventing any ambiguity about work.

Communication plan identifies how important information will be communicated to stakeholders throughout the project. It also determines who will be receiving the communication, how those people will receive it, when they'll receive it, and how often they should expect to receive that information.

Communication Management Plan

A communication management plan documents how the project manager manages and controls communication. All stakeholder needs must be addressed. Communication management plan becomes a part of the project management plan.

The different types of performance reports include:

Status Report: Reports the current performance of the process against performance measurement baseline

Progress Report: Describes the total work accomplished

Trend Report: Whether performance has an upward trend, or a downward trend is reported by the trend report

Forecasting Report: Future project status and performance is reported basis current (or historical) data

| Communication Type | Description | Frequency | Method or Format |
|--|---|--------------------------|--|
| What type of communication is this? | What is the description of the contents/purpose of this communication? | E.g., Friday every week. | E.g., Meeting, Conference Call, E-mail, Document, Report |
| Kickoff Meeting | This is an informational meeting to share the visions, goals, and critical success factors. | Specific date | Meeting |

| Communication Type | Description | Frequency | Method or Format |
|-----------------------------------|--|-------------------|-------------------------|
| Project Status Reports | This is an informational document used to update the steering team, the project team, and further project stakeholders about project progress, performance, and issues. | Bi-Weekly | Report |
| Project Status Meetings | This is an on-site team meeting to discuss topics from the current week and to plan for the next week. | Weekly | Meeting |
| Steering Team Meetings | This is a meeting attended by all primary team members to give updates on the project plan and any issues that need to be resolved. | Monthly | Meeting |
| Daily Sprint Cycle Meeting | This meeting enables all members of the 30-Day Sprint Cycle Team to share their progress since the last meeting, their planned objectives to achieve before the next meeting, and any issues or problems that are preventing them from performing their tasks. | Daily | Meeting |
| Sprint Planning Meetings | These meetings provide an opportunity for the customer to explain their vision of the requirements that are to be implemented within the next sprint and how they will function. | Each Sprint Cycle | Meeting |
| Sprint Technical Preview | In this meeting, the customer is presented with the developed set of requirements at the end of a 30-day sprint and has the option to accept them as complete, reject them fully or partially, and request changes via the change control process. | Each Sprint Cycle | Meeting |

| Communication Type | | Description | Frequency | Method or Format |
|------------------------------------|--|--|--|-------------------------|
| Sprint Post Mortem Meetings | | This meeting is conducted at the end of the 30-day sprint cycle to discuss and gather feedback on the completed cycle. The aim of this meeting is to learn plug any shortfalls encountered in this cycle and implement the same within the next cycle. | Each Sprint Cycle | Meeting |
| Issues Log | | This is a tracking document that monitors outstanding issues and assumptions that need a resolution. | Updated every time a new issue arises | Document |
| Scope Change Management Log | | This is a tracking document used to monitor scope changes. | Updated every time a new scope change arises | Document |

| Communication Type | Description | Frequency | Method or Format |
|---------------------------|--|---------------------|-------------------------|
| MIS Report | Log of backup and restoration undertaken. | Weekly reports | EXCEL / PDF |
| MIS Report | Log of component-wise downtime because of replacement any component at the Data centers or Disaster Recovery site | Weekly reports | EXCEL / PDF |
| MIS Report | Summary of resource utilization of critical components" | Weekly reports | EXCEL / PDF |
| MIS Report | Project Progress Report with schedule slippage details | Fortnightly reports | EXCEL / PDF |
| MIS Report | Overall performance reports including the analysis of queries completed, queries pending, queries escalated, completion time, responsiveness, concern areas, etc | Fortnightly reports | EXCEL / PDF |

| | | | |
|-------------------|--|---------------------|-------------|
| MIS Report | Network availability report in co-ordination with NIC team | Fortnightly reports | EXCEL / PDF |
| MIS Report | Summary of resource utilization of all application components in the Data Centers or in the Disaster Recovery site | Fortnightly reports | EXCEL / PDF |
| MIS Report | Summary of measured end user application response time for business transaction | Fortnightly reports | EXCEL / PDF |
| MIS Report | Summary of Used component uptime in the DC sites | Monthly reports | EXCEL / PDF |
| MIS Report | Summary of changes undertaken in the DC sites including major changes like configuration changes, release of patches, database reorganization, storage reorganization, etc. and minor changes like log truncation, volume expansion, user creation, user password reset, etc | Monthly reports | EXCEL / PDF |
| MIS Report | Consolidated SLA / non-conformance report | Monthly reports | EXCEL / PDF |
| MIS Report | Updated Software Inventory Report | Monthly reports | EXCEL / PDF |
| MIS Report | Updated IT Assets configured at Data Center and Disaster Recovery site based on recommendation given by Strategic Partner to NIC team | Monthly reports | EXCEL / PDF |
| MIS Report | Incident Reporting | Monthly reports | EXCEL / PDF |
| MIS Report | Complete system down – with root cause analysis | Monthly reports | EXCEL / PDF |
| MIS Report | Peaking of resource utilization on any component | Monthly reports | EXCEL / PDF |
| MIS Report | Bottlenecks observed in the system and the possible solutions and workarounds | Monthly reports | EXCEL / PDF |
| MIS Report | Security Incident Reporting | Monthly reports | EXCEL / PDF |
| MIS Report | Detection of security vulnerability detection with the available solutions / workarounds for fixing | Monthly reports | EXCEL / PDF |
| MIS Report | Hacker attacks, Virus attacks, unauthorized access, security threats, etc. – with root cause analysis and | Monthly reports | EXCEL / PDF |

| | | | |
|-------------------|--|-------------------|-------------|
| | plan to fix the problems | | |
| MIS Report | Any hazards or events like fire, environmental conditions, physical security, etc. at the Data Centres in co-ordination with NIC team | Monthly reports | EXCEL / PDF |
| MIS Report | Prepare ad-hoc reports and data analysis where standard reports are not available | Monthly reports | EXCEL / PDF |
| MIS Report | Maintain application deployment specifications for all instances of the e-NAM Platform application | Monthly reports | EXCEL / PDF |
| MIS Report | Develop and practice a robust disaster recovery plan to ensure no loss of data | Monthly reports | EXCEL / PDF |
| MIS Report | Database report and Asset Audit report | Quarterly Reports | EXCEL / PDF |
| MIS Report | Summary of incidents reported like Application down, Components down, overall downtime, security vulnerabilities detected, hacker attacks / security threats, peaking of utilization etc | Quarterly Reports | EXCEL / PDF |
| MIS Report | Feedback report from users for the Services rendered | Quarterly Reports | EXCEL / PDF |
| MIS Report | All type of reporting should be submitted periodically as per SLA measurement interval to the FGPL | SLA Reports | EXCEL / PDF |

a) Disaster Recovery Management

This Disaster Recovery Plan is designed to ensure the continuation of vital business processes if a disaster occurs. This plan will provide an effective solution that can be used to recover all vital business processes within the required time frame using vital records that are stored off-site. This Plan is just one of several plans that will provide procedures to handle emergency situations. These plans can be utilized individually but are designed to support one another. The first plan is the Crisis Management Plan. This plan allows the ability to handle high-level coordination activities surrounding any crisis. We will also discuss the development, maintenance and testing of the Disaster Recovery Plan. Lastly, we will discuss the culture and employee education on Disaster Recovery.

The term "disaster" is relative because disasters can occur in varying degrees. So, this Plan has considered this issue and incorporates management procedures as well as technical procedures to insure provable recovery capability.

The next key issue to be strongly considered within the strategy for disaster recovery is a recovery strategy for alternate processing (Hot-Site). This plan discusses the Hot-Site and the alternatives if the primary location is not available to provide Disaster Recovery services for the various system environments.

The final issue to be addressed within the Disaster Recovery Strategy is to ensure that every reasonable measure has been taken to identify and mitigate potential risks that exist within the processing environment. **The most successful Disaster Recovery Strategy is one that will never be implemented; therefore, risk avoidance is a critical element in the disaster recovery process.**

A Disaster Recovery Management System can be defined as the on-going process of planning, developing, testing and implementing Disaster Recovery management procedures and processes to ensure the efficient and effective resumption of vital business functions in the event of an unscheduled interruption. With the growing dependence on I/S and the Business Process to support business growth and changes associated with their complexities, compounded with the complexities of changing technology, the following elements are key to implementing a comprehensive Disaster Recovery Program:-

- Critical Application Assessment
- Back-Up Procedures
- Recovery Procedures
- Implementation Procedures
- Test Procedures
- Plan Maintenance

eNAM DRP Introduction

Disaster Recovery is the process & practices to recover user access to their application data and/or hardware that are needed to resume the performance of normal, critical scheme business functions after the events of even a natural Disaster or a disaster caused by technical failure or by human intervention.

National Agriculture Market (eNAM), the flagship program of the Honorable Prime Minister achieved cumulative trade as on date is 3.59 Cr. MT worth INR of 104,829 cores since its inception, 14th April 2016. More than 1.67 core Farmers, 1.46 lakh Traders & approximately 84,773 Commission Agents has registered with around 8000 system operators in eNAM Application until date.

In 1000 APMCs located across 18 states & 3 UT's approximately 22,000 lots worth nearly 10 cores are being traded through eNAM platform on a daily basis. Mandi operations & trade timings across the nation range from midnight 12 AM to next day late evening which literally demands 24x7 eNAM application operations. In our initial stage of eNAM implementation we observed even a small technical glitch has led to violent agitation inside the Mandi by Farmers & Traders.

In view of above implementation experiences & current days expanded statistics of project eNAM Is indicating the complexity and dependency of the post harvesting agricultural produce trading across the nation which is very risky to operate without a proper business continuity plan and specially a Disaster Recovery environment.

Information Technology projects of such large scale, which is dealing with critical data, round the clock operations and huge users' base, is always a risk factor without a viable Disaster Recovery plan. It may be machine or hardware failure, application errors, human mistakes, unpredictable natural calamities etc. can cause business interruptions, and a Disaster Recovery site in a different geographical location will help to eliminate such interruptions.

Disaster Recovery Scenario

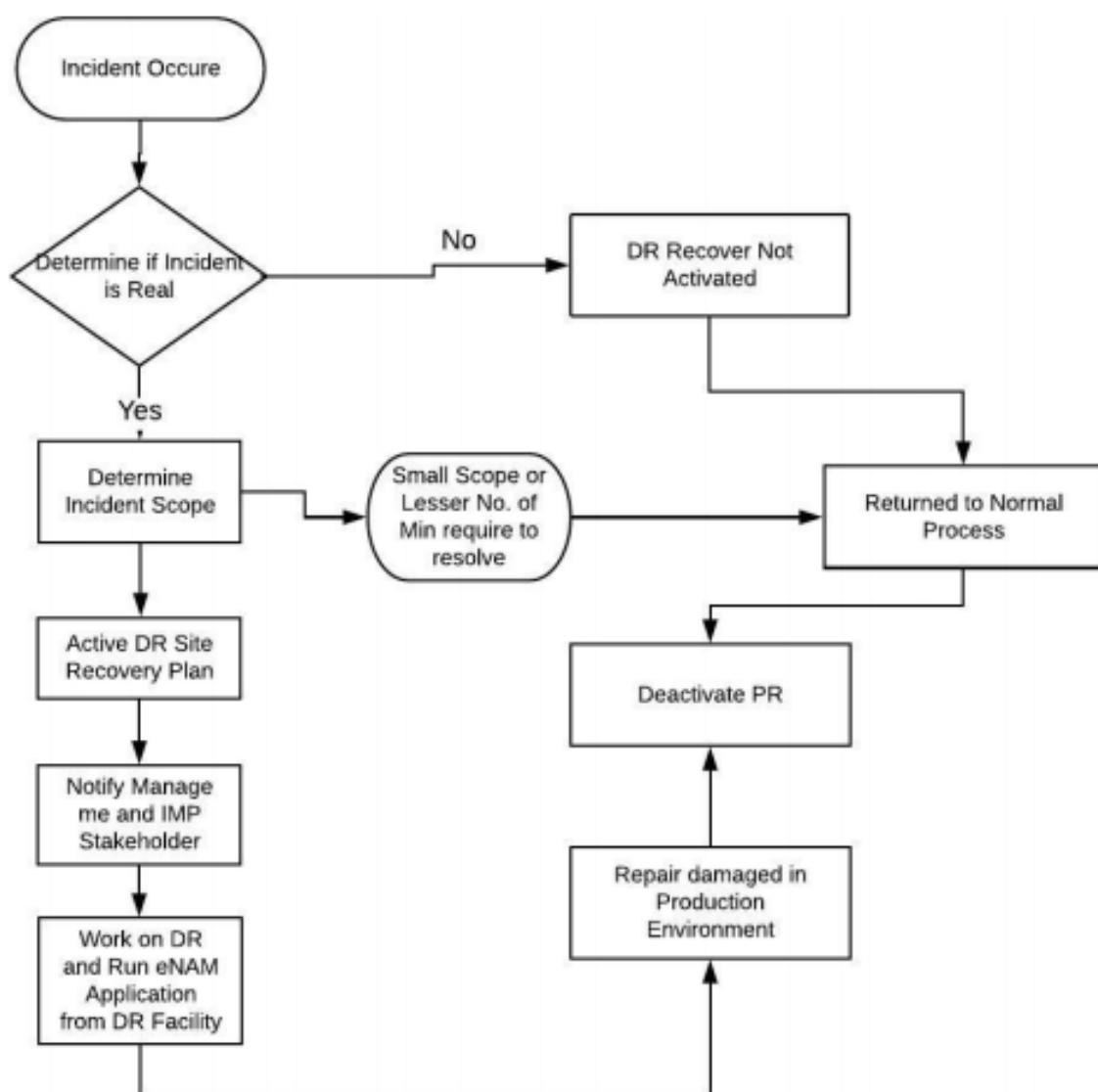
The disaster recovery scenario that will be specifically addressed, within the scope of this plan, is the loss of access to the computer center and the data processing capabilities of those systems and the network connectivity. Although loss of access to the facility may be more probable, this Disaster Recovery Plan will only address recovery of the critical systems and essential communications.

This scenario also assumes that all equipment in the computer room is not salvageable and that all critical telecommunications capability has been lost.

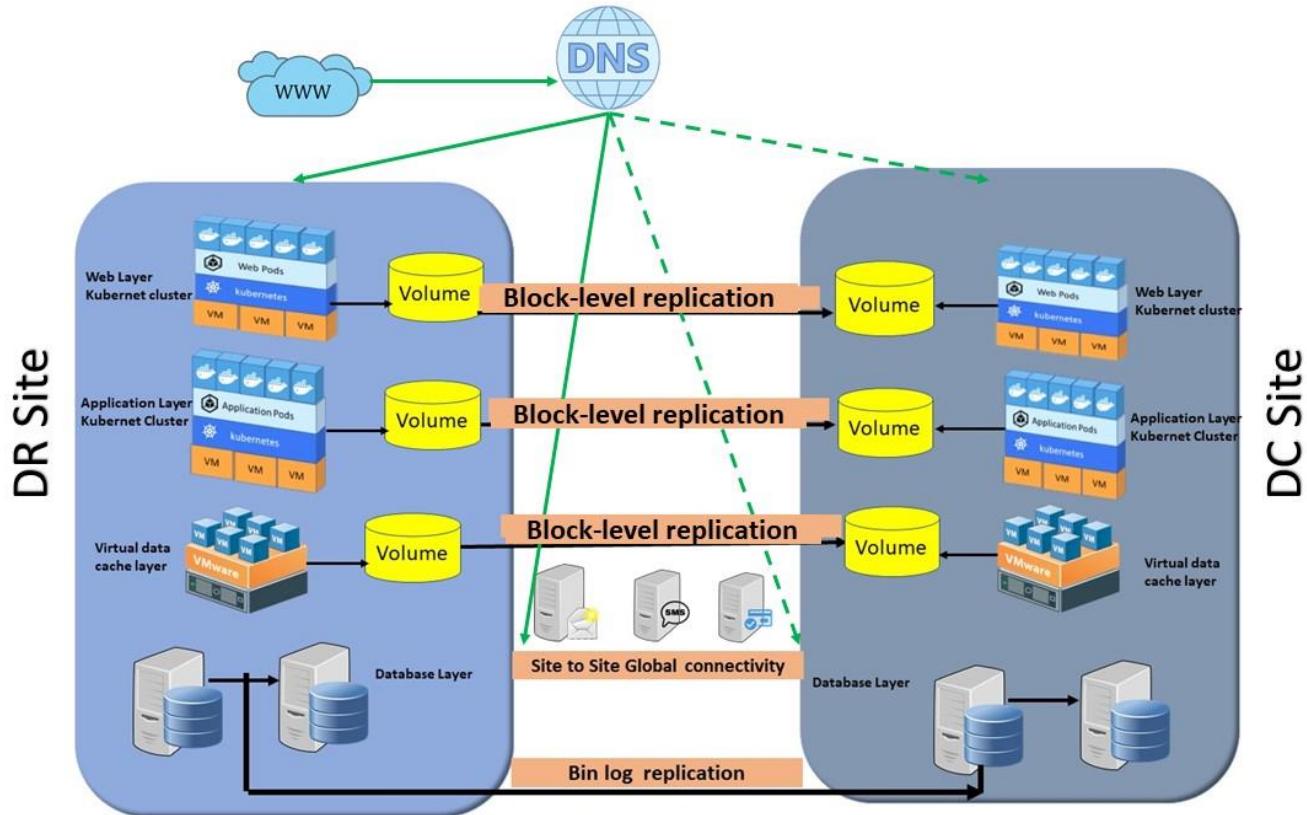
In the event of a declared Disaster, key personnel will take immediate action to alert the Disaster Recovery Center. Restoration of the Critical Coverage will be provided after a Disaster is declared and after turnover of the disaster recovery backup site. It will include, without limitation, the following:

- a) Delivery of the Authorized User Data and Software archived in off-site storage to the Disaster Recovery Center
- b) Connecting Network lines to the Disaster Recovery Center
- c) Operating the Critical Applications on the Configuration at the Disaster Recovery Center
- d) Provide Critical Coverage at the Disaster Recovery Center
- e) Provide workspace and required equipment.

eNAM Disaster Recovery (DR) activation Process Diagram



eNAM Disaster Recovery (DR) Logical Diagram



eNAM DRS Process

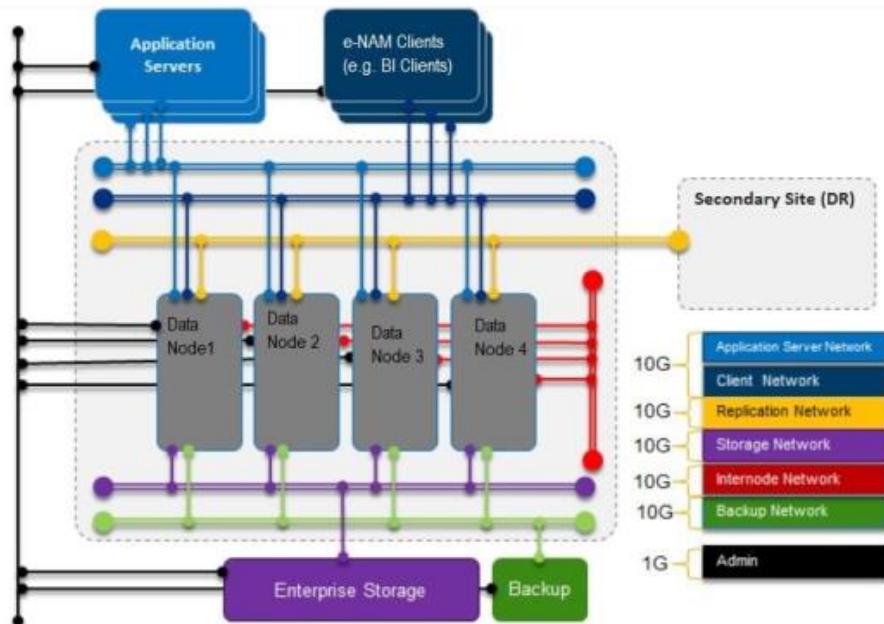
Above presented diagram is a logic diagram for DR architecture

Architecture design will be such that deployment can be easily scaled using Kubernetes stack to auto scale the services based on dynamic demand.

- All the Web Pods data will be synced through Block level replication
- All the Business layer Pods data will be synced through Block level replication
- All the Database will be replicated with Bin logs
- The DR and DC network layer Should be connected dynamic DNS to minimize the RTO and maintain minimum RTO and Site can be recovered Immediately
- The Block Level replication helps to maintain RPO and No loss of Trade settlement data

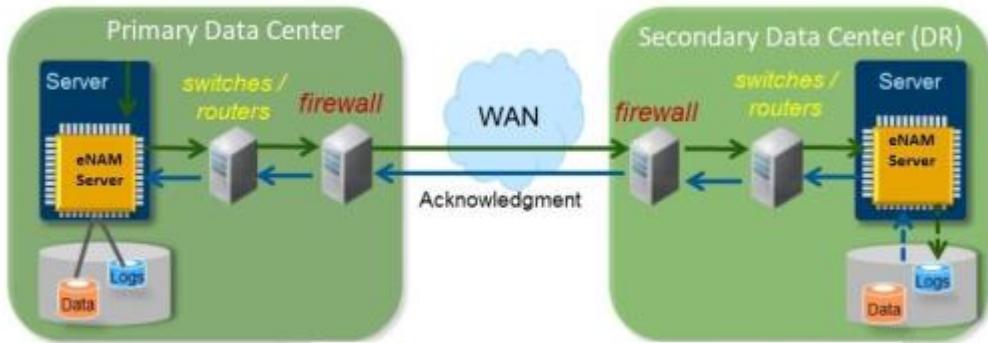
Assumptions:

1. In Case of Cold, DR the replication will be Asynchronous in nature and move server to Server by rsync in application, while code movement will be done immediately from DC to DR as a standard practice.
2. For e-NAM System Replication the bandwidth depends on the business load on the primary system of application. Transactional database and double the log amount as a buffer and use this per time unit to be transferred to the other side. This is then the minimum transfer rate. On top, we need further bandwidth for peaks from the delta data transfer happening every 10 minutes. This depends also on the business load and can vary accordingly. Therefore, we do not simply want to request a 10 Gbit dark fiber line between data centers but keep the cost as effective as possible according to effective business load, which will be calculated during DR configuration stage. Based on this final RPO and RTO will be calculated.
3. The following picture shows a possible network configuration for a e-NAM system running on hosts that are connected via an internode network (red). In addition, there are two types of clients attached: e-NAM application servers (light blue) and other e- NAM clients (dark blue, for example, the BI Application). The data is persistently stored on enterprise storage (purple) and backed up to a separate storage location (green). To make this setup highly available, a standby host has been defined; moreover, the data is replicated to another data center using asynchronous system replication (yellow). In addition, the use of external administration tools is possible thanks to the configuration of a separate, low-



bandwidth administrative network (black).

Since e-NAM application, system replication is a solution that involves the transfer of large amounts of information across significant geographic distances, the limitations in Wide Area Networks (WAN) technology will influence in asynchronous replication.



There is no straightforward recommendation regarding the bandwidth and the latency a system replication network must provide. A rough estimation of the required performance is given below. NAM system replication must meet the following two minimal requirements regarding throughput and latency:

- **Throughput:** It must be possible to transport the size of the persistently stored data within one day from the primary to the secondary data center.
- **Latency:** The redo log shipping time for 4KB log buffers must be less than a millisecond or in a low single-digit millisecond range – depending on the application requirements (mostly relevant for synchronous replication, but essential for asynchronous replication).

Assuming a shared network with 10Gbit/s bandwidth, the following table shows the round-trip ping latencies (in ms) between data centers which are achievable and reasonable.

b) Grievance Redressal Mechanism

Introduction

It is mandate of each Government Department to provide clean, efficient and transparent administration. Grievance Redress Mechanism has always been the part of Administration. In fact, the grievance redress mechanism of an organization is the scale to measure efficiency and effectiveness of any government department as it throws light on the way in which administration of Government Department works.

Administration or any system cannot be said accountable, responsive without having effective Grievance

Redress Mechanism. Key challenge is to handle it effectively and promptly. Information and Communication Technology can help in establishing prompt, effective, service-oriented Grievances Redressal and Management system.

Grievance Redressal and Management System has been included as major component under NAM Project to provide efficient mechanism to receive and monitor grievances of the various stakeholders in agricultural sector especially farmer. Farmer is the major stakeholder in the Agricultural sector and also in the NAM project. Farmer does not have fixed income and many a times depends on Government schemes and programs to meet both ends. Though Government schemes and programs in agricultural sector are being launched with good intentions, benefits may reach only partially or sometimes may not reach to the farmers at all due to denial of service or delay in processing.

Most of the times farmers and other stakeholders in agricultural sector are not able to get satisfactory and total services from government departments. Delay is the major factor that generates the grievances. Farmers are at the receiving end as they do not have knowledge about the procedures, means, time and access to government mechanism to lodge their grievances against lack of or inefficient, delayed services resulting in mute acceptance of the system as it is.

Grievances continue to arise because of a high systemic tolerance for delay and non-accountability in every day performance of functions. It is necessary to provide the efficient mechanism for timely receiving, addressing, managing and monitoring the grievances of all the stakeholders in this sector. Especially farmer should be empowered to register his grievances against the system which

introduces delay and creates hurdles for him against timely availing benefits of the Government schemes and programs meant for him.

It is proposed that the grievances related to software functioning and maintenance shall be resolved by the SP within the stipulated time prescribed in the contract. For physical delivery related issues, the relevant AMPC (mandi committee) shall be responsible and shall resolve grievances within a stipulated time. Grievance redressal would be more complex for cases where more than two APMCs are involved (from two different states). Such cases shall be reported to FGPL which shall act as the coordinating body and request the APMCs involved to take actions as may be appropriate. The APMCs would then act within their regulatory framework.

Scope of Grievance Redressal Management System

The following basic components shall be considered in the GRMS system:

- Provision for easier and approachable channel for submitting the grievances
- Multiple Gate Ways for submitting the grievances and for delivering the services

Based on above scope, following points was considered in the development of GRMS for NAM project:

- a) The GRMS shall be the part of the NAM project and provide an integrated common platform for all types of grievances.
- b) The grievances in GRMS will be received from grass root level i.e. from the farming community across the country. The technological solution should be easy to use for them.
- c) Facility has to be provided for submitting the grievance in GRMS through multiple channels like Web / SMS / e-mail etc at APMC helpdesk, Kisan Call Centre, Common Service Centres, Information
- d) Kiosk, etc. available in the vicinity of the farmers.
- e) It should have provision to acknowledge the complainer by issuing Grievance registration number through SMS / e-mail / IVRS / WEB Interface.
- f) The System should support multi languages / regional languages.
- g) Automatic generation of reminder / SMS alert to concerned officer, if action has not been taken in specified time.
- h) The GRMS system shall be automatic as much as possible with less human intervention except for submitting and updating the status of grievances.
- i) Provision for broadcasting of any specific / urgent information for farmers / Stakeholders / Government Officers in case of any calamity.
- j) Facility to forward the application to concerned authority through email with update Link for

-
- updating the application remark and status.
- k) Provision to inform status of the action taken on the grievances submitted through SMS, email and web based.
 - l) Proposed solution should be able to provide tool for monitoring and managing grievances.

Objectives

- a. Establish a single window system for farmers and other stakeholders to register their grievances
- b. To bring efficiency and effectiveness in Grievance Redress
- c. To bring transparency
- d. 24x7 access for farmers and other stakeholders of Agricultural sector to lodge the complaints using the channels available in their vicinity
- e. Workflow based Grievances Redress and Management System
- f. Publishing the public grievances work and receipt/disposal statistics relating to redress of public grievances for common public
- g. Easy monitoring from higher levels – To review of receipt and disposal of grievances, to track no response, delayed response of incomplete and non-satisfactory response.
- h. Availability of database and analytical reports to record and monitor the progress of grievance redress, identify the section/division where it is being sent, etc., know the time taken in dealing with the grievance, enable review of pending grievances to study problem prone areas and suggest remedial measures for prevention
- i. Ability to fix time limits for disposal of work relating to public grievances and generate automated alerts if these time limits are crossed.
- j. Online acknowledgement generation of each grievance petition, indicating the name, designation and telephone number of the official who is processing the case, the time frame in which a reply will be sent.

Expected Outcomes

- a. Easy interface to submit the Grievances
- b. Effective Monitoring of Grievances
- c. Immediate Dissemination of information to farmer, trader and other concerned stakeholder

GRMS (Grievance Redressal Management System) Framework

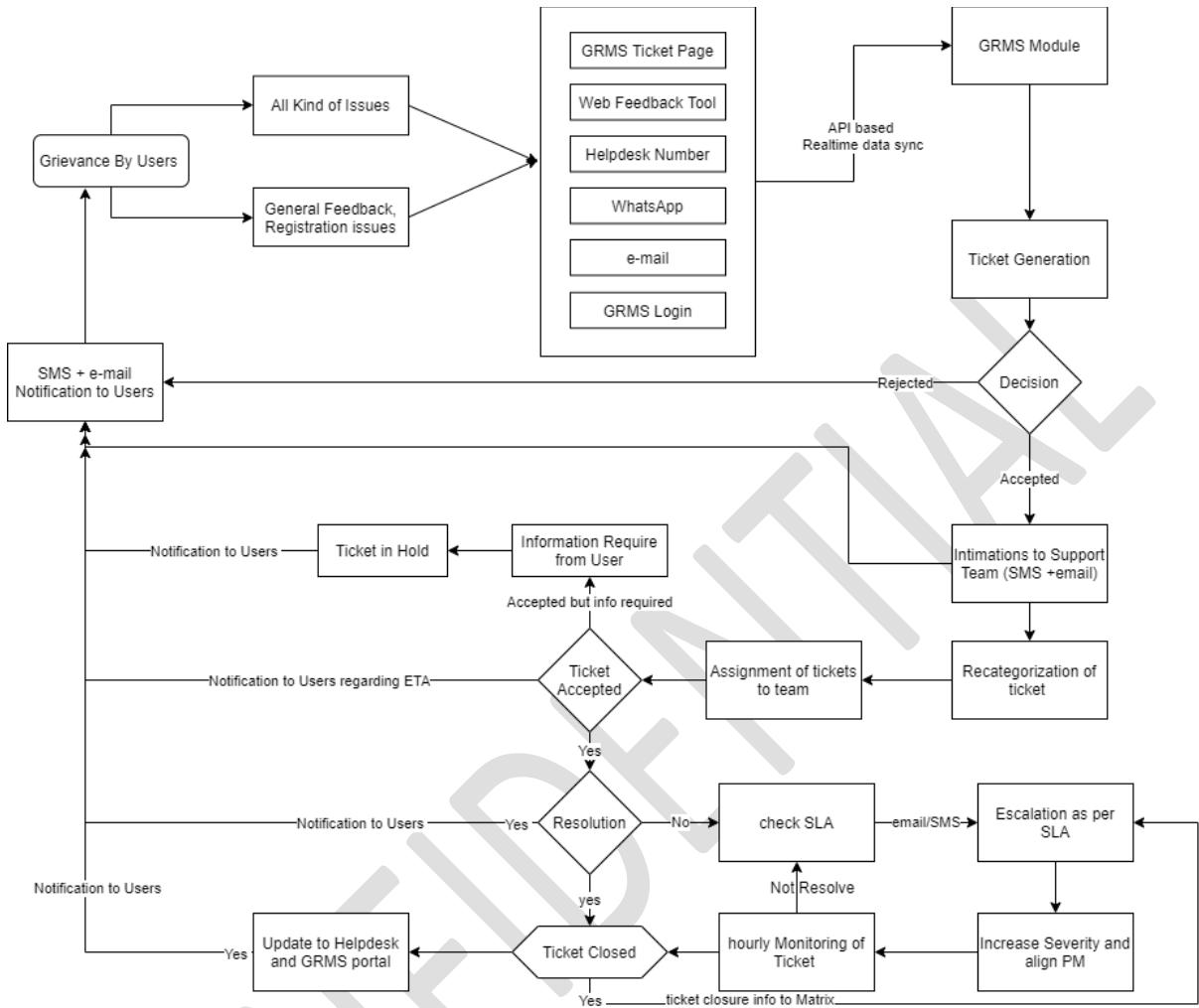
GRMS is provided for online tracking of grievances and also stakeholders can register their grievances through help desk, web site and track their status on line.

GRMS incident management is anything that interrupts business continuity.

The scope of GRMS incident management starts with an end user reporting an issue and ends with a service desk team member resolving that issue.

Raising Grievance

- a. User will have following option to raise the Grievance through :
 - i) Portal
 - ii) Call Centre
 - iii) Email
 - iv) SMS
 - v) WhatsApp
- b. While raising the Grievance user can select to whom the Grievance should be raised – APMC/SAMB/FGPL.
- c. If done through Web, User will be able to upload supporting documents as well.
- d. User will be provided a Ticket Number for the Grievance Raised.
- e. APMC/SAMB/FGPL Grievance Administrator will get a Ticket Raised by the user in the Grievance Management Dashboard.



Reassigning Grievance

Grievance Administrator can evaluate whether the Grievance is related to Software or Administrator. If it is related to Software, administrator can reassign it to SP-IT Administrator.

Grievance Not Related to Software

If the Grievance is not related to software then the administrator will evaluate whether it can be resolved at that layer (APMC/SAMB/FGPL) and if it needs reassignment to Higher or Lower layer (GPL/SAMB/APMC user) it can be done-eg; If APMC finds that certain query needs to be resolved at SAMB level he/she can reassign the same to SAMB and vice-versa.

Resolving Grievance:

Once the Grievance is resolved the status of the Ticket can be updated and user can see the status on the dashboard.

Tracking of Grievance Ticket:

User can track the status of the Grievance ticket by the ticket number generated during raising the grievance.

GRMS Report

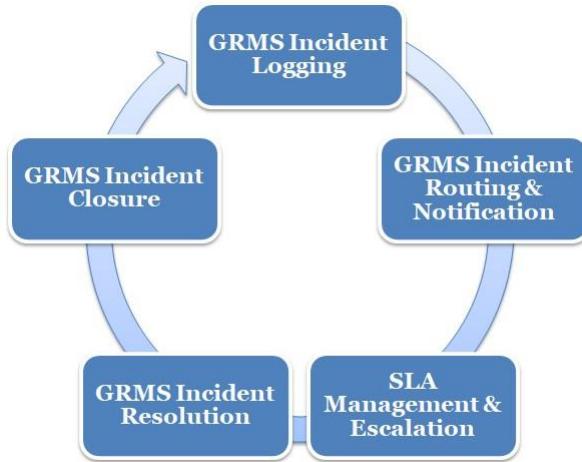
The Grievances can be tracked through downloading the report provided for specific login, for monitoring it regularly.

The Stages in GRMS Incident Management

With proper GRMS incident management in place, collecting information about incidents is streamlined and less chaotic without having emails fly back and forth for the purpose

Incident management process when enabled with the relevant automations allows service desk teams to keep an eye on SLA compliance, and sends notifications to technicians when they are approaching an SLA violation; technicians also have the option to escalate SLA violations by configuring automated escalations , as applicable to the incident. After diagnosing the issue, the technician offers the end user a resolution, which the end user can validate. This multistep process ensures that any issue affecting business continuity is resolved as soon as possible.

GRMS Incident management lifecycle



- **GRMS Incident logging**

GRMS incident can be logged through phone calls (1800270-0224), emails(nam@FGPL.in, enam.helpdesk@gmail.com), SMS, web forms published on the self-service portal of eNAM.

GRMS Incident routing and assignment

- It gets routed to eNAM Helpdesk Team
- **SLA management and escalation**

While the incident is being processed, the technician needs to ensure the SLA isn't breached. An SLA is the acceptable time within which an incident needs response (response SLA) or resolution (resolution SLA). SLAs can be assigned to incidents based on their parameters like category, requester, impact, urgency etc. In cases where an SLA is about to be breached or has already been breached, the incident can be escalated functionally or hierarchically to ensure that it is resolved at the earliest.

| SLA Description | SLA | CASE LEVEL |
|---|-----------------|------------|
| Requester Incident Receipt Confirmation via automated mail | Instant | Level 1 |
| Resolution or Copy of open Incident Notification and Discussion with FGPL | After 48 hours | Level 2 |
| Incident closure | Within 72 hours | Level 3 |

Management reports helpful in monitoring and analyzing and identifying nature and areas of dissatisfaction to take action pro-actively. From the NAM Portal the Grievance will be redirected to the concerned Offices. The L1, L2 and L3 Officers will then check the Validity of the Grievance and answer it accordingly.

- **GRMS Incident resolution**

GRMS incident is considered resolved when the technician has come up with a temporary workaround or a permanent solution for the issue.

- **GRMS Incident closure**

GRMS incident can be closed once the issue is resolved and the user acknowledges the resolution and is satisfied with it.

- **GRMS Incident status**

How far along an incident is in the incident management process? Common statuses include:

- **New:** An incident that has been logged but not yet worked on.
- **Assigned:** An incident that has been received in the IT help desk and assigned to a technician.
- **In progress:** An incident that has been assigned to a technician and is in the process of receiving a resolution.
- **Resolved:** An incident that was worked on by a technician and has received a resolution.
- **Closed:** An incident that was closed once the resolution was acknowledged by the end user.

The key performance indicators for GRMS incident management:

Metrics that drive important decisions are termed key performance indicators (KPIs). Below are a few KPIs for effective IT incident management.

- **Average resolution time-** The average time taken to resolve an incident.

- **Average initial response time**- The average time taken to respond to each incident.
- **SLA compliance rate**- The percentage of incidents resolved within an SLA.
- **First call resolution rate**- Percentage of incidents resolved in the first call.
- **Number of repeat incidents**-The number of identical incidents logged within a specific time frame.
- **Reopen rates**- The percentage of resolved incidents that were reopened.
- **Incident backlog**- The number of incidents that are pending in the queue without a resolution.
- **Percentage of major incidents**- The number of major incidents compared to the total number of incidents.
- **End user satisfaction rates**- The number of end users or customers who were satisfied with the IT services delivered to them.

Glossary for GRMS incident management

Incident

An unplanned interruption to an IT service or reduction in the quality of an IT service. Failure of a configuration item, even if it has not yet affected a service, is also an incident

Incident identification

The process of discovering an incident.

Incident logging

Creating and maintaining a record of an incident in the form of a ticket.

Incident closure

Closing an open incident ticket once the incident has been resolved.

Incident escalation rules

A set of rules defining the hierarchy for escalating incidents, including triggers that lead to escalations. Triggers are usually based on incident severity and resolution time.

Incident management

Managing the life cycle of all incidents to restore normal service operation as quickly as possible and minimize business impact.

Incident management report

A series of reports produced by the incident manager for various target groups (e.g. teams responsible for IT management, service level management, other service management processes, or incident management itself).

Incident manager

The person responsible for the effective implementation of the incident management process and carrying out reporting. Also represents the first stage of escalation if an incident is not able to be resolved within the agreed service level.

Incident monitoring

Tracking the processing status of outstanding incidents so that counter measures may be introduced as soon as possible if service levels are likely to be breached.

Incident record

A collection of data with all details of an incident, documenting the history of the incident from registration to closure.

Incident report

A report that includes information about incidents, how they were handled, and other data that can help measure the performance of the incident management process.

Incident resolution

The workaround or correction that fixes the incident and restores service to its best quality.

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