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# Inventory Management System (IMS): Transforming ARV Supply Chain In India

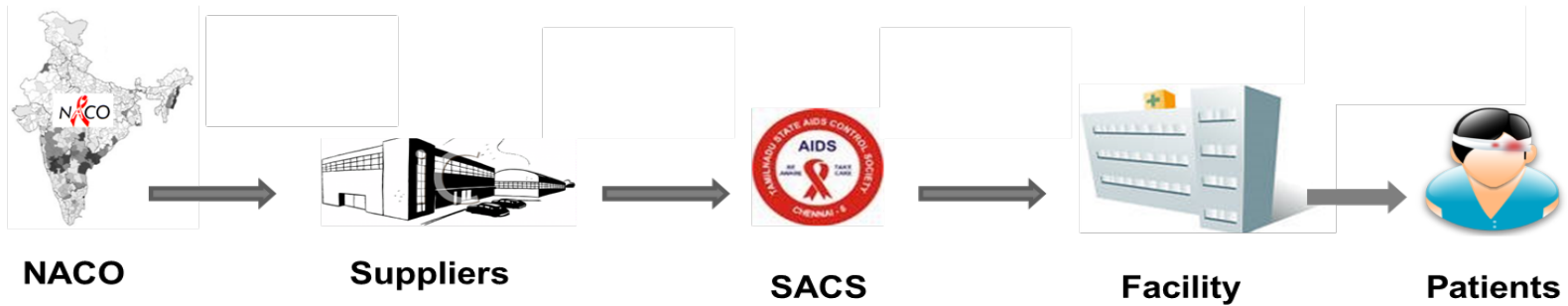


- Prateek Gupta
- Nisha Subramanian
- Aude Wilhelm

## Clinton Health Access Initiative Access and Supply Chain Team



# NACO Supply Chain – Overview



## Fast Facts

79 Centrally Procured Items

~20,000 Point of Care Facilities

39 State Warehouses (SACS)

524 ART Centres

~930K patients on ARV Drugs

> 10M patients served (annual)

Fixed Demand – Low Supply Chain Complexity



# Supply Chain Challenges

## Symptoms

### Relocations

To balance demand & availability of drugs/kits

### Expiries & Shrinkage

Significant % of inventory procured not utilised

### Stock Outs

Non-finalisation of tender or imbalance in demand

### Productivity

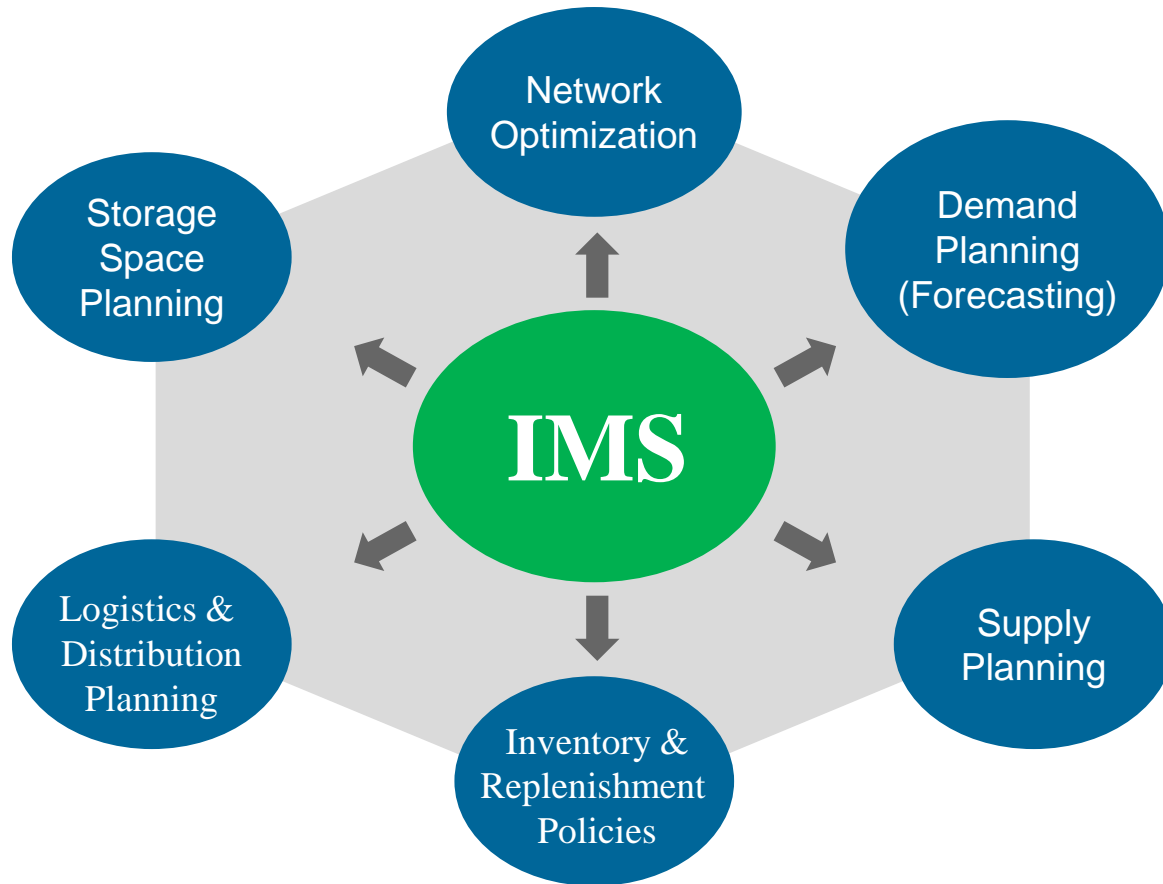
Considerable time spent in manual registers & reports, manual errors

## Issues & Challenges

- Demand Planning & Forecasting
- Supply Planning & Scheduling
- Inventory Management & Replenishment
- Storage Space Planning & Optimization
- Logistics Optimization
  
- Supply Chain Performance Monitoring
- National Standard Operating Procedures

**Impact:** Patient Treatment, Budget Utilization, Productivity

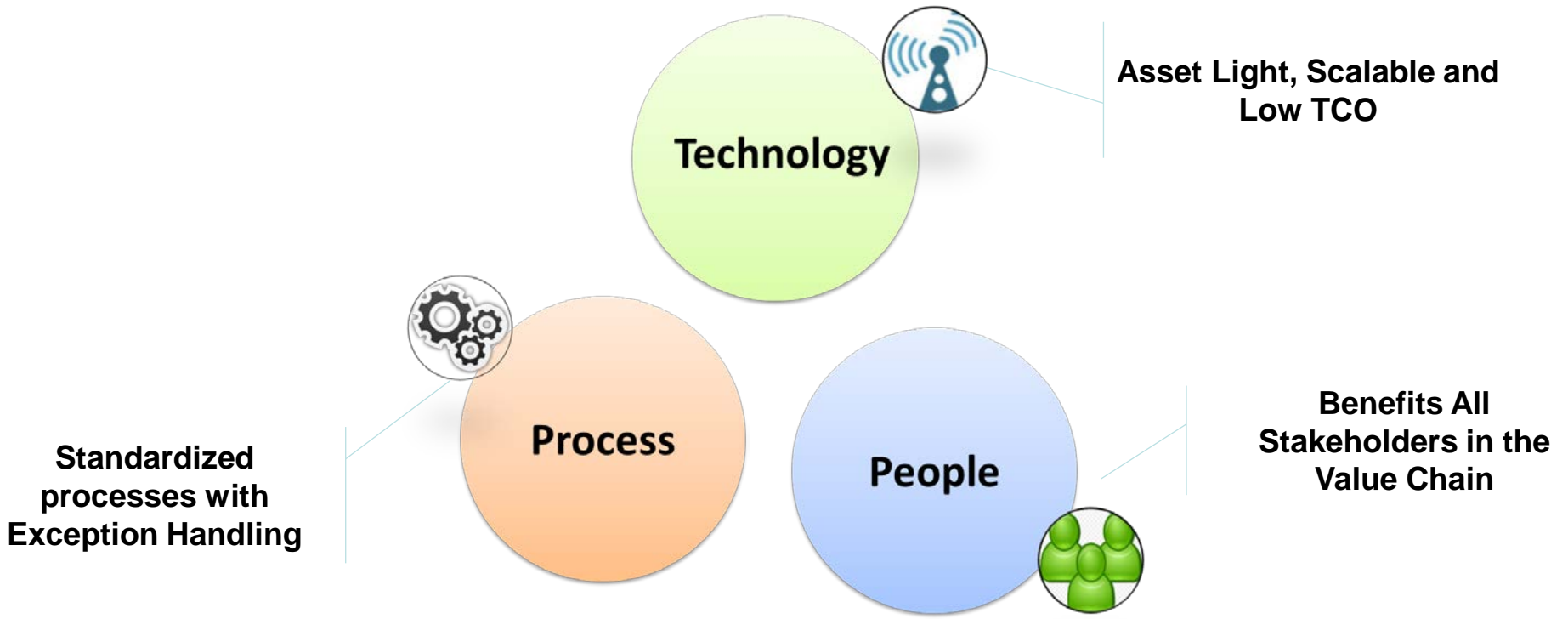
# The missing link...



“The goal is to turn data into information, and information into insight.”.. Carly Fiorina



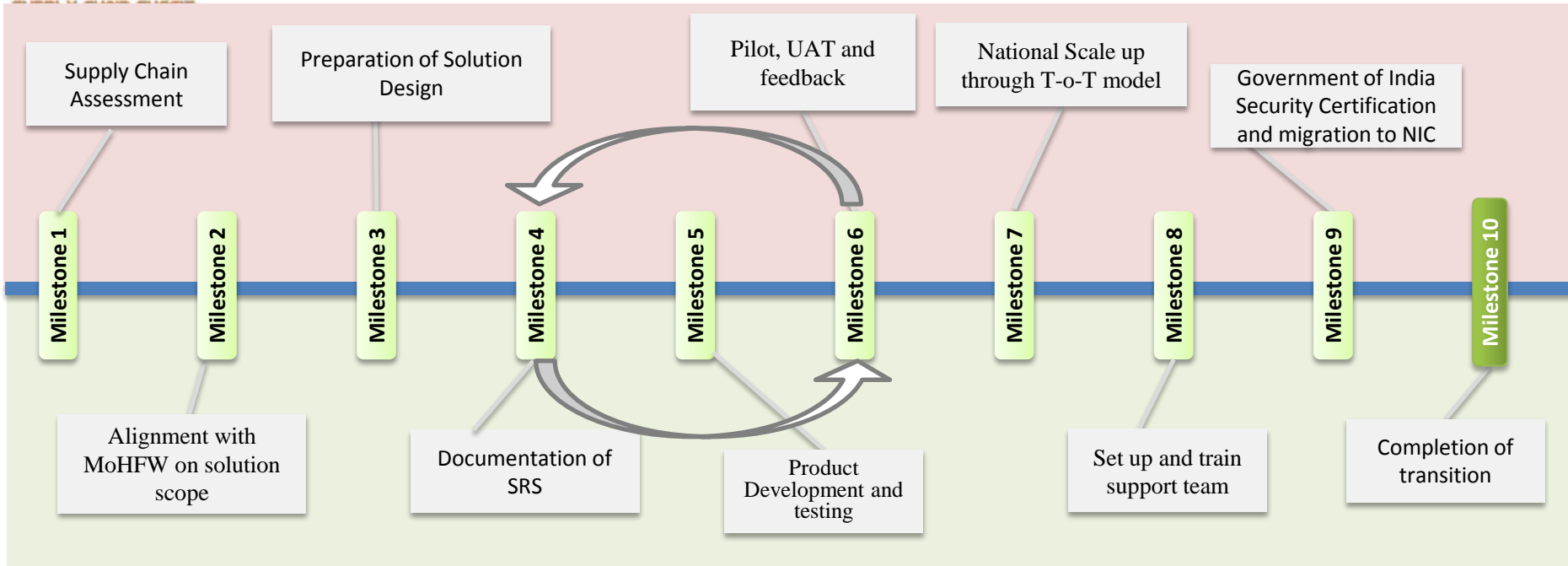
# Precursors to Technology-led Interventions



Without right Processes and People in place, Technology solution will not be sustainable



# Project Phases (2013- 2016)



## Solution Design

NACO provided timely sign off on the scope of the solution

## Solution Development

NACO helped the CHAI team to understand all the inventory processes

## Implementation

NACO ensured availability of infrastructure at all levels

## Transition

NACO provided sign off & NIC infrastructure



# IMS: Features & Functionalities

## Basic

Contract & Supplier Management	Stock Reports & Management	Stock Receipt & Dispatch
Product & Facility Management	Patient Registration & Dispensation	Event Notifications – email + SMS
Dispensation Reports (National, State & Facility)	Barcode Enabled	Role based Dashboards

## Advanced

Automated Patient Status Tracking	CD4 & Adherence Monitoring	Digitally Signed Invoices for Supply Payments
Independent Reporting Engine	Role-based Access Privileges	GIT Inventory Tracking
Patient Bio-Metrics (Fingerprint)	National Patient Portability	Offline Dispensation (Windows + Android)

Configurable

Open Source

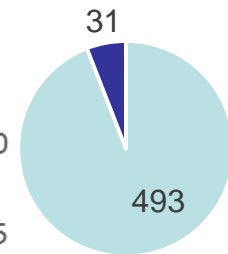
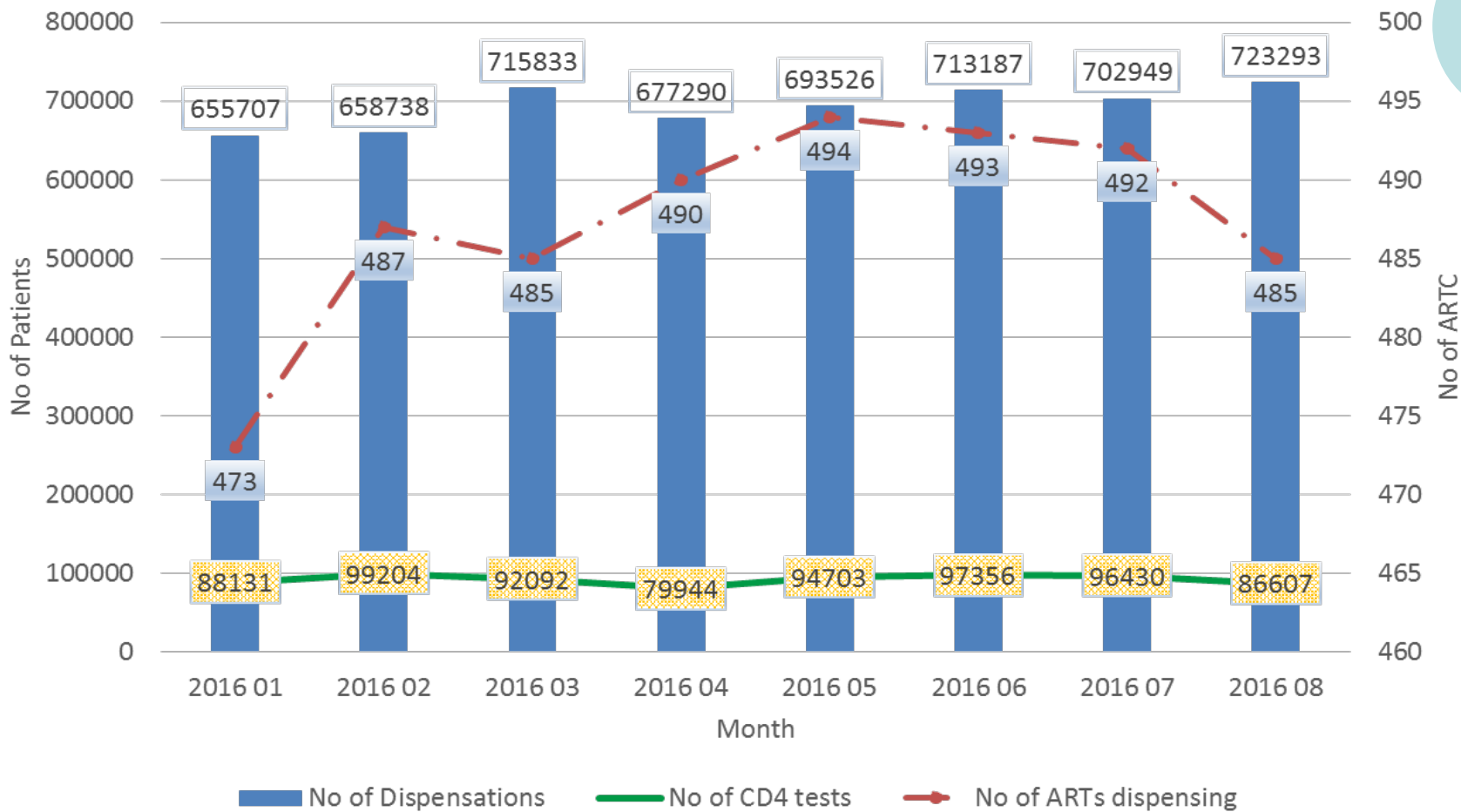
Modular

Customizable



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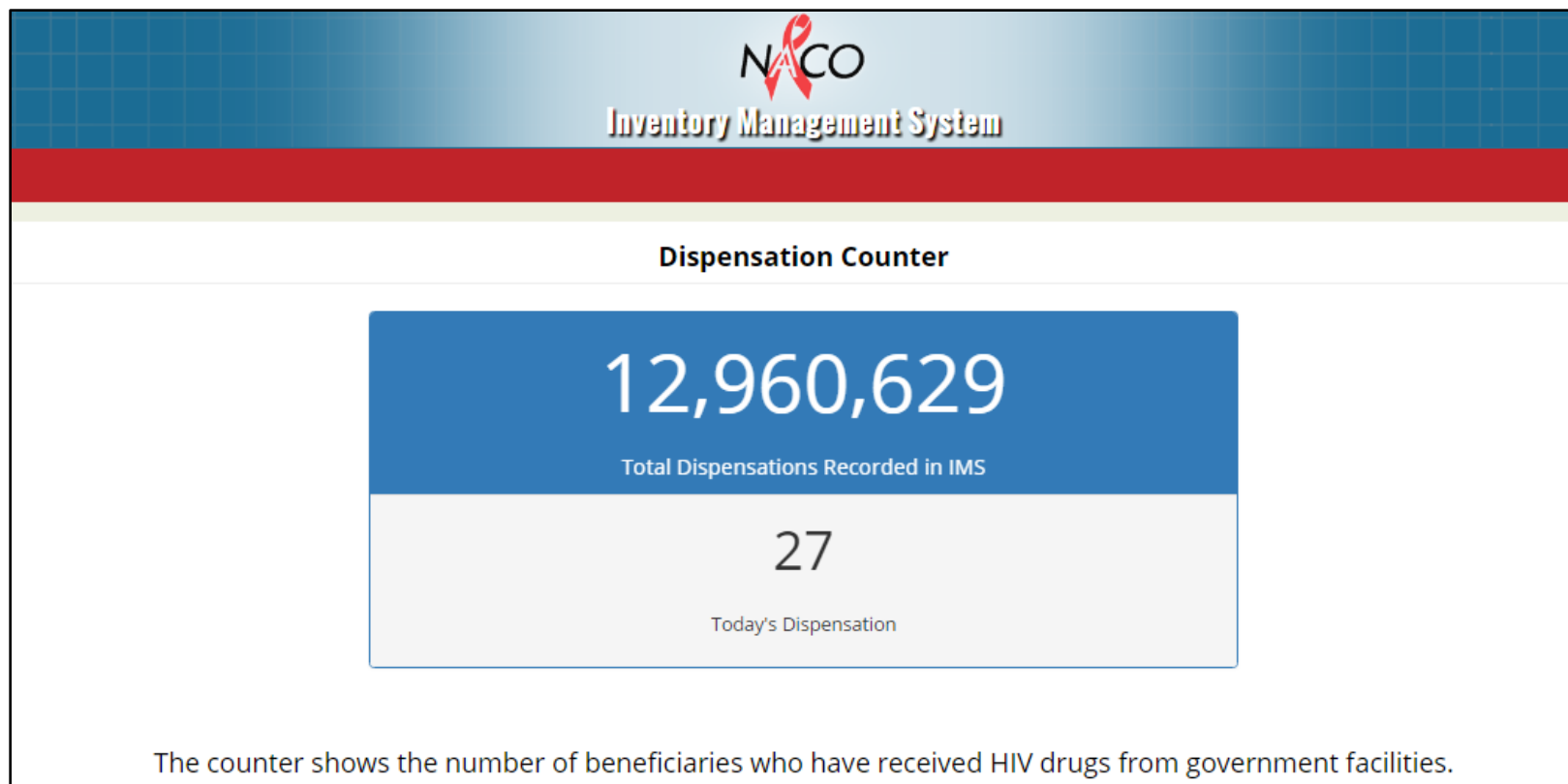
# National Stats: ARTC Usage





# Dispensation Counter

<https://ims.naco.gov.in/dcount>



Screenshot taken as on 13<sup>th</sup> Nov 2016- 0326 hrs



# Dashboards & Report Generation

## Reports

- Improved Reporting Engine
- Faster report generation
- More comprehensive reports
- Customizable reporting

## Dashboard

- Dashboard with Key Information highlighted
- Key patient data - Expected patients, etc.
- Key stock levels – low stock, expiry stock
- Alerts & Notifications

## Inventory Reports

- Daily Inventory Report
- Near Expiry Report
- Patient Dispensation Report
- Expected Patients Report
- Missed Appointment Report
- Stock Ledger Report
- Dispatch Report

## Consolidated Reports

- Stock Summary Report
- Stock Out Report
- Expiry Report
- National Inventory Report
- State Dispensation Report

## Patient Reports

- Patient Status Reporting (On ART, Mis, LFU, Transferred etc)
- Patient Profiles
- Link ART Reporting
- Regimen based Reporting
- Dispensation summary with Stock Requirements

In addition, more in-depth analyses and reports can be generated from the database



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# Role Based Dashboards

Ministry of Health & Family Welfare  
Government of India

**NACO**  
Inventory Management System

Welcome, FAROOQ ALI PANWAR (Purcharser)  
SF MC, Bikaner  
Last Login: Nov 17, 2016 @ 12:32 pm

Dashboard Patients Dispensation Products Relocate Receive Reconciliation Link ART Users Reports Settings Help Logout

## Dashboard

**Incoming** 0  
3 Days in Transit

**QIT** 2  
190 Days - Ongoing

**Expiry in next 3 months** 15

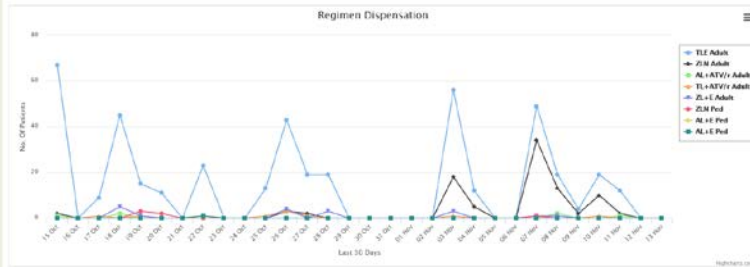
**Due List** 0  
13-Nov  
14-Nov 15-Nov

## Notifications

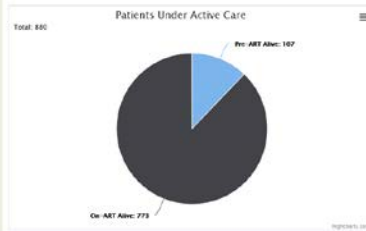
Show 10 entries

Description	Notification Type	Date/Time
Stock Adjustment has been made for Efavirenz 200 mg tablet by SP MC, Bikaner	Inventory	02 Jun 2016
Stock Adjustment has been made for Stavudine 30mg + Lamivudine 150mg + Nevirapine 200mg by SP MC, Bikaner	Inventory	01 Jun 2016
STN (STNS0000016013013) has been approved for dispatch to ART Centre, Hanumangarh from ART Centre - S.P. Medical College, Bikaner	Approval	07 Jan 2016
STN (STNS0000016013012) has been approved for dispatch to ART Centre - District Hospital, Nagaur from ART Centre - S.P. Medical College, Bikaner	Approval	07 Jan 2016
STN (STNS0000016013014) has been approved for dispatch to ART Centre, Govt DB GH, CHURU from ART Centre - S.P. Medical College, Bikaner	Approval	07 Jan 2016

All Regimen  Include LACs



Regimen	No. Of Patients
TLE Adult	664
ZLN Adult	234
ZLN Ped	7
ZLN E Ped	2
TL+N Adult	1
AL+N Ped	4
ZLN Adult	31
AL+E Ped	6
SLN Adult	1
SL+E Adult	1
AL+E Adult	2
AL+N Adult	12
TL+ATV Adult	14



Patient Status	No. Of Patients
Pre-ART Alive	107 4.54%
On-ART Alive	773 34.95%
Pre-ART LFL	110 4.37%
Pre-ART Died	234 16.58%
Pre-ART Opted Out	104 4.70%
Eligible for ART	13 0.59%
Pre-ART MIS	0 0.00%
ART Died	601 27.37%
ART LFL	66 2.98%
ART Opted Out	90 4.07%

## Dashboard

**NOA Behind Schedule** 27  
View Details

**ZLN-A Status** 3.81  
40%

**TLE-A Status** 3.02  
52% Delivered

**Unique Dispensations (last month)** 662930  
Today's Dispensation 14884

## Notifications

Show 10 entries

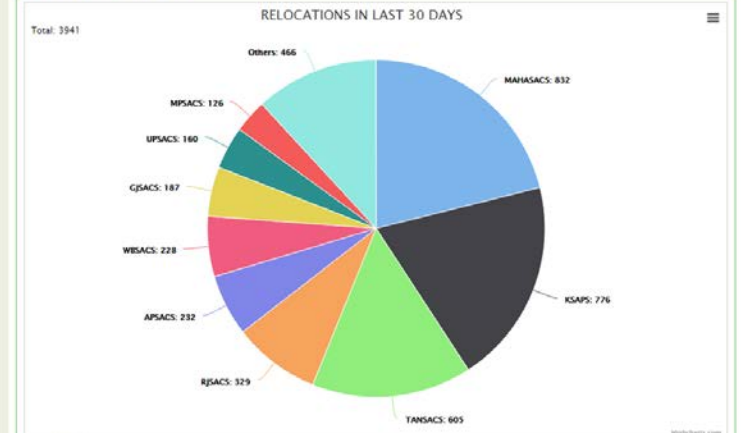
Description	Notification Type	Date/Time
FAC generated for consignment from Aurobindo Pharma Ltd for Zidovudine 300 mg + Lamivudine 150 mg tablets	GRN	19 Apr 2016
FAC generated for consignment from Beacon Diagnostics Pvt Ltd for RPR Test Kits	GRN	19 Apr 2016

## Inventory Position

Select Products

SACS	(ZLN-A) Zidovudine 300mg+ Lamivudine 150mg + Nevirapine 200mg Tablets			(EFV-A) Efavirenz 600 mg tablet			(TLE-A) Tenofvir 300mg + Lamivudine 300mg + Efavirenz 600mg		
	Monthly Consumption	Stock	Months of Inventory	Monthly Consumption	Stock	Months of Inventory	Monthly Consumption	Stock	Months of Inventory
National	18931515	72073229	3.81	1032769	4946066	4.79	8982718	27128731	3.02
AMACS	0	0	0.00	0	0	0.00	0	0	0.00
ANDAMANSACS	0	0	0.00	0	0	0.00	0	0	0.00
APSACS	3097270	11227412	3.62	138999	453042	3.26	1525359	4572768	3.00
ARUNACHALSACS	1120	5700	5.09	49	1380	28.16	334	450	1.35

## Relocations Since 19 Mar 2016





# Impact

## Short Term (Operational)

- **Productivity:** Automated notifications and on demand reports have increased productivity of IMS users by ~28%
- **Inventory Rationalization:** Analysis of supply, consumption and stock data led to procurement rationalization saving **17M USD** in first 6 months
- **Unlocking Efficiencies:** Has enabled increased ART eligibility, introduction of 3<sup>rd</sup> Line drugs and other resource intensive initiatives.
- **Reduced Relocations:** Relocations have reduced from couple of thousand to less than 500 in a month
- **Supplier performance** : Enabled real time monitoring of supplier performance

## Long Term (Strategic)

- **Forecasting:** Increased accuracy of Forecasting and Demand leading to improve budget utilization
- **Increased Accountability and Transparency** – Positively impact expiry, drug availability.
- **Advanced Patient Insights:** Real-time data from IMS can be leveraged to get insights into patient treatment data like
  - Retention cascade analysis
  - Adherence analysis
  - CD4 / Viral Load trend analysis
  - Reducing LFUs and SMS based monitoring

Laid the foundation for programmatic transformation



# Conclusions

For Inventory to flow down, information needs to flow up

Manual system of record keeping, detrimental to SCM and performance

Digital recording of inventory transactions- Necessity and not Luxury,  
for large, complex and optimized supply chains

Essential QRs- Robust, Scalable, Configurable and Customizable

Implementation, Adoption, Change Management-  
Key to SCM transformation

Payoffs are exponential compared to TCO of Inventory Management System



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Thank You

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Clinton Health Access Initiative  
Access and Supply Chain Team



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## Additional Slides

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# Critical Success Factors

## Solution Design

- Focus on user transactions; discourage “EOD reporting”
- Design solution to add new features and requests without compromising data integrity
- User interface must be intuitive enough for novice users
- Continual engagement with the development team
- Prevent loss of data; team uploaded validated data of suppliers, locations, inventory, patients etc.

## Implementation

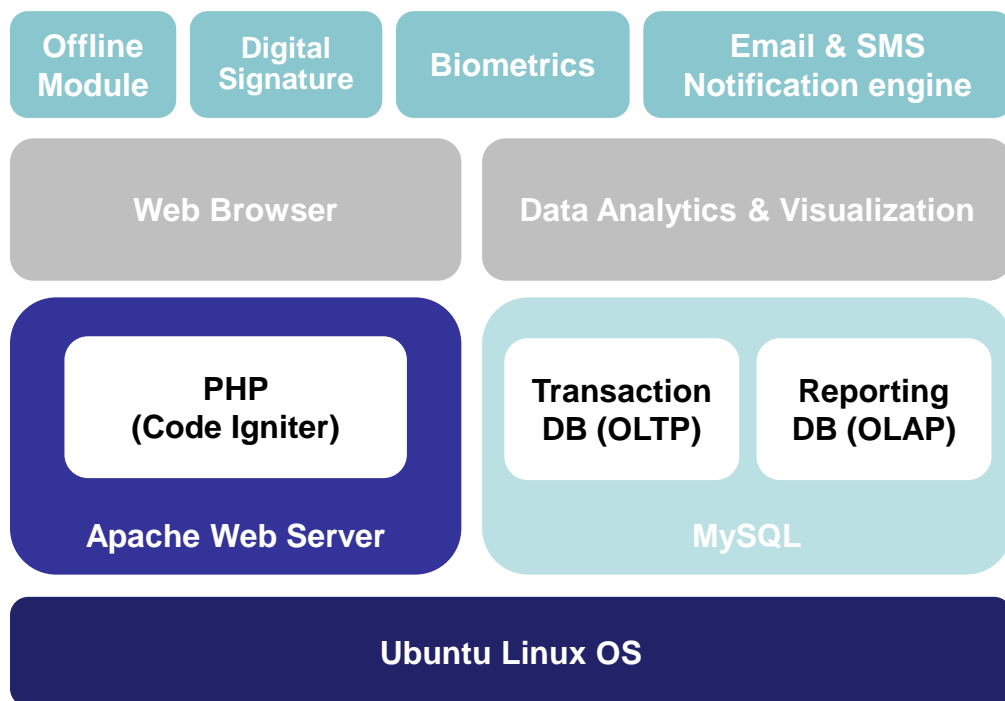
- Have right team members for managing stakeholders, designing solution, change mgmt. and training
- Identify the Project Champion from MoH
- Frequent communication to create awareness within the organization
- Conduct field studies to understand and document all the processes with exceptions
- Record user feedback; team documented and studied 500+ user suggestions received during UAT

## Sustained Usage

- Plan and conduct a “Deep Implementation”; team conducted 130 hands-on workshop to train 1400 users
- Present a strong value proposition to all users – “What’s in it for me?”; reports generated from IMS improve productivity across user base
- Ensure the organization is on board; NACO conducts monthly reviews with project directors of all states to ensure 100% adoption of IMS
- Plan and build capacity for a successful transition



# Architecture Overview



- Solution developed and deployed on an open source LAMP Stack
- Dedicated reporting database –provides capability to generate reports without affecting transactions
- Modular design of solution – can easily be updated to include other features/ modules
- Implements a role based access control system – helps configure access to features without code change
- Open source & Licence free – interoperability - integration with other systems



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# Android Tablet Version- Offline

ART Centre  
Fortis Hospital, New Delhi

Search Patient Patient Name/ ART Number

- Dashboard
- Patient List
- Today's Dispensation
- Record Consumption
- Data Synchronization
- User Settings
- Logout

21 Due List 24 Patient

© 2015 NACO IMS

Search Patient Patient Name/ ART Number

Product Dispensed	Available Qty.	Batch	Expiry	Adherence (%)	Remaining Pills	Dispence Qty
Type product name to add						

NEXT APPOINTMENT 14 Apr 2016

14 days 30 days 60 days

11 May 2016	12 May 2016	13 May 2016	14 May 2016	16 May 2016	17 May 2016
0	0	0	0	0	0

Dispensed to: Patient Proxy Side Effect Select

Confirm Dispensation Copied to clipboard. Cancel Dispensation

21 Due List 24 Patient Dispense Today's

Search Patient Patient Name/ ART Number

Patient Name: sun Age: 61 Gender: F ART Number: 001213 Status: 1

Regimen: NA Weight band: NA Appointment Date: 10 May 2016 Last Visit: 11 Apr 2016

REPEAT LAST DISPENSATION

REGIMEN MODE DISPENSATION

PRESCRIPTION MODE DISPENSATION

VISIT HISTORY

Visit Date	Product Dispensed	Remaining Pills	Adherence	Dispenced Qty
11 Apr 2016	EFV-A (Efavirenz 600 mg tablet)	NA	NA	56

21 Due List 24 Patient Dispense Today's

Data Synchronization

Sync Your Data from Online

Last data sync Apr-11, 2016 | 2:25 pm



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# Dispensation to Patients

## Current Visit Dispensation Details

Repeat Last Dispensation

Regimen Mode Dispensation

Prescription Mode Dispensation

Product	Avail Qty.	Batch	Expiry	Adherence (%)	Remaining Pills	Dispense Qty
ZLN-A (Zidovudine 300mg+ Lamivudine 150mg + Nevirapine 200mg Tablets) - Tablet	130950	<a href="#">LZE115088</a>	2018-10-31			120

Type product name to add

Next Appointment: 16 May 2016

14 Days  30 Days  60 Days

Date	0	0	0	0	0
12 May (Thu)	13 May (Fri)	14 May (Sat)	16 May (Mon)	17 May (Tue)	18 May (Wed)

Dispensed to:  Patient  Proxy (picked up on behalf of patient)

Side Effects: Select

Biometric Captured:

Confirm Dispensation

Cancel Dispensation

## Patient Details

Name: **SHA** Age: **48 Years 4 Months** Gender: **Female**  
 Status: **On-ART Alive** ART No: [RI/UD/7447](#) Barcode: No [Update](#)

Regimen: **RG2/ZLN Adult** [Update](#) Weight Band: **Over 30 kg** [Update](#)  
 (ZLN-A (Zidovudine 300mg+ Lamivudine 150mg + Nevirapine 200mg Tablets))

Last Visit Date: 23 Feb 2016 Next Appointment: 05 May 2016

## Visit History

Visit Date: 23 Feb 2016 [Dispense Again](#)

Product Dispensed	Remaining Pills	Adherence	Dispensed Qty
ZLN-A (Zidovudine 300mg+ Lamivudine 150mg + Nevirapine 200mg Tablets)	28	89%	120

Visit Date: 04 Feb 2016 [Dispense Again](#)

Product Dispensed	Remaining Pills	Adherence	Dispensed Qty
ZLN-A (Zidovudine 300mg+ Lamivudine 150mg + Nevirapine 200mg Tablets)	2	97%	60

Visit Date: 05 Jan 2016 [Dispense Again](#)

Product Dispensed	Remaining Pills	Adherence	Dispensed Qty
ZLN-A (Zidovudine 300mg+ Lamivudine 150mg + Nevirapine 200mg Tablets)	0	97%	60



# Role Based Access Control

#	Role	Access Level	Session Time	Action
1	Supplier <span>Primary</span>	Supplier	10 minutes	<a href="#">Access Settings</a>
2	System Administrator <span>Primary</span>	Super Admin	10 minutes	<a href="#">Access Settings</a>
3	Store In Charge	SACS	10 minutes	<a href="#">Access Settings</a>
4	Project Director <span>Secondary</span>	SACS	10 minutes	<a href="#">Access Settings</a>
5	SACS Report Viewer	SACS	10 minutes	<a href="#">Access Settings</a>
6	State System Admin <span>Primary</span>	SACS	10 minutes	<a href="#">Access Settings</a>

## "NACO ADMINISTRATOR" ACCESS SETTINGS

### NACO Modules

	View	Add	Edit	Delete
<input checked="" type="checkbox"/> Product Control	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Facility Types	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Program Division	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Regimen	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> SACS/Warehouse Master	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Supplier Master	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

### SACS Modules

	View	Add	Edit	Delete
<input type="checkbox"/> Facility Master	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>



# Sample Reports: Stock Summary Report

#	SACS	Product	a) Opening Stock (incl expired)	b) Receipts			c) Distribution			d) Stock adjusted		e) Closing Stock (incl expiries)
				b1) Stock recd. during month from supplier	b2) Stock recd. during month through relocation	b3) Usable stock received from unreg sources	c1) Stock given to own facilities	c2) Stock relocated to other facilities	c3) Stock given to unregistered recipients	d1) Stock added (stock found)	d2) Stock written off (Expired stock, missing)	
1.	Delhi State AIDS Control Society	HIV (Rapid) Kits - 1st Antigen	758	0	0	0	719	0	30	0	0	9
2.	Delhi State AIDS Control Society	Whole Blood Finger Prick Test Kits	629	0	0	0	3	0	39	0	0	587
3.	Delhi State AIDS Control Society	Triple Blood Bag 350ml	0	0	0	18608	0	0	0	0	0	18608
4.	Delhi State AIDS Control Society	Quadruple Blood Bag	0	0	0	0	0	0	0	0	0	0
5.	Delhi State AIDS Control Society	Zidovudine + Nevirapine 200mg Tablets	950400	0	0	0	730800	0	8400	0	0	211200

**Consolidated Stock Summary (State wise)**

#	SACS	Product	a) Opening Stock (incl expired)	b) Receipts			c) Distribution			d) Stock adjusted		e) Closing Stock (incl expiries)
				b1) Stock recd. during month from supplier	b2) Stock recd. during month through relocation	b3) Usable stock received from unreg sources	c1) Stock given to own facilities	c2) Stock relocated to other facilities	c3) Stock given to unregistered recipients	d1) Stock added (stock found)	d2) Stock written off (Expired stock, missing)	
1.	Assam State AIDS Control Society	Tenofovir 300mg + Lamivudine 300mg + Efavirenz 600mg	5460	143760	0	0	75600	0	30	0	0	73590
2.	Bihar State AIDS Control Society	Tenofovir 300mg + Lamivudine 300mg + Efavirenz 600mg	34920	0	0	0	16200	0	0	0	0	18720
3.	Chhattisgarh State AIDS Control Society	Tenofovir 300mg + Lamivudine 300mg + Efavirenz 600mg	16680	201240	0	0	67980	0	0	0	0	149940
4.	Delhi State AIDS Control Society	Tenofovir 300mg + Lamivudine 300mg + Efavirenz 600mg	0	0	0	0	0	0	0	0	0	722520
5.	Goa State AIDS Control Society	Tenofovir 300mg + Lamivudine 300mg + Efavirenz 600mg	0	39000	0	0	0	0	0	0	0	39000

**Consolidated Stock Summary (Product wise)**



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# Sample Reports: National Inventory Summary

## Summary of National Inventory Report

#	Atazanavir 300mg + Ritonavir 100mg tablets			Efavirenz 200 mg tablet			Lopinavir + Ritonavir Syrup (80/20 mg/ml) 160 ml per bottle			
	SACS	Monthly Consumption	Stock	Months of Inventory	Monthly Consumption	Stock	Months of Inventory	Monthly Consumption	Stock	Months of Inventory
1	DSACS	18233	47881	2.63	7395	25209	3.41	21	455	21.67
2	KSAPS	31798	253909	7.99	27280	230097	8.43	179	2524	14.1
3	UKSACS	781	138	0.18	1514	8537	5.64	1	2	2
4	KSACS	9854	20117	2.04	1792	7632	4.26	5	56	11.2
5	CMACS	0	0	0	0	0	0	0	0	0
6	PACS	0	0	0	0	0	0	0	0	0
7	APSACS	42977	70705	1.65	19076	120395	6.31	27	1341	49.67
8	TANSACS	44915	115176	2.56	20135	132195	6.57	34	722	21.24
9	MAHASACS	13758	170258	12.38	44750	719406	16.08	212	3853	18.17
10	MDACS	10626	128361	12.08	7086	129084	18.22	25	637	25.48
11	RJSACS	10099	16690	1.65	10564	45318	4.29	57	549	9.63
12	MPSACS	2473	5897	2.38	7844	20321	2.59	22	375	17.05
13	GJSACS	32301	86791	2.69	16106	56903	3.53	54	210	3.89