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KEMSA Support Program

Inventory Analysis Report

March 2013

AID-623-C-11-00010

This publication was prepared and produced by Deloitte Consulting LLP for review by the United States Agency for International Development.

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Kenya Medical Supplies Agency (KEMSA) Support Program

Contract Number: AID-623-C-11-00010

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ACRONYMS

DISC	Deloitte Integrated Supply Chain Model
EMMS	Essential Medicines and Medical Supplies
ERP	Enterprise Resource Planning
ICT	Information and Communications Technology
KEMSA	Kenya Medical Supplies Agency
SKU	Stock-Keeping Unit
SOP	Standard Operating Procedure
WMS	Warehouse Management System

I. EXECUTIVE SUMMARY

This report provides an analysis of current inventory management activities at the Kenya Medical Supplies Agency (KEMSA) as well as recommendations to address gaps and mitigate the risks of suboptimal performance. Deloitte conducted this analysis by using our methodology, based on industry leading supply chain practices, and applying the unique requirements of KEMSA's public health supply chain operations to tailor the approach. We examined the planning processes currently in place across KEMSA's Operational and Procurement Units using both qualitative and quantitative techniques.

Currently, KEMSA's Operational and Procurement Units function predominately on supply chain execution activities (i.e., picking, consolidation, shipping, order fulfillment, etc.) and little on traditional supply chain planning processes to manage inventory, such as demand, inventory, and supply planning. Demand planning establishes the visibility of future customer requirements for each commodity. Inventory planning defines the amount of inventory necessary to protect customer service levels set by KEMSA. Supply planning determines commodity replenishment patterns. These planning functions must be in place for the Operations and Procurement Units to perform execution activities effectively. In their combined form, these planning processes represent a core supply chain function that is required for KEMSA to provide high quality service to its customers for every commodity it manages.

Critical to the supply chain planning function is the access and availability of accurate and timely supply chain data for forecasting, inventory replenishment, and quantification (determination of supply requirements). The analysis showed that KEMSA is not fully using data to help avert cost penalties, undesirable customer service levels, and other areas of improvement. While data is available within the Enterprise Resource Planning (ERP) and Warehouse Management System (WMS), accessibility is difficult and reliability of extraction rules is inconsistent. Despite these conditions, there is room to improve KEMSA's inventory management practices through the institution of data and root cause analysis.

Finally, KEMSA lacks a defined team of planners who are accountable for developing supply chain plans to help guide operations and procurement activities. We provided a summary of our recommendations in Table 1 to strengthen KEMSA's inventory management operations.

Table 1: Summary of Recommendations to Strengthen KEMSA's Inventory Management Operations

Recommendation	Key Actions
1. Institute a structured planning process to manage inventory levels	• Develop and implement Standard Operating Procedures (SOPs) • Track performance to ensure adoption of the processes in daily practice
2. Establish a Supply Chain Planning Unit to own and implement the process	• Develop the organizational design of the Unit and job descriptions • Implement through employee hiring, transfer, and/or training
3. Develop a set of inventory management reports to identify inventory risks (e.g., expiries, stock-outs, etc.)	• Design reporting needs based on requirements for leading practices • Develop the reports using the best possible technology solution – ERP report or spreadsheet • Test data extracts and functionality • Train users on the application and decision support capability
4. Educate and train KEMSA Operational and Procurement Units	• Prepare a curriculum of education and training for the stakeholders • Design course content • Develop course materials • Prepare workshops and training sessions • Conduct courses and workshop exercises • Follow up on adoption of practices

The sections below provide further details of the analysis and recommended actions to strengthen supply chain planning processes at KEMSA.

II. INTRODUCTION

In May 2011, USAID awarded the two-year KEMSA Support Program to Deloitte Consulting LLP as the lead implementing partner. The goal of KEMSA Support Program is to strengthen KEMSA's ability to provide public health facilities throughout the country with the right quantity of quality commodities, in a timely manner, for effective service provision. The following five tasks cover the areas targeted for improving KEMSA's business operations.

1. Review KEMSA's legal status (KEMSA Act) and make recommendations to strengthen its operational mandate
2. Strengthen KEMSA's governance architecture and practice
3. Strengthen KEMSA's inventory management and tracking
4. Strengthen KEMSA's warehouse and distribution

5. Support for KEMSA to develop, implement and monitor a Performance Measurement Program (PMP)

The inventory analysis activity supports task three, specifically in the areas of demand, inventory, and supply planning. The following analysis provides a comprehensive picture of current planning processes, identified process gaps, and key recommendations to address these gaps and mitigate risk of sub-optimal performance. The subsequent corrective actions will ultimately help KEMSA improve health outcomes through efficient and effective inventory management of health commodities.

III. BACKGROUND

Based on information provided by the KEMSA Quality Assurance Unit, KEMSA delivers health commodities to approximately 4,000 health facilities throughout Kenya, to include provincial hospitals, district hospitals, sub-district hospitals, health centers, and dispensaries. Of the 2,031 stock-keeping units (SKU) that are distributed, 18% are pharmaceutical, 21% are equipment, and 60% are non-pharmaceutical items.

The analysis focused on a subset of pharmaceuticals within the Essential Medicines and Medical Supplies (EMMS) category, using data for a group of approximately 50 primary commodities.

IV. APPROACH

The KEMSA Support Program team conducted the analysis by leveraging the Deloitte Integrated Supply Chain (DISC) toolkit, an approach that incorporates leading public and private sector supply chain practices. We applied the DISC toolkit to the unique requirements of KEMSA's public health supply chain operations.

Qualitative Assessment

The team conducted interviews with members of the Operational and Procurement Units to gain an understanding of needs, issues, and current business conditions. We held these interviews in both one-on-one and group settings. The output of these interviews provided us with further details about day-to-day activities within warehouse operations, quality assurance, distribution, procurement, and customer service areas. With the information collected during the interviews, we assessed the current state of supply chain planning at KEMSA against a traditional maturity model.

Quantitative Assessment

Along with the qualitative assessment, we collected a variety of data elements to determine KEMSA's overall performance during the last year, including monthly data from customer order placement, issued (shipped) quantities, procurement receipts, and inventory levels. This provided insight into historical performance and information to develop a baseline for measurement.

Areas of identified improvement include the accuracy and consistency of the business rules used for data extracted from the ERP/WMS systems. For example, in the collection of customer order and issue data we found discrepancies that were identified as duplicate dispatch notes in the ERP system that were not filtered during initial extracts. We identified specific issues and are working

closely with KEMSA's Information and Communications Technology (ICT) department to help correct.

V. ANALYSIS AND FINDINGS

The KEMSA Support Program team conducted an analysis of the current KEMSA processes and tools used in inventory management. This included an examination of how KEMSA conducts activities to manage inventory and the data/information used to inform inventory management decisions. From this, we identified and described a collection of findings, grouped into four categories:

1. **Inventory Management**: Day-to-day processes that assure inventory records are accurate and up to date.
2. **Supply Chain Planning:** Demand, inventory, and supply planning processes.
3. **Distribution Dispatch &Load Planning:** Efficiencies and effectiveness of managing customer orders for distribution,
4. **Supply Chain Tools & Reports:** Ability to use information as a means of decision-making.

Inventory Management

Qualitative Assessment

Table 2: Summary of Findings and Impact Related to Inventory Accuracy

Finding	Impact
Inventory accuracy and master data records need better maintenance.	• Poor inventory records lead to lower customer service levels and performance • Lack of standard practices promotes unreliable data in systems • Decisions will be based on inaccuracies and increase logistics costs

Inventory accuracy is a fundamental building block for managing inventory availability and proper customer service levels. We attribute these inaccurate inventory records to poor record keeping habits, undocumented spoilage, damage, or miscounts. KEMSA uses two physical inventory counts spaced six months apart along with periodic cycle counts on the faster moving commodities to maintain inventory accuracy. We observed that stock level reports may contain accuracy issues due to timing of running reports not in sync with timing of system balances updates. KEMSA performs stock checks on a regular basis and updates the book balance using the count recorded by the warehouse personnel. Typically, the inventory control personnel will verify the variance between the stock count and the book balance before updating current inventory records.

Another fundamental element of inventory management is the accurate maintenance of master data. Master data identifies all of the attributes tied to a commodity, such as product codes, descriptions, weights, cube, and costs. KEMSA does not have a standard process for maintaining this data for its commodities. In many instances, we identified variances between product code and descriptions stored in the ERP/WMS systems and those used in the Standard Order Request Form distributed to the customers for ordering purposes. These variations can lead to confusion and improper order fulfillment where wrong codes are used for commodity orders. In other instances, master data such as weight and cube have never been established or maintained. Accumulating the weight and cube can provide valuable information to the distribution and dispatch teams for building loads of customer orders in a particular route.

Qualitative Assessment

Table 3: Summary of Findings and Impact Related to ABC Analysis

Finding	Impact
KEMSA does not maintain an ABC analysis.	• Slower moving commodities may receive more attention than those commodities needing higher priority • Priorities need to be established to manage the large number of commodities with limited personnel and resources

ABC classification is a useful attribute for aligning warehouse space, setting cycle count priorities, and establishing a commodity's customer service level. Categorizing commodities

based on their respective annual movement provides supply chain planners the ability to prioritize and manage large numbers of commodities.

There are arguments for using either a quantity basis or a value basis to develop the ABC classification for its commodities. There are organizations that use both means to accommodate different stakeholders. Typically, the financial stakeholders want to see the ABC analysis from a value basis. Logistics functions and planning teams will use the quantity basis. Both are easily calculated. Standard operating procedures need to be established for preparing and reporting the ABC analysis. The ERP/WMS functionality should also be enhanced to allow for automation of this activity based on defined business rules.

Leading practice bases traditional ABC analysis on the criteria shown below. KEMSA can adjust these percentages as needed. Organizations can also use a fourth category, D, to classify commodities no longer active yet still in inventory.

- **A items** - 20% of the items accounts for 70% of the annual consumption value/quantity of the items.
- **B items** - 30% of the items accounts for 25% of the annual consumption value/quantity of the items.
- **C items** - 50% of the items accounts for 5% of the annual consumption value/quantity of the items.

Figure 1 provides an example of an ABC classification developed by quantity.

Figure 1: Example of an ABC Classification Based on Quantity

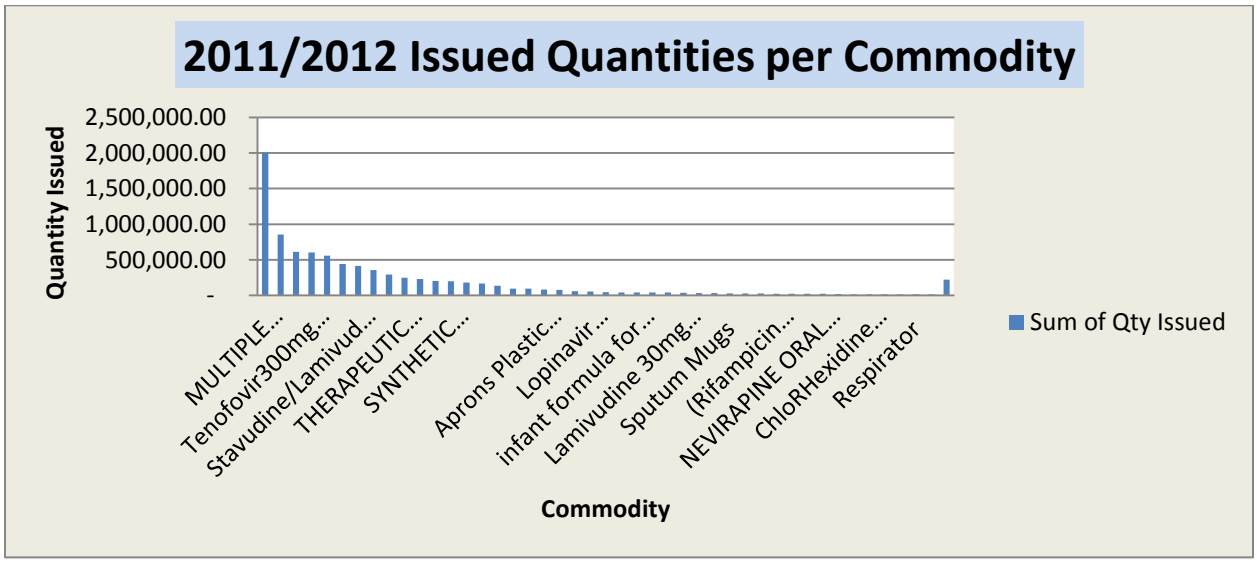
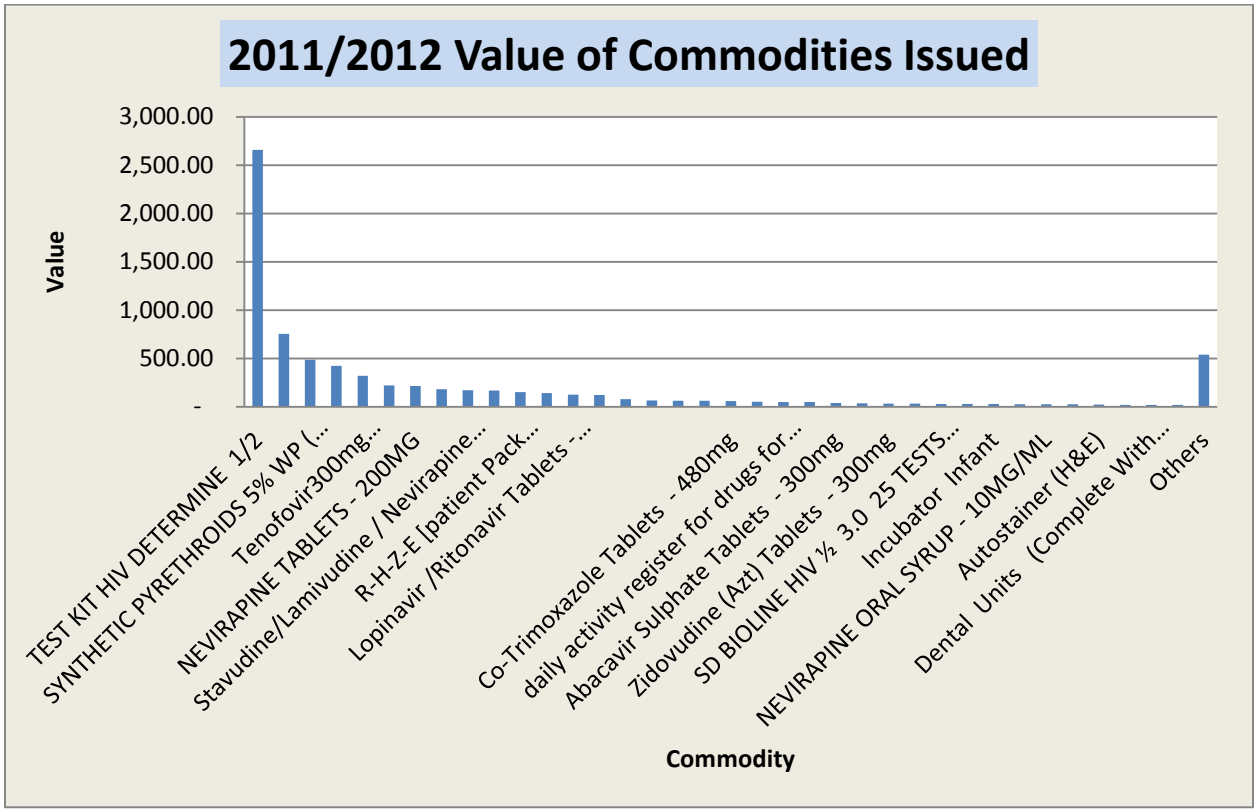


Figure 2 shows example of an ABC classification based on value.

Figure 2: Example of an ABC Classification Based on Value



Supply Chain Planning

Demand Planning

Qualitative Assessment

Table 4: Summary of Findings and Impact Related to the Forecast Process

Finding	Impact
No operational forecast process or tools exist for KEMSA upon which to base key supply chain decisions.	• Low customer service levels • Higher costs of distribution due to lack of commodities to fill orders and trucks • No visibility for proper decision making of future procurement requirements

The demand planning process is one of the key functions of supply chain planning. The demand plans quantify the estimated customer requirements for commodities that drive operational activities and decision-making. We found a gap in that no one at KEMSA was currently preparing or equipped to develop an operational forecast of the customers' needs for commodities.

At present, the Ministry of Health develops and manages commodity demand plans through the forecasting and quantification process. This process evaluates the requirements for treatment and medical equipment across the Kenyan national landscape. The data used to determine this includes clinical, demographic, and cultural information. These components, along with educated assumptions, provide the backbone for the current demand planning process. These plans only translate into an annual commodity requirement used by the procurement team for the purchase of commodities and equipment. There is no documented evidence that an equally thorough process is followed for all EMMS categories such as exists for program commodities, e.g., antiretrovirals and nutritional commodities. From an operational standpoint for KEMSA, there is no detailed, demand plan or enabling forecasting tool that provides a monthly or quarterly estimate used to develop the near-term operational activities and decisions.

Table 5: Summary of Findings and Impact Related to Customer Oder Variability

Finding	Impact
Monthly customer order patterns display high variability.	• Facilities lack confidence receiving what they ordered • High fluctuations in demand lead to uncertainties and higher inventory levels

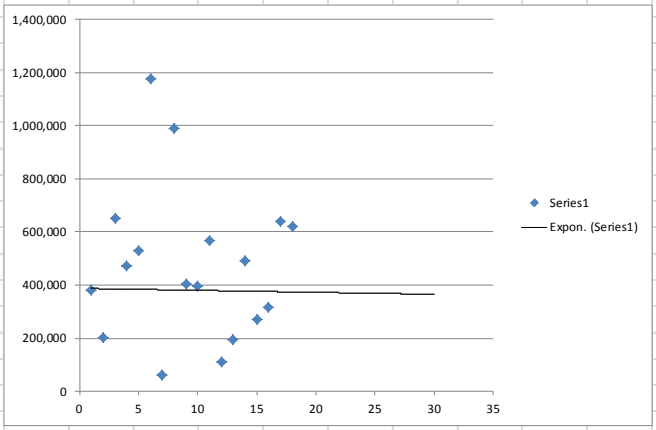
Effective demand planning requires a thorough analysis of demand data – in this case, customer orders from public health facilities. As such, the team conducted an evaluation of customer order data extracted from the ERP/WMS systems. We retrieved and analyzed customer order data for 50 EMMS commodities for 18 months between January 2011 and June 2012 to evaluate trends and variability. The analysis revealed that order history is highly variable with no discernible pattern and that issues data may be the best dataset currently available for use in the demand planning process. Consumption data would be the most suitable as it represents the actual usage of a specific commodity through a facility based on patient needs, however this is not actively submitted by facilities and no process is currently followed for capturing of EMMS consumption data.

Figure 3 shows that the order data has wide variations across the months, making it difficult to discern any pattern. To the right of the graph we calculated a 3-month moving average also shown on the graph as the line plotted against the individual data points. The variability of actual demand is shown by the scatter plot against the 3-month moving average shown by the solid line. These monthly variations in customer demand suggest the facilities are responding to unfulfilled orders rather than consumption patterns of their patients.

Figure 3: Monthly Data Analysis Showing Variability

PM01CTX001	Co-Trimoxoxazole Suspension - 240mg/5ml

	Qty/Month	3 Mo Moving Avg
Jan_2011	382,059	
Feb_2011	201,500	
March_2011	652,970	412,176
April_2011	472,435	442,302
May_2011	529,920	551,775
June_2011	1,175,551	725,969
July_2011	59,380	588,284
Aug_2011	990,029	741,653
Sept_2011	405,623	485,011
Oct_2011	394,615	596,756
Nov_2011	566,825	455,688
Dec_2011	111,250	357,563
Jan_2012	194,500	290,858
Feb_2012	489,840	265,197
March_2012	270,388	318,243
April_2012	315,433	358,554
May_2012	640,091	408,637
June_2012	619,224	524,916



Much of the monthly order variability may be due to the placement of orders to meet KEMSA's distribution plan, which is based on a quarterly order cycle. Hence, we also looked at orders on a quarterly basis and found it to be somewhat less variable. Reducing variability is an important element of demand planning as it affects inventory target levels. It should also be noted that the transition from the push to pull ordering mechanism will make order data unreliable for a period in time due to the nature of the transition where at the start facilities could not place orders based on their real demand but were provided with predefined order quantities for specific commodities.

Figure 4 is a quarterly view of the same commodity shown in Figure 3. There is still a level of variability across the quarters that may also suggest some form of seasonality.

Figure 4: Quarterly Data Analysis Showing Variability

PM01CTX001	

	Qty/Month
Jan_2011	382,059
Feb_2011	201,500
March_2011	652,970
April_2011	472,435
May_2011	529,920
June_2011	1,175,551
July_2011	59,380
Aug_2011	990,029
Sept_2011	405,623
Oct_2011	394,615
Nov_2011	566,825
Dec_2011	111,250
Jan_2012	194,500
Feb_2012	489,840
March_2012	270,388
April_2012	315,433
May_2012	640,091
June_2012	619,224

Q1-2011	583,559
Q2-2011	1,655,325
Q3-2011	2,224,960
Q4-2011	1,367,063
Q1-2012	795,590
Q2-2012	1,225,912

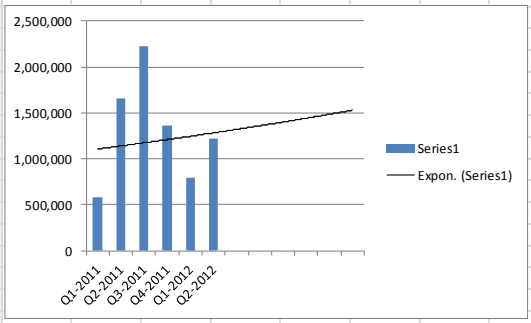


Table 6: Summary of Findings and Impact Related to Drawing Rights

Finding	Impact
The Ministry of Health develops the annual drawing rights that set the customers' budget and caps the amount of medical supplies they can acquire in a year.	• Drawing rights are not detailed to specific commodities • Customer drawing rights may not provide an allocation of funds to support their actual commodity needs

Each year, the Ministry of Health establishes an annual budget that sets the amount of medical supplies that each customer may acquire in a year. This value is an annual figure and does not stipulate any proportions at the commodity level.

KEMSA's Customer Service Unit monitors each customer's order each cycle and determines whether the order violates the drawing rights. Customer service representatives will communicate with the customer if violations exist.

We also found that drawing rights have some bearing on the development of commodity demand estimates. The drawing rights form a maximum value of medical supplies that ship to the customers in a year. Using this value, there are approaches that can proportion the value down to a commodity level.

Given the high variability in customer order activity and these orders are not necessarily in tune with the drawing rights, we find that using a proportioning method to allocate demand to each commodity is an alternate means for examination of estimating commodity demand.

Inventory Planning

Qualitative Assessment

Table 7: Summary of Findings and Impact Related to Procurement Lead Times

Finding	Impact
KEMSA must deal with long procurement lead times.	• Long lead times makes it difficult to respond to changing customer needs • Longer lead times generally translate into higher inventory levels

Inventory plans are presently based on a coverage period determined by the lead time for acquiring a replenishment delivery. With long lead times and much uncertainty in demand, the tendency for most supply chains will be to have large amounts of inventory. However, given the concerns over expiration of certain commodities, this needs better control.

Table 8: Summary of Findings and Impact Related to Visibility

Finding	Impact
KEMSA is unable to formulate inventory decisions due to a lack of visibility.	• Poor customer service levels • Inventory levels not aligned to demand • Warehouse clogged with too much of some commodities and too little of others • Procurement decisions not synchronized with customer needs

To provide visibility of an expected monthly demand, current inventory, and replenishment shipments due from suppliers we developed a stock status report. The stock status report can bring together into a single report the commodity demand forecasts, stock-on-hand, and inbound procurement orders to quickly view where inventory imbalances could cause further out-of-stock conditions. As a tool, the KEMSA Operational and Procurement Units can use this report for decision-making in their weekly Integrated Planning Meeting.

The stock status report will help identify where inventory issues exist. It is evident that there are many inventory issues at present. In some cases, procurement orders are overdue leading to gaps in inventory availability. There are other situations where no procurement order is in place to avoid a shortage. The stock status report will help focus the needed attention on these issues.

Quantitative Assessment

Table 9: Summary of Findings and Impact Related to Order Fulfillment

Finding	Impact
KEMSA's order fulfillment performance for EMMS commodities is low at an average 40%.	• Poor customer service • Customers respond with future orders to make up for previous shortages • High demand variability

Order fulfillment is one of the primary measures of an organization's ability to completely fill a customer order with on-hand inventory. Poor quantity fill rates are one of the first symptoms of broken processes and the lack of proper inventory planning.

We compared customer order data and commodity issue data and found that the quantity fill rates for the 50 EMMS was on average of 40%. Quantity fill rate provides a comparison of what the customer actually received versus what they had ordered. The low level of quantity fill rate suggests gaps in inventory availability. Without the visibility of a more detailed demand plan it is difficult to identify when supplier replenishments are delayed to meet the health facilities' demand.

Table 10 shows a summary of the fill rate report prepared for this analysis. We based these findings on a sample of 50 EMMS commodities using data as of June 2012. Not shown in this diagram are the monthly details for the periods of January of 2011 through June of 2012.

Table 10: EMMS Fill Rate Report

KEMSA Fill Rate Report - EMMS Primary 50 Pharmaceuticals				
		QTY Issued	QTY Ordered	Fill Rate
Commodity	Description	Total	Total	%
PM09WAT001	Water For Injection	16,420,721	53,426,225	30.7%
PM09REH001	Rehydration Salts Oral (Ors)	5,118,201	20,030,234	25.6%
PM01AMX005	Amoxycillin Suspension (Pfr) - 125mg/5ml	6,518,780	16,918,951	38.5%
PM01CTX001	Co-Trimoxoxazole Suspension - 240mg/5ml	3,703,423	8,471,633	43.7%
PM01GEN002	Gentamicin Injection - 80mg	2,525,875	7,036,141	35.9%
PM03QUN004	Quinine Dihydrochloride Injection - 300mg/1ml	3,571,519	5,405,969	66.1%
PM03MET002	Metronidozole Suspension - 200mg/5ml	2,099,655	3,421,898	61.4%
PM01PEN003	PENICILLIN BENZYL INJECTION - 5MU	1,280,576	3,200,268	40.0%
PM05DCL002	Diclofenac Injection - 75mg	1,805,106	3,013,697	59.9%
PM01CEF002	Ceftriaxone Injection - 1G	486,759	2,669,340	18.2%
PM10XYT001	Oxytocin Injection - 10 Iu/ml	1,298,534	2,705,493	48.0%
PM03MET004	Metronidazole Injection - 5mg/ml	1,268,441	2,133,872	59.4%
PM01AMX007	Amoxycillin/Clavulanic Acid Syrup (Pfr)-228mg/5ml	187,883	1,254,207	15.0%
PM07DAZ001	Diazepam Injection - 10mg	565,156	1,156,074	48.9%
PM07CHL001	Chlorpromazine Injection - 50mg/2ml	94,954	1,264,374	7.5%
PM03QUN003	Quinine Dihydrochloride Injection - 300mg/1ml	572,635	1,069,616	53.5%
PM09SDU003	Sodium Lactate Solution	259,636	1,713,849	15.1%
PM01AMX004	Amoxycillin Capsules - 250mg	4,820,643	972,923	495.5%
PD01SHS001	Sodium Hypochlorite Solution	279,520	718,241	38.9%
PM07LGN002	Lignocaine 2% Dental Cart With Adrenaline-1:80 000	9,848	533,902	1.8%
PM09DEX004	Dextrose - 10%	13,680	440,860	3.1%
PM09SDU005	Sodium Chloride /Normal Saline Solution	142,329	463,714	30.7%
PM05PAR002	Paracetamol Suspension - 120mg/5ml	161,526	374,780	43.1%
PM07BUP001	BUPIVACAINE HYD IN DEXTROSE INJ - 5MG	0	302,570	0.0%
PM07FLE001	Fluphenazine Injection - 25mg/ml	281,234	299,515	93.9%
PD01PDS001	Povidone-Iodine Solution - 10%	104,508	246,992	42.3%
PM10NSU001	Insulin Biphasic 30/70 - 100Iu/ml	90,551	275,848	32.8%
PM01CTX004	Co-Trimoxazole Tablets - 480mg	103,752	231,925	44.7%
PM06HYD001	Hydralazine Injection - 20mg/ml	0	219,153	0.0%
PM01CPR002	Ciprofloxacin Tablets - 250mg	24,760	239,697	10.3%
PM06MAG001	Magnesium Sulphate Injection - 50%	42,969	172,211	25.0%
PM09ZNC001	Zinc Sulphate Tablets - 20mg	93,127	152,861	60.9%
PM06HEP001	Heparine Injection - 5000Units/ml 5ml	5,826	144,292	4.0%
PM05BRU002	Ibuprofen Tablets - 200mg	114,405	134,503	85.1%
PM07SUX001	Suxamethonium Chloride Injection	13,290	143,747	9.2%
PM07THP001	Thiopentone Sodium Injection - 500mg	85,403	84,411	101.2%
PM05MRP003	Morphine Sulphate Injection - 10mg/ml	20	69,812	0.0%
PM01CPR001	Ciprofloxacin Tablets - 250mg	8,291	47,659	17.4%
PM11MEP001	Omeprazole Capsules - 20mg	6,611	40,217	16.4%
PM10NSU003	Insulin Soluble - 100Iu/ml	12,013	45,291	26.5%
PM07CAR002	Carbamazepine tablets 200mg	2,901	18,328	15.8%
PM10GLB001	Glibenclamide Tablets - 5mg	10,191	19,545	52.1%
PM03TND001	Tinidazole Tablets - 500mg	17,072	18,958	90.1%
PM07HAT001	Halothane Inhalation	9,740	15,734	61.9%
PM07BEN001	Benzhexol Tablets - 5mg	7,935	14,148	56.1%
PM07CHL002	Chlorpromazine Tablets - 100mg	11,197	12,617	88.7%
PM06HYD003	Hydrochlorothiazide Tablets - 50mg	7,246	11,625	62.3%
PM07AMT001	Amitriptyline Tablets - 25mg	8,160	10,236	79.7%
PM07HAL003	Haloperidol Tablets - 5mg	3,478	8,794	39.5%
PM01AMX002	Amoxycillin/Clavulanic Acid Syrup (Pfr)-228mg/5ml	0	1,500	0.0%
PM13SAL003	Salbutamol Nebulizing Solution - 5mg/ml 10ml	0	370	0.0%
PM06ENA001	ENALAPRIL TABLETS - 5MG	0	1	0.0%
	Totals	54,270,080	141,378,821	38.4%

A deeper analysis of the quantity fill rate report showed the following information:

- Seven of the 52 EMMS commodities maintained fill rates of 75%-100%
- Eleven commodities maintained a fill rate of 50%-75%
- Sixteen commodities had fill rates of 25%-50%
- Eighteen commodities had fill rates of 0%-25%

Based on this analysis, 45 commodities (86%) fall below a fill rate level of 75%. The results from the fill rate examination suggest that a more proactive approach to tracking inventory is required to improve the overall fill rate performance.

Procurement Planning

Quantitative Assessment

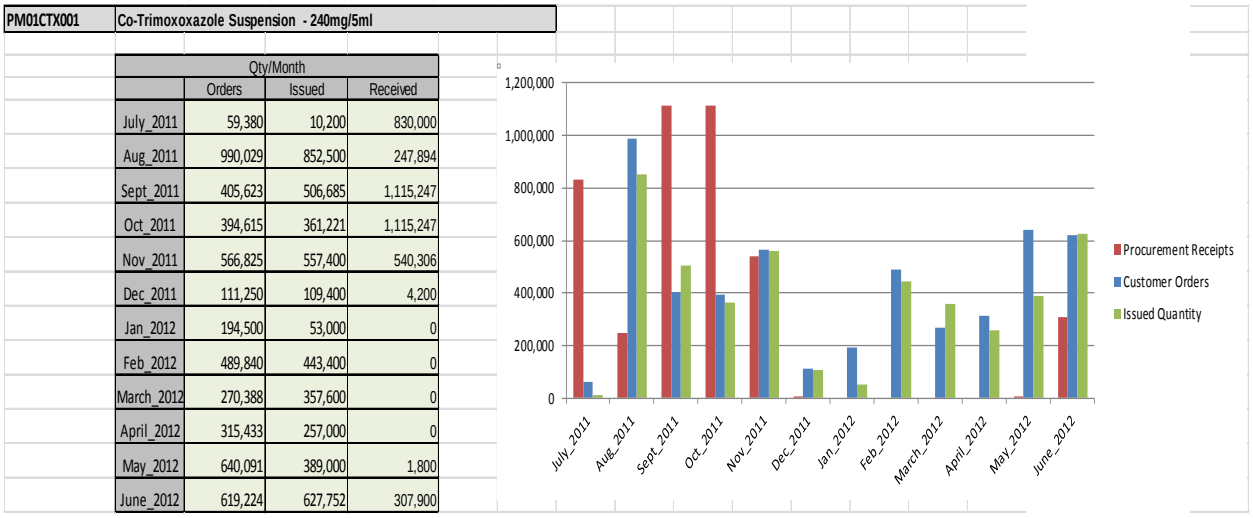
Table 11: Summary of Findings and Impact Related to Procurement Planning

Finding	Impact
KEMSA's procurement planning is highly constrained by funding and administrative processes and impedes the flexibility to balance supply needs with customer demand.	• Replenishment orders are not aligned to customer demand patterns • Replenishment orders do no arrive in a timely manner and cause gaps in inventory availability

The timeliness of inventory availability is highly dependent on the various stages of the procurement process. Each of these stages from tender initiation to tender award and contracting, make up components of the inventory replenishment lead time for commodities and equipment.

Figure 5 illustrates how procurement order receipts (the red bars) arrive in comparison to customer orders (the blue bars) and issued quantities (the green bars). There appears to be an influx of procurement receipts during certain periods and little to no receipt activity in others. This creates warehouse capacity issues that result in large inventory levels taking up critical storage space. We believe that this is caused by the annual allocation of funds provided to KEMSA for their procurement process. KEMSA begins the tender process once funds are allocated. Initial receipt of these orders occur six months into the fiscal year that funds were allocated.

Figure 5: Procurement Order Receipt Analysis



PM01CTX001	Co-Trimoxoxazole Suspension - 240mg/5ml		
	Qty/Month		
	Orders	Issued	Received
July_2011	59,380	10,200	830,000
Aug_2011	990,029	852,500	247,894
Sept_2011	405,623	506,685	1,115,247
Oct_2011	394,615	361,221	1,115,247
Nov_2011	566,825	557,400	540,306
Dec_2011	111,250	109,400	4,200
Jan_2012	194,500	53,000	0
Feb_2012	489,840	443,400	0
March_2012	270,388	357,600	0
April_2012	315,433	257,000	0
May_2012	640,091	389,000	1,800
June_2012	619,224	627,752	307,900

Table 12: Summary of Findings and Impact Related to Procurement Tools

Finding	Impact
Procurement has few tools to assist them with managing the flow in inbound receipts.	• Overdue replenishment orders do not receive proper attention • Inventory shortages occur during periods when replenishment orders are overdue

To assist with the procurement planning process, we developed a spreadsheet tool that evaluates the current procurement plan against the annual forecast based on customer orders. This provides a different perspective of demand than that developed in the forecast and quantification process run by the Ministry of Health. Customer demand will fluctuate across the year while the Ministry's estimates remain static. There is a need to evaluate the procurement plan against this more fluid demand picture.

The procurement planning tool can be used by the procurement team to compare its current plans against customer demands. The near-term months of supply column identifies situations where the near term Procurement plan (next 3 months) may result in inventory shortages. The total compared to last year's orders column identifies the difference in total procurement orders in place against an annual customer demand estimate.

Figure 6: Procurement Planning Tool

KEMSA Procurement Comparison - EMMS Primary 50 Pharmaceuticals

KEMSA Code No	Item Description Name / Form / Strength	Order Unit Size	Avg Monthly Demand Last 3 Months	Ordered Last Year	Stock On-Hand	Near Term Procurement Receipts Due In	Long Term Procurement Receipts Due In	Total Procurement Plan	Stock On-Hand Plus Procurement	Total Compared to Last Year Orders	Near Term Months Supply
PM01AMX005	Amoxycillin Suspension (Pfr) - 125mg/5ml	100x100mL	1,680,795	13,314,958	804,801	4,244,397	6,592,361	10,836,758	11,641,559	(1,673,399)	3.0
PM01AMX004	Amoxycillin Capsules - 250mg	1,000	27,079	414,804	13,817	133,772	138,635	272,407	286,224	(128,580)	5.5
PM01CTX001	Co-Trimoxoxazole Suspension - 240mg/5ml	100x50mL	524,916	5,057,198	185,300	3,764,889	3,364,889	7,129,778	7,315,078	2,257,880	7.5
PM01CTX004	Co-Trimoxazole Tablets - 480mg	1,000	7,744	180,197	49,851	28,500		28,500	78,351	(101,846)	10.1
PM09DEX004	Dextrose - 10%	24	13,116	244,254	0	67,277	43,315	110,592	110,592	(133,662)	5.1
PM07DAZ001	Diazepam Injection - 10mg	10	34,077	670,635	630			0	630	(670,005)	0.0
PM10GLB001	Glibenclamide Tablets - 5mg	1,000	1,362	12,404	13,041			0	13,041	637	9.6
PM03MET002	Metronidozole Suspension - 200mg/5ml	100ml	226,639	2,134,267	1,012,895	1,488,764	1,458,082	2,946,846	3,959,741	1,825,474	11.0
PM10XYT001	Oxytocin Injection - 10 Iu/ml	10	190,838	1,707,573	3,371,250	3,758,330		3,758,330	7,129,580	5,422,007	37.4
PM05PAR002	Paracetamol Suspension - 120mg/5ml	4x5L	25,036	239,255	139,363	201,600	208,655	410,255	549,618	310,363	13.6
PM03QUN003	Quinine Dihydrochloride Injection - 300mg/1ml	100	42,203	557,975	0			0	0	(557,975)	0.0
PM03QUN004	Quinine Dihydrochloride Injection - 300mg/1ml		295,613	4,033,000	298,600	19,445	4,861	24,306	322,906	(3,710,094)	1.1
PM09SDU005	Sodium Chloride /Normal Saline Solution	20	25,156	310,752	0			0	0	(310,752)	0.0
PM09WAT001	Water For Injection	100	791,405	9,146,657	5,644,553	12,363,430	4,204,650	16,568,080	22,212,633	13,065,976	22.8
PM09REH001	Rehydration Salts Oral (Ors)	100	367,459	3,318,828	6,019,293	814,972	1,473,219	2,288,191	8,307,484	4,988,656	18.6
PM01GEN002	Gentamicin Injection - 80mg	100	516,326	4,587,758	300	5,662,700	331,400	5,994,100	5,994,400	1,406,642	11.0
PM01PEN003	PENICILLIN BENZYL INJECTION - 5MU	100	265,840	2,209,555	0	2,000,000		2,000,000	2,000,000	(209,555)	7.5
PM05DCL002	Diclofenac Injection - 75mg	5	265,194	2,021,167	956,128			0	956,128	(1,065,039)	3.6
PM01CEF002	Ceftriaxone Injection - 1G	12	205,412	1,870,863	0	400,000		400,000	400,000	(1,470,863)	1.9
PM03MET004	Metronidazole Injection - 5mg/ml	96	92,300	1,033,818	1,288,753	1,900,000	300,000	2,200,000	3,488,753	2,454,935	34.5
PM01AMX007	Amoxycillin/Clavulanic Acid Syrup (Pfr)-228mg/5ml	24	79,445	814,874	0			0	0	(814,874)	0.0
PM07CHL001	Chlorpromazine Injection - 50mg/2ml	10	117,466	926,359	11,288	601,940	51,060	653,000	664,288	(262,071)	5.2
PM09SDU003	Sodium Lactate Solution	24	286,298	1,380,186	30,662	64,512	136,080	200,592	231,254	(1,148,932)	0.3
PD01SHS001	Sodium Hypochlorite Solution	4x5L	43,498	430,918	69,493	57,407	36,961	94,368	163,861	(267,057)	2.9
PM07LGN002	Lignocaine 2% Dental Cart With Adrenaline-1:80 000	100	19,548	369,357	0	29,000		29,000	29,000	(340,357)	1.5
PM07BUP001	BUPIVACAINE HYD IN DEXTROSE INJ - 5MG	10	16,037	201,920	48,699			0	48,699	(153,221)	3.0
PM07FLE001	Fluphenazine Injection - 25mg/ml	10	17,260	184,195	40,148	360,000		360,000	400,148	215,953	23.2
PD01PDS001	Povidone-Iodine Solution - 10%	12x1L	7,182	131,568	42,042			0	42,042	(89,526)	5.9
PM10NSU001	Insulin Biphasic 30/70 - 100Iu/ml	10	19,800	154,608	10,188	75,000		75,000	85,188	(69,420)	4.3

Distribution, Dispatch, and Load Planning

Qualitative Assessment

Table 13: Summary of Findings and Impact Related to Quarterly Orders

Finding	Applicable Recommendation
The Ministry mandates that customer's order once per quarter as a perceived means of reducing overall transportation costs.	• Implement a structured planning process to manage inventory levels • Institute a set of informative planning reports

In order to hold down distribution costs KEMSA's customer base places their replenishment orders on a quarterly basis. While this helps to minimize the distribution costs, it may not fully account for the additional inventory costs required for the facilities to maintain their inventory. With only four opportunities to order each year, the average inventory for a facility will be three

times as large compared to the opportunity to order 12 times per year. For example, if a facility had an annual consumption rate on a commodity for 100,000 units, they would need to order on average 25,000 units each quarter. If they were able to order on a monthly basis, their average order would fall to 8,333 units per order. In addition, with the variability in demand, there is a greater probability of facility out-of-stocks when ordering only four times per year as well as a longer duration between replenishments.

Table 14: Summary of Findings and Impact Related to Distribution Plans

Finding	Applicable Recommendation
KEMSA develops a distribution plan to manage the routing and scheduling of customer orders during a quarterly cycle.	• Implement a structured planning process to manage inventory levels • Institute a set of informative planning reports

The distribution plan helps KEMSA plan the routing and scheduling of customer orders in a quarterly cycle and plan for the transportation needs to meet this schedule. Several factors can take the plan off target. The Customer Service Unit works with the customer base to schedule the order placement according to the distribution plan although customers may not send in their order as prescribed. In addition, transportation availability can also influence the schedule and interfere with the steady flow of customer order shipments. These factors require a continuous review and rescheduling of the distribution plan over the course of the quarterly cycle.

In collaboration with KEMSA, we implemented a weekly Distribution Planning Meeting to help identify and resolve issues that will interfere with the plan. The meeting includes Warehouse personnel, Customer Service personnel, and Distribution Planning personnel.

Table 15: Summary of Findings and Impact Related to Load Planning

Finding	Applicable Recommendation
KEMSA must deal with issues of load planning affecting the daily schedule of customer order shipments and transportation availability.	• Implement a structured planning process to manage inventory levels • Institute a set of informative planning reports

Load planning involves maximizing the space utilization of a truck to accommodate customer orders along a particular route. KEMSA does not maintain the volume (i.e., cubic measure) attribute of a commodity in the ERP/WMS as part of the master data. We have seen that a particular commodity may have different volumes due to various container sizes from different suppliers.

Load planning also suffers from the lack of visibility of customer orders. The Customer Service Unit enters customer orders into the system close to the date in the distribution plan even though these orders may be in house several days earlier. This delay contributes to the lack of visibility for preparing load plans for the numerous routes.

KEMSA does not have any tools to help manage the load planning process. This process is done manually using spreadsheets to help assist with the process.

Supply Chain Tools and Reports

Qualitative Assessment

Table 16: Summary of Findings and Impact Related to Supply Chain Information

Finding	Impact
KEMSA lacks a convenient and user friendly means of accessing supply chain information for decision-making purposes.	• Poor decision making • No visibility to customer needs • Poor customer service levels • Higher costs

KEMSA lacks easy access to information that can provide the overall visibility of supply chain activity. The ERP/WMS does have a reporting capability with pre-designed reports available. While these reports provide a basis of information, the user does not have the ability to create ad-hoc reporting to isolate and focus on specific issues.

Planning issues can take on many different forms that require a variety of information needs. Leading practices provide supply chain planners with ad-hoc, or user defined, reporting tools. These tools do not require ICT involvement to program or produce for each request.

Supply chain planners typically use a data warehouse as the foundation of information from which they can access the data as needed.

VI. RECOMMENDATIONS

In this section, we provide a series of recommendations to strengthen KEMSA's inventory management capabilities. Our findings highlight fundamental inventory management and planning practices which are lacking at KEMSA. To remedy this, we have identified four key areas that when implemented will strengthen KEMSA's ability to effectively and efficiently manage inventory. The four areas are:

1. Implement a structured planning process
2. Establish a Supply Chain Planning Unit
3. Develop a set of informative planning reports
4. Educate and train KEMSA stakeholders

Implement a Structured Planning Process

The fundamental objective for supply chain management is having the right product at the right place at the right time. To achieve this, a comprehensive inventory management process must be created and implemented to manage demand, inventory, and supply.

These three components form an integrated process that defines what the customer needs, whether the organization has what they want, and how much additional inventory the organization needs to satisfy these orders. Demand plans, or forecasts, provide projections of future customer needs on a commodity by commodity basis. Inventory can also be projected forward against this demand providing visibility to when the inventory will run out. Supply planning then provides the replenishment requirements that are needed to satisfy future customer needs. These replenishment orders will become procurement actions.

Demand Planning

KEMSA must develop demand plans to visualize and quantify inventory needs. Demand planning is the process that develops forecasts of customer requirements over a period of time equivalent to the lead time to acquire commodities. Key elements of this process include choice of forecast model, time horizon, level of aggregation, external constraints, and human intelligence.

KEMSA should develop a demand plan using a moving average forecast model. Statistical analysis of historical KEMSA data resulted in forecasts with high variability due to highly fluctuating or "lumpy" demand. When lumpy demand conditions exist, most statistical models default to a level, average forecast. Considering the lack of statistical analysis tools, a moving average model should be developed. With 24 months of customer order data available, a three-month moving average model will provide a value that represents average movement during a cycle. A longer-term moving average can be used to smooth out cycle-by-cycle variability as needed.

A more advanced smoothing model approach can be employed once the push to pull transition has been fully rolled out, where a 12-month moving average is calculated along with a three-month moving average. A smoothing factor between 0.1 and 0.3 is then applied to effectively control how much emphasis is placed on the three-month average to refine the output. The formula for this method is as follows: Forecast = ((Twelve-Month Average * (1 – factor)) + (Three-Month Average * factor).

With lead time for procurement at roughly six months, KEMSA should develop the operational forecast for at least 12 months. This 12-month horizon provides visibility for longer range procurement decision-making. This would be the minimum time horizon. There are other needs for longer visibility which require the forecast to be extended further into the future. For KEMSA, the use of a moving average model makes this straight forward given the calculated forecast will be the same for each period into the future.

Regarding aggregation level, KEMSA requires a forecast at the operational level. Hence, the forecast can be created for each SKU or alternatively developed at a category level and then disaggregated back to SKU level based on historical ratios. This is considered operational forecasting. There are other levels of aggregation which may be used for higher level planning, where groups of commodities with common attributes are combined to develop a higher level of aggregation for forecasting that can be used for more strategic planning. However, the immediate need at KEMSA is an operational forecast.

Drawing rights represent a constraining factor in demand planning. Drawing rights are based on the value of commodities that customers can order in a year. It is very possible that the sum of the forecasts calculated by the moving average model would exceed the amount of product that customers can order. Using a weighted average calculation can align each commodity forecast with the total annual drawing rights. We want to ensure that forecasts generated on a commodity does not exceed the proportional requirements created by the drawing rights. For hospitals the gap between constrained and unconstrained forecast can be used by KEMSA's Supplementary Services Division for targeted sales efforts.

Finally, to validate the forecast, KEMSA should hold periodic collaboration sessions with input from stakeholders with an understanding of current business conditions. From a customer

viewpoint, Customer Service can provide information about customer ordering activity. Where possible, Ministry of Health personnel can provide longer range outlooks to assess changing trends. The collaborative process involving the Planning Unit, Customer Service, and Ministry personnel should establish a final operational forecast that is used in the development of inventory and supply requirements.

Inventory Planning

KEMSA needs to strengthen all aspects of inventory management to get control of the poor performance of customer order fulfillment in the area of quantity fill rate.

There are two key fundamental concepts in inventory planning – safety stock and cycle stock.

- Safety stock is the amount of inventory needed to protect against out-of-stock situations due to forecast variability and lead time variability.
- Cycle stock inventory is the amount of inventory carried based on the frequency of re-supply.
- Average inventory can be calculated as one-half the cycle stock plus safety stock.

For commodities with low forecast accuracy, KEMSA should attempt to maintain its safety stock levels as low as possible to avert overstocking which will result in expiries. KEMSA does not currently have any process in place to calculate or manage safety stock levels. We suggest that the new Planning Unit establish rules to guide its decision-making on how much safety stock is needed on a commodity-by-commodity basis.

We do not recommend KEMSA use a statistical formula for setting safety stock given the high variability found in forecast error and delivery time. Many organizations in this situation will simplify this by using a periods-of-supply value. KEMSA should perform an ABC analysis to categorize commodities by their movement. The top 20% of these commodities are classified as “A” items, the next 30% are “B”, and the remaining 50% are “C”. Items with no movement can be classified as D if desired. The “A” items tend to have higher priorities therefore safety stock may be slightly higher for these items, “B” items will have less than “A”, and “C” items will carry the least.

Safety stock is also a function of resupply rules. If a commodity can be resupplied in a shorter time, then safety stock only needs to consider variability during this period of resupply. To counter the effect of having very large safety stock of “A” items, the period of resupply should be shortened. The impact of shortening the resupply period also lowers the cycle stock.

KEMSA needs to establish their process for determining the ABC category of its commodities. This process should be re-evaluated at least twice a year although doing this quarterly is advised. Next, A items should be resupplied each month and not more than once a quarter. B items should be resupplied quarterly. C items should be re-supplied no more than twice a year.

Safety stock for all items should be equal to the period of resupply. If an item is resupplied once a month then safety stock could be set at one month’s supply. We recognize this is far below the levels maintained today. We see the reasons for holding larger inventories is based on long resupply times and the uncertainty of availability as well as the Procurement Unit negotiating low prices based on large volumes. The last point may look like savings in the short run but in the long run the cost is levied in other ways through warehouse storage cost and potential expiries.

Cycle stock is a function of how many times a commodity is replenished over a time horizon. If KEMSA were to receive a commodity twice a year, then its cycle stock would show a six-month supply that is consumed by demand followed by another six-month supply consumed by demand over the next six months.

KEMSA's procurement approach has shown most commodities replenishment orders received once or twice a year. This will keep inventory levels high and make it difficult to operate the storage plan in the warehouse effectively. Warehouse space needs to accommodate a large number of commodities to maintain a balanced inventory. Receipts of large quantities of one commodity take up space needed by other commodities.

More frequent replenishment receipts should be established by the Planning Unit. For the faster moving commodities (A items), KEMSA should try to establish monthly replenishment receipts. For the B items, replenishment receipts should be planned no more than six times a year. For C items, KEMSA should establish a policy of planned receipts no greater than three times a year.

These more frequent replenishment receipts will provide more flexibility to manage the warehouse space and provide a greater mix of all commodities to improve the fill rates on customer orders.

Supply Planning

KEMSA's procurement process is not synchronized to KEMSA's supply chain needs. Supply plans determine how replenishment orders should be placed and when they need to arrive. Supply planning drives the actions taken by procurement to properly attend to the standard operating procedures to acquire the commodities. KEMSA will need to establish greater dialogue and share supply planning information with its suppliers to improve the timely receipt of commodities. Both the Procurement and Planning Unit will play a role in the collaboration with its suppliers.

Based on the inventory policies described above, replenishment of inventory is determined by supply plans. Supply plans are calculated by a process called reorder point planning. A reorder point is determined when a commodity's inventory level reaches a quantity that will allow for the replenishment of the commodity to arrive when inventory is equal to safety stock. This relationship is a traditional inventory planning practice and can be managed in a spreadsheet tool. The supply plans will then be communicated to the Procurement Unit at which point a replenishment order should be submitted to the supplier.

At present, KEMSA is not in a position to adopt this process. Obstacles such as the annual funding allocation by the Ministry of Health cause replenishment orders to be determined at the time funds are allocated.

We recognize that certain changes will need to be made for supply plans to become more responsive to the changing needs of the customers. KEMSA's decision to move from a push to a pull environment warrants a more responsive supply planning process.

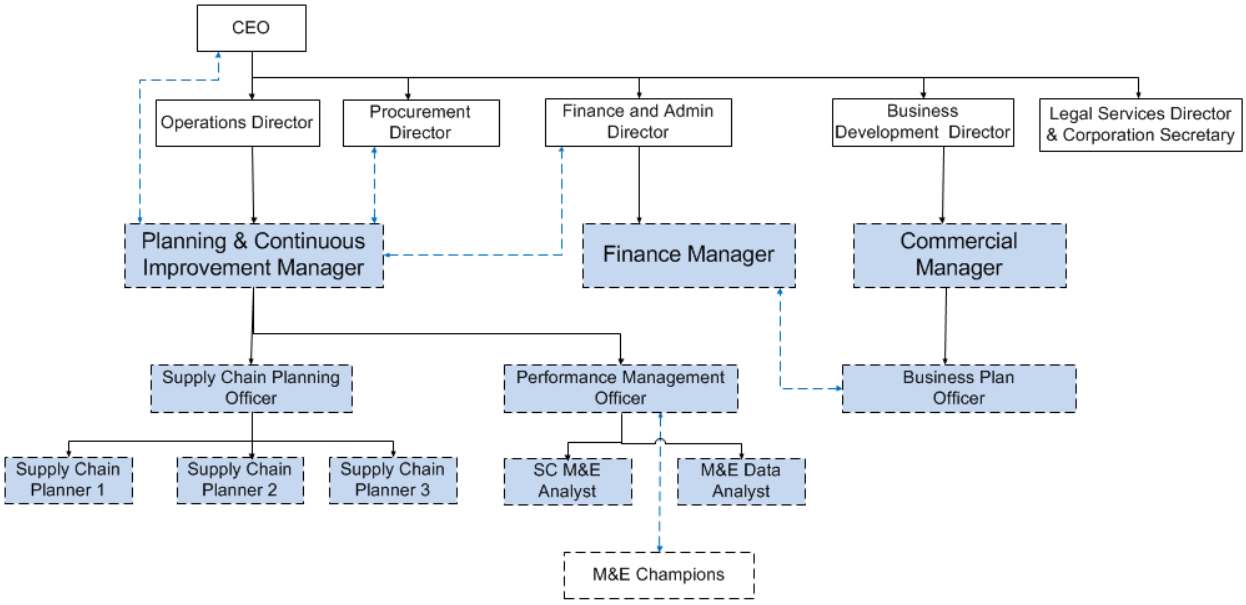
Establish a Supply Chain Planning Unit

The planning process described above would not be viable without personnel assigned to develop and oversee operational plans. Currently, KEMSA's departments are all assigned to supply chain execution functions (i.e., procurement, warehousing, distribution, customer service,

etc.) Hence, an additional unit is required to perform the tasks required to collect and analyze execution data and draw up supply chain plans to achieve organizational objectives.

The recommended organizational diagram in Figure 7 aligns the Planning Unit with the Operations Director in a direct reporting capacity. This is important given that most of the supply chain activity falls within operational control. Planning transcends operations with stakeholders in finance and procurement as well. The alignment recognizes the need for additional requirements placed on the Planning Unit by these groups.

Figure 7: Recommended Supply Chain Planning Unit Structure



The proposed Planning & Continuous Improvement Manager directs the activities of the Supply Chain Planning Unit as well as the Performance Management Unit. The Supply Chain Planning Officer will direct the planning activities supported by three Supply Chain Planners. The Officer and Planners are responsible for planning activities revolving around 50 commodities.

Develop a Set of Supply Chain Planning Reports

Accessing information in a timely manner is key to successful planning. The following list of reports support the planning process recommendation by providing the Planning Unit with fundamental information to effectively manage inventory and identify issues and risks for resolution.

1. **Stock Status Report -** This report is designed to provide inventory visibility for all commodities managed by KEMSA. The report should be designed to run on an as needed basis. It will be used at least weekly in the Planning Meeting.
2. **Supply Planning Report** - This report provides a 12-month projection of inventory availability based on a monthly forecast and current Procurement Pipeline orders.
3. **Customer Order History Report** - This report shows a year-over-year display of past customer order history.

4. **Overdue Procurement Order Report** - This report identifies the Procurement Orders with the Date Promised in the past. The report is sorted on the Date Promised field and secondarily sorted by the Commodity Description.
5. **Order/Issue/Receipt Report** - This report provides a historical perspective of customer order history, what KEMSA issued, and the amount received in a corresponding month.
6. **Customer Order to Date Report** - This report provides a tracking of customer order quantity to date for a commodity against the forecast for the quarter/cycle.
7. **Forecast Accuracy Report** - This report provides the quarterly/cycle forecast error statistics.

In addition to these critical reports, KEMSA would benefit greatly from ad hoc reports. The supply chain planning function confronts many different scenarios that make it difficult to design a report for all of these situations. Ad hoc reporting allows the planner the flexibility to access information in the manner and at the time they choose. This capability is generally found in a data warehouse tool which provides the planner access and report design functionality. A data warehouse is a tool separate from the current ERP/WMS system which collects data from various sources including the ERP/WMS to generate flexible and timely reports for monitor. It essentially automates the monitoring and evaluation process for supply chain management and all other operations across KEMSA.

Educate and Train KEMSA Stakeholders

All stakeholders, including management, should receive supply chain planning training. Sessions should be administered in an interactive format facilitated by an instructor with appropriate credentials and industry experience in planning functions. It is important that all KEMSA personnel understand the basics of planning, the importance of accurate record keeping, and how it plays a critical role in meeting overall objectives. The following outline provides the framework of courses that should be developed and delivered.

Table 17: Training Framework

Course Focus Area	Description	Attendees
Introduction to Supply Chain Planning	• Strategic overview of all supply chain planning components • Overview of supply chain planning unit, its responsibilities, and its collaborative interactions with all other stakeholders	KEMSA leadership, KEMSA management, KEMSA Supply Chain Planning Unit, KEMSA Operations Managers, KEMSA Procurement Managers, and Ministry of Health programs
Demand Planning	• A detailed examination of the demand planning process – the data, the business environment, uses of forecasts for business decision making	KEMSA Supply Chain Planning Unit, KEMSA Operations Managers, KEMSA Procurement Managers, and Ministry of Health programs

Course Focus Area	Description	Attendees
Inventory Planning	• Commodity details, funding arrangements, constraints • Inventory management at KEMSA – inventory accuracy, stock taking process, ERP support • Inventory target levels	KEMSA Supply Chain Unit, KEMSA Operations Managers, and KEMSA Procurement Managers
Supply Planning	• The process of determining replenishment quantities and working with Procurement to actualize the purchases • Managing the inbound replenishments to assure inventory availability	KEMSA Supply Chain Unit, KEMSA Operations Managers, and KEMSA Procurement Managers