INTEGRATED LOGISTICS MANANGEMENT SYSTEM

A Research Topic
Presented to the Business Division
Lebanese American University

In Partial Fulfillment of
the Requirement for the Degree of
Master in Business Administration

BY
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JUNE, 1997

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ACKNOWLEDGEMENTS

I would like to express my deep and sincere gratefulness to my parents for their morale support and continuous encouragement without which I wouldn't be here today. My truthful gratitude to my family members for their believe in my person and their consistent motivation and support.
I also would like to insist on the importance of the contribution of Mr. Marwan Abdul Malek (Pepsi Cola Financial Manager) to the achievement of this degree , by giving me the opportunity to lead this project as well as for his continuous trust , support and encouragement.
I also would like to thank my friends Rindala Hilal, Imad Haddara, Rana Karake and all others for their assist and help throughout the studies, and Dina Jourdi , Malek Ounsi and Wissam Amkie for being very patient and tolerant with me.
Last but not least, I would like to express my sincere and deep gratefulness to my advisors Dr. Tarek Mekdashi and Dr. Hussein Hejase for the knowledge they gave me as well as for their trust and support. I also would like to thank all faculty members for their commitment to education and standards.

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CHAPTER I

INTRODUCTION

1.1 GENERAL OVERVIEW :

Our uncertain economy is marked by mature markets, the globalization of industry, high energy costs, potential energy and material shortages, high interest rates and capital rationing , a low growth rate in productivity, and the threat of inflation. In this context, maintaining corporate profitability growth and return on investment is becoming increasingly difficult. It has become necessary for management to explore new areas and investigate new methods of generating revenue and reducing costs. Few areas offer the potential for profit improvement that can be found in the logistics function. This is because logistics costs can exceed 25 percent of each sales dollar at the manufacturing level[1].

1.2 LOGISTICS DEFINITION :

In the past, the trade and academic press has given logistics a variety of names some of which are :

Physical Distribution; Distribution Engineering; Business Logistics; Materials Management; Supply Chain Management or Industrial Logistics.

At one time or another, all of these terms have referred to essentially the same thing : The management of the flow of goods from point-of-origin to point-of-consumption. But

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[1] Bernard J. Lalonde, John R. Grabner. "Integrated Distribution Systems : A Management Perspective." International Journal of Physical Distribution, October 1970, p. 134.

"Logistics Management" is the most widely accepted and used terminology to express the logistics function and its management.

According to the Council of Logistics Management, logistics management can be defined as follows :

> *"The process of planning, implementing and controlling the efficient, cost effective flow and storage of raw materials, in-process inventory, finished goods, and related information from point-of-origin to point-of-consumption for the purpose of conforming to customer requirement".*[2]

Some have argued that logistics is only important to manufacturing firms. However, logistics is an important component of the operation of all companies, including retailers, wholesalers, and other service providers.

1.3 COMPONENTS OF LOGISTICS MANAGEMENT :

Efficient management of the flow of goods throughout the operation cycle requires successfully planning, implementation, and control of a multitude of logistics activities. Included within the logistics management function are customer service, traffic and transportation, warehousing and storage, plant and warehouse site selection, inventory control, order processing, distribution communications, procurement, material handling, parts and service support, salvage and scrap disposal, packaging, return goods handling, and demand forecasting. Figure 1.1 illustrates the components of logistics management .

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[2] Definition provided by the Council of Logistics Management, 1986.

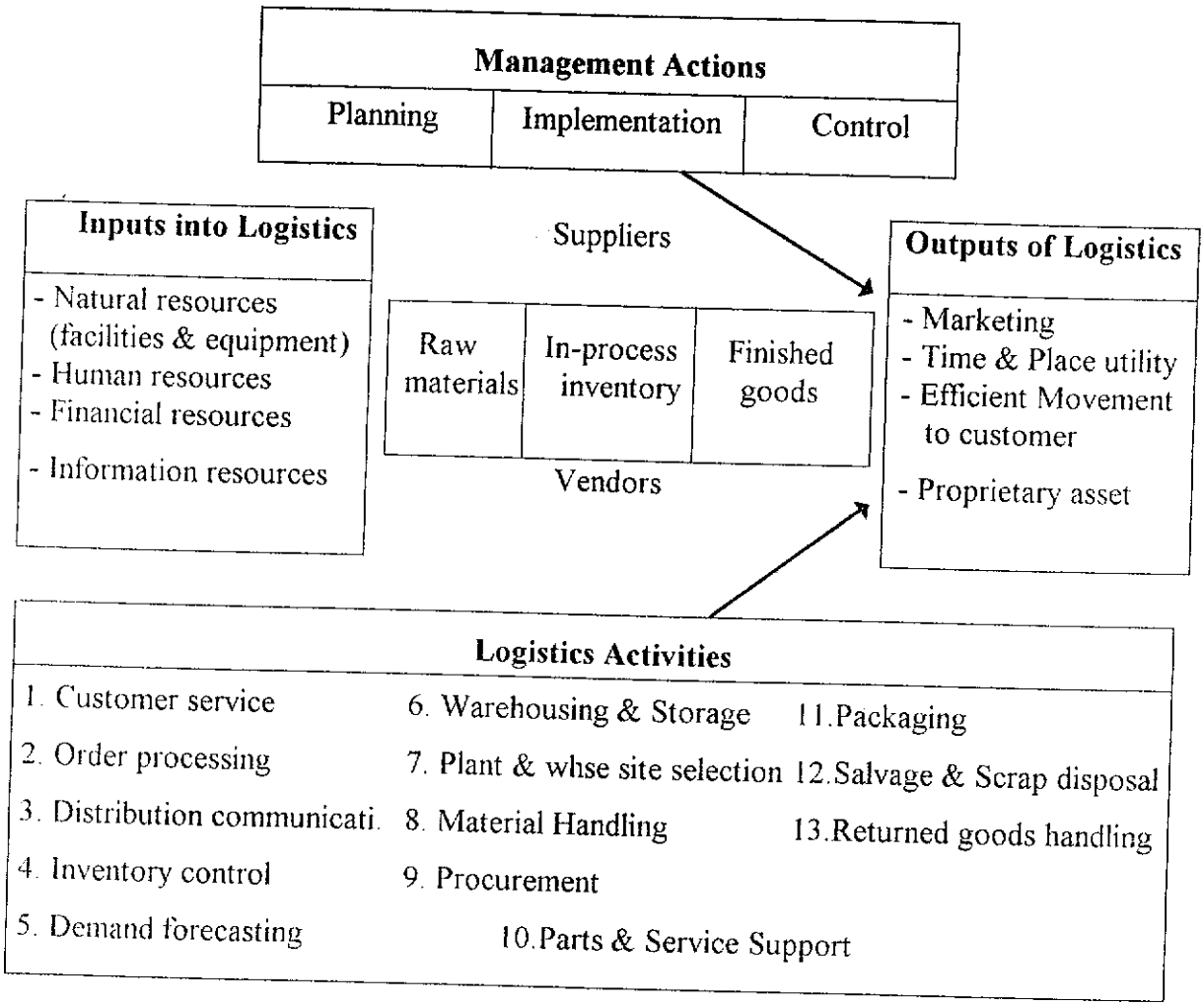

FIGURE 1.1 Components Of Logistics Management[3]

1.3.1 Customer Service : Is defined as "a customer-oriented philosophy which integrates and manages all of the elements of the customer interface within a predetermined optimum cost-service mix"[4]

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[3] Douglas M. Lambert , James R. Stock , "Strategic Logistics Management", p.5.

[4] Bernard J. Lalonde , Paul H. Zinszer, "Customer Service : Meaning and Measurement " p. iv.

Customer service acts as the binding and unifying force for all of the logistics management activities. Customer satisfaction, of which customer service is an integral part, occurs if the firm's overall marketing efforts are successful. Thus customer service involves successful implementation of the integrated logistics management concept in order to provide the necessary level of customer satisfaction at the lowest possible total cost.

1.3.2. Order Processing : The components of the order processing activity can be broken down into three major components : (1) operational elements , such as order entry/ editing, scheduling, order shipping and invoicing. (2) communication elements, such as order modification, order status inquiry and product information requests. (3) credit and collection elements, including credit checking and accounts receivable processing / collecting. The speed and accuracy of a firm's order processing has a great deal to do with the level of customer service the company provides and thus the level of customer satisfaction.

1.3.3. Distribution communications : Success in today's business environment requires the management of a complex communications system. Effective communication must take place between : (a) the firm, its customers, and its suppliers; (b) the major functional components of the company - marketing, manufacturing, logistics and finance ; (c) the various logistics activities such as customer service , warehousing ... . Communication is the vital link between the entire logistics process and the firm's customers. Accurate and timely communication is the cornerstone of successful logistics management.

1.3.4. Inventory control : The inventory control activity is critical because of the financial necessity of maintaining a sufficient supply of product to meet both customers'

needs and manufacturing requirements. Maintaining raw materials, parts and finished goods inventory consumes both space and capital. Money tied up in inventory is not available for use elsewhere. Successful inventory control involves determining the level of inventory necessary to achieve the desired level of customer service while considering the cost of performing other logistics activities.

1.3.5. Demand forecasting : Demand forecasting involves the determining the amount of product and accompanying service that customers will require at some point in the future. The need to know precisely how much product will be demanded is important to all facets of the firm's operations - marketing , manufacturing, logistics and finance. Marketing forecasts of future demand determine promotional strategies, allocation of sales force efforts, pricing strategies, and market research activities. Manufacturing forecasts determine production schedules, purchasing and acquisition strategies, and in-plant inventory decisions.

1.3.6. Warehousing & Storage : Are activities that manage the space needed to hold or maintain inventories. Specific storage activities include decisions as to whether the storage facility should be owned, leased or rented ; warehouse layout and design ; product mix considerations ; safety and maintenance.

1.3.7. Plant & Warehouse site selection : The strategic placement of plants and warehouses near the company's markets can improve the firm's customer service levels. Proper facility location can also allow lower volume-related transportation rates in moving products from plant to warehouses , plant to plant , or warehouse to customer.

1.3.8. Material Handling : is concerned with every aspect of the movement or flow of raw materials, in-process inventory, and finished goods within a plant or

*1.3.13. **Return goods handling** :* The handling of return goods is often referred to as "reverse logistics". Buyers may return items to the seller due to product defects, overages, incorrect items received, or other reasons. Most logistics systems are ill-equipped to handle product movement in the reverse channel. The cost of handling return goods can be very high if not managed properly by the logistics function.

1.4 EFFECT OF TECHNOLOGY ON LOGISTICS MANAGEMENT

Technology has had an impact on all facets of business, but in the logistics area the impact has truly been significant. The diffusion of technology is changing the way companies do business and the way firms relate to customers and suppliers. Computers, Information Systems, and communication systems are being increasingly used in transportation, warehousing, order processing, materials management, purchasing, and procurement. Literally, every area of logistics has been affected by the technological revolution and the developments in computers and information and communication systems.

Traditional methods of managing logistics activities are proving inadequate in today's fast-paced economy, and executives have been forced to innovate. If firms do not respond appropriately, they may face losses in market share, creating for themselves positions of competitive dis-advantage. Fortunately, assistance is available due to recent innovations and developments in technology.

In a Council of Logistics Management study of senior executives in manufacturing, merchandising, and logistics service organizations, "Logistics 95", several trends were identified[5]. The top three trends were all directly related to the use of computers, communication systems, and information systems :

1. The rapid proliferation of data processing systems enables the distribution or logistics organizations to handle and control information in ways that will change the traditional methods of servicing customers and supplying products.
2. Advances in computer technology will allow electronic data interchange to be pervasive. All phases of logistics will be involved, and communication technology will create opportunities for large savings.
3. The major difference between the logistics operating environment of 1995 and that of today will be the improvement in the timeliness and completeness of the exchange of information between channel members.(1)

The use of technology in logistics offers significant potential. A firm can create a competitive advantage by adopting a strategic perspective with respect to computers, communication and information technology.

1.5 INTEGRATED LOGISTICS MANAGEMENT :

Many companies have not managed logistics as an integrated system; for them, successful implementation of the integrated logistics management concept can lead to significant improvements in profitability. The foundation of the integrated logistics management

concept is total cost analysis, which we is defined as minimizing the total cost of transportation , warehousing, inventory, order processing and information systems, and lot quantity cost, while achieving a desired customer service level.

During the past 30 years, logistics has emerged as a separate and dynamic discipline. Many major corporations have acknowledged the importance of logistics by placing responsibility for this function at the vice presidential level. Basically, the integrated logistics management concept refers to administering the various activities as an integrated system. In firms that have not adopted an integrated logistics approach, logistics is a fragmented and often uncoordinated set of activities spread throughout various organizational functions with each individual function having its own budget and set of priorities and measurements. Many firms have found that total distribution costs can be reduced by integrating such distribution-related activities as customer service, transportation, warehousing, inventory management, order processing and information systems, and production planning and purchasing. Without this integrated approach, inventory tends to build up at the following critical business interfaces :

- Supplier-purchasing
- Purchasing-production
- Production-marketing
- Marketing-distribution
- Distribution-intermediary (wholesaler / retailer)
- Intermediary-consumer

[5] Report of the "Logistics 95" meeting of the Council of Logistics Management in Chicago, p.38.

In addition to improving the flow of inventory, integration improves transport asset utilization and warehouse asset utilization and eliminates the duplication of departmental efforts.

1.6 PURPOSE & NEED OF THE STUDY :

This study was conducted in order to analyze the efficiency of the Logistics & Manufacturing activities at Societe Moderne Libanaise pour le Commerce S.A.R.L. (SMLC) . This study allowed the company to identify some weaknesses in the operation while screening out new opportunities for improvement. The implementation of an integrated Logistics Management System helped the company in optimizing the efficiency of its operations and thus contributing effectively to the overall corporate profitability improvement.

1.7 OUTLINE :

This study was based on three major techniques : (1) System design , with business process re-engineering ; (2) Best practices applied in many international manufacturing companies (bottling companies mainly) ; (3) Operation research techniques specially in forecasting and transportation.

It is worth mentioning here that the research will follow the following outline :

Chapter II will deal with the gap analysis conducted at Societe Moderne Libanaise pour le Commerce, the Lebanese bottler of PEPSI COLA , which highlighted the opportunities for the new system and screened out weaknesses of the old one. A

comparative study will reflect the major changes in the operation process and the added value of each change.

Chapter III will explain the methodology used in each of the modules composing the Integrated Logistics System. This chapter will also deal with the operation research techniques incorporated into the system.

Chapter IV will talk about the results of the study and the benefits of each module. The results of the numerical comparative study will reveal the real value or contribution of the system to the overall increase in corporate efficiency .

Chapter V , finally will summarize the major study findings and will suggest certain recommendations concerning the issue of integrated logistics systems.

CHAPTER II

PROJECT EVALUATION
& IMPLEMENTATION APPROACH

2.1 PROBLEM SYMPTOMS :

With the growing product diversity and limited manufacturing facilities , Societe Moderne Libanaise pour le Commerce (SMLC) faced a major problem in 1995. The problem was the high occurrence of Out-Of-Stock (OOS) in all of its warehouses. Those OOS caused the company to lose not only in terms of sales revenues , but also in market share due to the availability of its direct competitor , Coca Cola and its indirect competitors , Juices .

Recognizing this fact , the company's top management with the collaboration of the international company started a new project for re-designing the logistics system of the company in order to minimize OOS and increase logistics efficiency and thus increase overall corporate profitability.

In order to conduct this project , a team was nominated. This team was formed of people belonging to different organizational functions : Sales , production, transportation, raw material, warehousing, and MIS.

Some of the major symptoms that indicated to management that there was a problem in the company's current logistics functions were :

1. High occurrence of OUT-OF-STOCKS
2. un-balanced distribution of finished products.

3. High raw material inventory levels in certain items while shortage in others

4. Double transportation and double handling of finished goods

5. High transportation costs. (inter-warehouse transportation)

6. Inaccurate forecast

7. Un-efficient space utilization in warehousing

8. High flavor and size changeovers on the production lines

In order to identify all these problems , many techniques were used . Some of these techniques include :

* Questionnaires

* On-The-Floor Supervision

* Year-Ago-Comparative study

* Analysis of sales vs inventory on-hand

* Analysis of production downtime, changeover time , and waste .

* Ratio analysis of the financial statements

* Weekly forecast accuracy calculation / per product / per location

* Analysis of the transportation activities

2.2 DAYS-SUPPLY EXERCISE - SYSTEM OVERVIEW

The days of supply exercise was a small system developed internally in order to measure the effect of OOS and highlight responsibilities. The system components are the following:

2.2.1 Inputs : - Warehouse full good physical count

- Warehouse Empties physical count

- Transportation schedule / Actual transportation

- Hub / Plant fullgood & empties physical count

- Actual daily production

2.2.2 **Calculations :** - Days of supply per SKU [6] / Location

- SKU System wide days supply

- Lost Sales opportunities

- Fair Share distribution of products

- Optimal inventory level (physical count)

2.2.3 **Reports :** - Days Supply for each SKU at one location (exercise 1)

- Days Supply for one SKU in all locations (exercise 2)

- Lost sales tracking for an SKU at a location (exercise 3)

The system was designed to :

i. Assist production manager in the daily production scheduling process :

- Base production schedule of the day or period on the criticality of the SKU in the whole network

- Prioritize according to loss effects due to SKU un-availability . That is , if more than one sku are running out of stock, choose to produce the one with the highest lost sales effect.

ii. Assist transportation manager / fleet manager in the daily transportation schedule setup:

- Base the "WHAT" to transfer on the availability of the SKU in the hubs.

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[6] SKU is Stock Keeping Unit and refers to each product type (i.e. Pepsi 250ml returnable)

- Use the Days Supply of each SKU at each location as a guide to "WHERE" to transfer. The Days Supply of one product should be balanced across the network.

- Prioritize according to loss effects due to sku un-availability.

iii. Provide finance , production, sales and warehouse managers with operation efficiency reports :

- Lost sales opportunities
- Inventory tracking
- Six weeks average sales by sku / by warehouse
- Actual transfers vs scheduled transfers (% completion)
- logistics activities tracking

iv. Highlight gaps in the logistics process and allocate responsibilities :

- Period accumulated lost sales opportunities
- No fair share distribution across warehouses
- Average sales by sku / by warehouse
- Categorize problems

v. Train all involved managers to use the DAYS-OF-SUPPLY concept :

Since the Integrated Logistics & Manufacturing system optimization technique is based on the System Wide Days Supply calculation, explaining and exposing functional managers to this concept , and consequently benefits of using it , will facilitate change management process required to derive optimum profitability contribution from using the system.

vi. Prepare coordination channels , data flow and information collection pre-work required for the successful implementation of the new integrated logistics & Manufacturing system (IL&M) . The success of IL&M lies in :

- The degree of coordination and communication between inter-functional managers.
- The information infrastructure based on which the system will operate
- Days of Supply Exercise intends to enhance communication channels and to create coordination-intensive managerial environment.

2.3 EVALUATION OF THE PROBLEM :

In order to justify the needed investment of implementing a new computerized integrated logistics system, we had to evaluate the losses due to the current logistics process.

In order to do so, a computerized system was developed to analyze sales, inventory, transportation and production performance while suggesting some optimal solutions.

2.3.1 Gap Analysis Findings :

Listed below, are some of the major numerical findings derived from the days-of-supply exercise system. Those numbers where used in estimating the potential contribution of implementing an integrated logistics system. The problems causing the OOS were categorized and the percentage contribution of each was calculated. (see Table 2.1 for overall estimation of OOS.)

There are several types of reports : (1) OOS estimation by product by location (Table 2.2)

(2) Identified categories of problems

(3) percentage contribution to total losses;

(4) Financial impact of Inaccurate Forecast (Fig. 2.1)

2.3.2 Implementation Guidelines - Project Plan Kit :

Listed below are exhibits about project planning and implementation approach used during our implementation at SMLC.

TABLE 2.1 : Consolidated Out-Of-Stock Report

SOCIETE MODERNE LIBANAISE pour le COMMERCE

PEPSI COLA

SKU UN-AVAILABILITY OPPORTUNITY LOST

SUMMARY

PERIOD : 21/08/1995 TO 21/09/1995

SKU CODE	DESCRIPTION	QTY CHOUEIFAT	QTY HAZMIEH	QTY BEIRUT	QTY SAIDA	QTY TRIPOLI	QTY ZAHLEH	QTY ALEY	QTY AAKBIEH	QTY BIBLOS	QTY DEKWENEH	QTY AKKAR	QTY TOTALS	PRICES	AMOUNTS L.L. TOTALS	AMOUNTS $ TOTALS
302	MIRINDA RETURNABLE 100 CL	15,465	5,837	1493	420	9,916	11,228	580	2,053	1,570	645	8,042	44,359	7,000	310,513,000	192,268
202	7UP RETURNABLE 100 CL.	4,224	619	5739	217	4,408	2,426	676	642	35	529	1,957	17,633	9,600	169,276,800	104,815
207	7UP DIET ONE WAY	0	4,510	8403	940	2,246	644	505	0	1,119	3,363	17	16,743	12,000	200,916,000	124,406
301	MIRINDA RETURNABLE 25 CL.	5,297	1,818	0	0	1,642	4,837	431	0	3,144	0	530	13,594	12,000	163,128,000	101,008
112	PEPSI MAX ONE WAY	1,019	4,322	2260	749	2,818	1,215	438	470	5,620	4,545	374	12,383	9,600	118,876,800	73,608
208	7UP DIET CAN	242	215	2197	210	3,582	549	3,345	784	1,848	2,880	205	6,995	7,500	52,462,500	32,485
111	PEPSI MAX CAN	84	2,447	0	12	2,816	743	1,114	197	2,115	2,636	497	6,102	12,500	76,275,000	47,229
303	MIRINDA ONE WAY	34	1,254	662	63	393	1,277	301	301	307	1,757	328	3,683	13,000	47,879,000	29,646
110	PEPSI PET 0.5 L.	173	1,467	1504	0	453	63	8	33	110	147	7	3,660	16,500	60,390,000	37,393
108	PEPSI DIET ONE WAY	51	1,416	1083	0	383	277	175	104	1,251	714	0	3,210	12,500	40,125,000	24,845
306	MIRINDA PET 1.5 L.	45	401	161	0	162	884	241	170	306	0	0	1,653	7,000	11,571,000	7,165
204	7UP CAN	75	0	0	0	1,386	0	0	0	0	0	0	1,461	10,800	15,778,800	9,770
206	7UP PET 1.5 L.	57	0	488	0	473	296	172	38	320	131	47	1,314	13,000	17,082,000	10,577
304	MIRINDA CAN	0	285	389	0	56	451	0	0	0	0	0	1,181	12,000	14,172,000	8,775
105	PEPSI CAN	0	0	0	0	896	212	0	0	0	0	0	1,108	10,800	11,966,400	7,410
103	PEPSI PET 1.5 L.	155	0	0	0	0	541	76	194	355	1,115	0	696	12,500	8,700,000	5,387
109	PEPSI DIET CAN	0	154	192	0	95	61	45	52	214	0	0	502	12,000	6,024,000	3,730
104	PEPSI ONE WAY	42	0	85	0	50	281	0	180	0	137	65	458	7,000	3,206,000	1,985
307	MIRINDA PET 0.5 L.	7	84	0	0	91	167	0	0	27	40	0	349	10,800	3,769,200	2,334
107	PEPSI DIET RETURNABLE 25	0	273	0	0	47	10	0	0	49	61	0	330	12,500	4,125,000	2,554
209	7UP PET 0.5 L.	0	89	0	0	162	1	0	4	0	39	0	252	16,500	4,158,000	2,575
201	7UP RETURNABLE 25 CL.	0	0	0	0	0	154	89	0	0	0	237	154	12,000	1,848,000	1,144
102	PEPSI RETURNABLE 100 CL	0	0	0	0	0	109	1	0	0	0	0	109	9,600	1,046,400	648
203	7UP ONE WAY	0	0	0	0	0	106	36	0	0	0	0	106	12,000	1,272,000	788
101	PEPSI RETURNABLE 25 CL	0	0	0	0	0	0	0	0	0	0	0	0	16,500	0	0
	TOTALS	*26,970*	*25,191*	*24,656*	*2,611*	*32,075*	*26,532*	*8,233*	*5,222*	*18,390*	*18,739*	*12,308*	138,035		1,344,560,900	832,545

SOCIETE MODERNE LIBANAISE pour le COMMERCE
PEPSI COLA

EXERCISE 1

SKU UN-AVAILABILITY
& SALES OPPORTUNITIES
EXERCISE

SAIDA

PERIOD : 21/08/1995 To : 21/09/1995

WORKING DAYS = 27

SKU CODE	SKU DESCRIPTION	SELL DAYS	PERIOD SALES	SIX WEEKS AVG. SALES	TO DATE INVENTORY	DAYS SUPPLY	DIFF.	SCH. TRANSP.	ACT. TRANSP.	ACCUMULATED LOST SALES	LOSS % OF SALES	# DAYS OUT OF STOCK	INCREMENT OPPORT. LOST	TOTAL LOSS
101	PEPSI RETURNABLE 25 CL	27	12006	445	1741	4	1296	11214	12490	0	0%	0	0	
102	PEPSI RETURNABLE 100 CL	27	28137	1042	2857	3	1815	32820	29950	0	0%	0	0	
103	PEPSI PET 1.5 L.	27	3480	129	1540	12	1411	4499	5016	0	0%	0	0	
104	PEPSI ONE WAY	27	368	14	783	58	775	800	1040	0	0%	0	0	
105	PEPSI CAN	27	10615	393	2416	6	2023	20600	19400	0	0%	0	0	
107	PEPSI DIET RETURNABLE 25	27	297	11	273	25	262	350	400	0	0%	0	0	
108	PEPSI DIET ONE WAY	27	155	6	107	19	101	160	0	0	0%	0	0	
109	PEPSI DIET CAN	27	1180	44	100	2	56	1768	1250	0	0%	0	0	
110	PEPSI PET 0.5 L.	27	131	5	16	3	11	0	0	0	0%	0	0	
111	PEPSI MAX	26	307	12	303	26	291	1500	4980	12	4%	1	0	12
112	PEPSI MAX ONE WAY	16	646	40	311	8	271	0	0	444	69%	11	305	749
201	7UP RETURNABLE 25 CL	27	5822	216	1552	7	1336	3300	1400	0	0%	0	0	0
202	7UP RETURNABLE 100 CL	27	2949	109	889	8	779	3600	0	202	7%	2	15	217
203	7UP ONE WAY	27	3891	144	876	6	732	5208	5544	0	0%	0	0	0
206	7UP PET 1.5 L.	27	657	24	283	12	259	924	924	0	0%	0	0	0
207	7UP DIET ONE WAY	12	303	25	0	0	-25	420	252	403	133%	16	537	940
208	7UP DIET CAN	20	378	19	19	1	0	0	400	150	40%	8	60	210
209	7UP PET 0.5 L.	27	80	3	14	5	11	0	0	0	0%	0	0	0
301	MIRINDA RETURNABLE 25 CL	27	7500	278	1395	5	1117	8000	8170	0	0%	0	0	0
302	MIRINDA RETURNABLE 100 CL	26	5152	198	749	4	551	6330	6300	330	8%	2	30	420
303	MIRINDA ONE WAY	25	562	22	340	15	318	1780	720	56	10%	3	7	63
304	MIRINDA CAN	27	6395	237	664	3	427	5400	5825	0	0%	0	0	0
306	MIRINDA PET 1.5 L.	27	1270	47	433	9	386	726	1518	0	0%	0	0	0
307	MIRINDA PET 0.5 L.	27	64	2	25	11	23	0	0	0	0%	0	0	0
TOTAL			92348	3465	17691	5	14226	109388	105579	1658				2613

TABLE 2.2 : Saida Warehouse OOS Report

FIGURE 2.1 : Economic Impact of Inaccurate Forecast

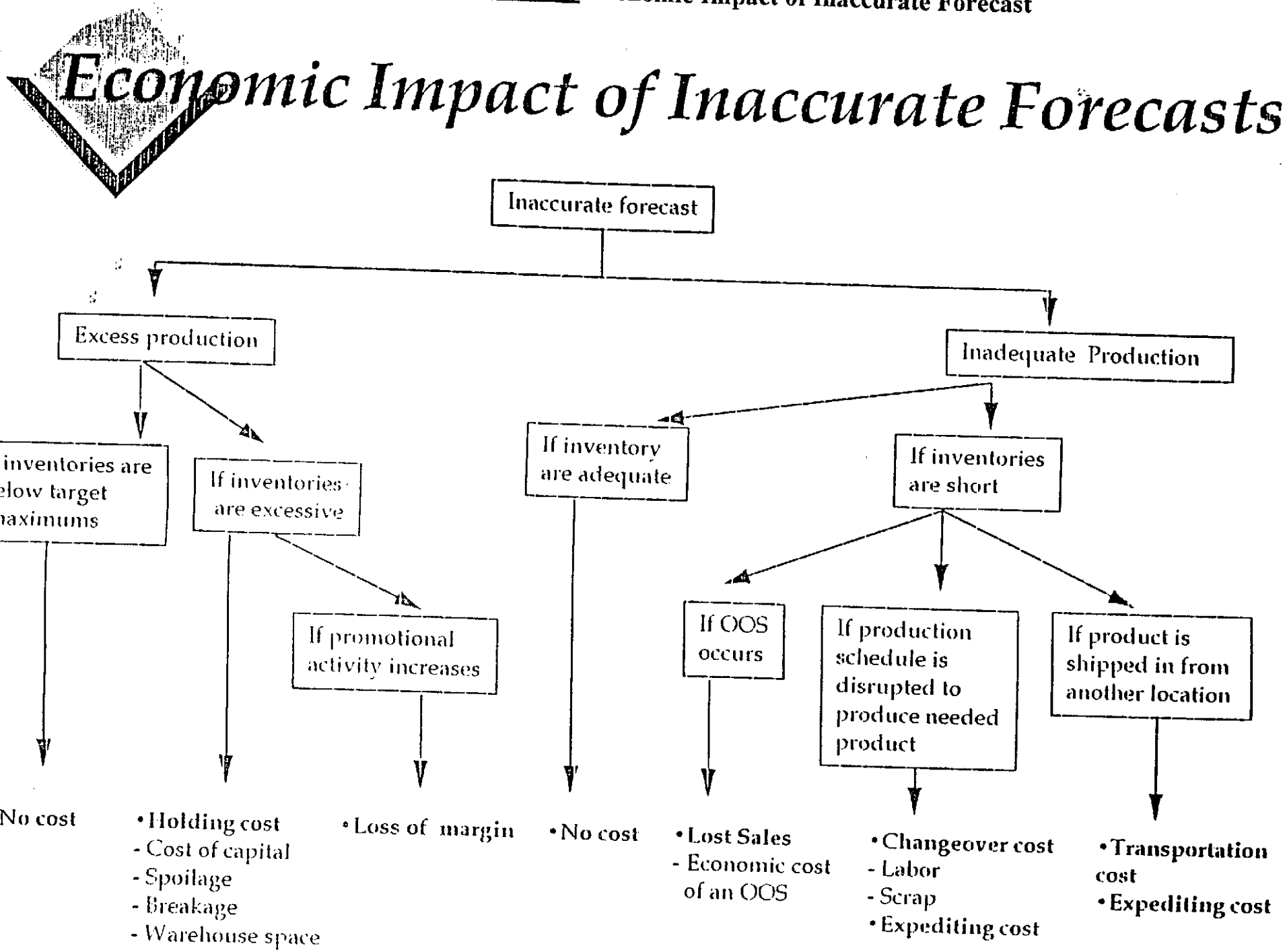


EXHIBIT 2.1

1. EXECUTIVE OVERVIEW

The purpose of the Logistics & Management (L&M) Standard Project Plan Kit is to help ensure that L&M is successfully implemented in an area of logistics and manufacturing operations. The contents of the Plant Kit are based upon learnings from the implementation in other international markets like Spain , Hungary or Jaddah in the Saudi kingdom tailored to fit our own environment .

A successful L&M implementation project requires :

1. Proper Expectations : setting quantifiable objectives at the very beginning of the project , to be able to realize the benefits of PL&M, committing to upgrading the business processes as needed
2. A clear viable approach : having an executable game plan to fit the company's situation while assuring that standards and best practices are developed and met.
3. Realistic Time frames : ambitious enough to allow commitment and focus, but achievable to maintain momentum
4. Proficiency : knowing what needs to be done and having the skills to execute the tasks
5. Adequate resources : defined roles, responsibilities and authorizations for the logistics, manufacturing, finance and MIS staff on the implementation team, and adequate funding to execute the project as planned
6. Sponsorship, Ownership and Leadership : to make sure that the project gets done the right way , the sponsor should provide top management support while

the owner insures dedication and commitment of the operational staff and the leader follows on the details and makes sure plan if fully executed.

This L&M Project Plan Kit provides the tool to support the foregoing requirements for successful L&M project implementation

EXHIBIT 2.2

2. SETTING PROJECT OBJECTIVES: Logistics and Manufacturing Processes

GOAL STATEMENT

The primary goal of a PL&M implementation project is to produce an operational information system that support Logistics (Demand Forecast, Transport & Inventory Management) and Manufacturing (Production Scheduling Inventory Management, Materials Requirements Planning) efficiently, accurately and in a timely manner.

High-quality customer service depends upon the ability to process transactions quickly, correctly and cost-effectively and the ability to provide decision-makers with information about the market. In addition both local statutory requirements and PCI reporting requirements must be met.

GENERAL PL&M REQUIREMENTS

Generally, an Area operation has three requirements of a PL&M system:

1. that transactions be processed quickly, correctly and cost-effectively
2. that local market conditions can be analyzed in a timely manner
3. that reports meet local management and statutory requirements and PCI reporting requirements in a timely and accurate manner

Requirement #1 means that the system must be able to process an adequate volume of transactions during the normal working hours with a normal amount of staff. *Inefficient, innacurrate or redundant procedures and data entry must be eliminated,* if possible, during the implementation or soon after by analyzing the way things are currently done and making the changes necessary to adopt the best business practices for keeping warehouses stocked, scheduling transport, and scheduling production, all based upon a sound demand forecast. The system must have built-in controls for data integrity. The system should be implemented in such a way that data is captured once, checked, and *automatically* recalculated, posted, summarized and consolidated for reporting.

Requirement #2, timeliness, means the ability to act with speed. That is, adequate system resources must be available during peak production times, and modules and procedures must be correctly *integrated* during implementation to capture information and report quickly, and operating environments must be made compatible and stable, to allow deadlines to be met. The system reports must provide useful information for market analysis, as defined by local management.

Requirement #3 means that the implementation must be customized to local requirements, such as proper tax accounting for inventory movements, or the physical configuration of the local distribution network. At the same time, the system must be able to produce information for other applications that fulfill the PCI reporting requirements, such as PF&A and PS&D, and ultimately be integrated with these systems.

EXAMPLES OF OBJECTIVES

Objectives are set forth in a **"Project Overview"** document produced by the Project Owner and Leader. The "Project Overview" objectives are presented to the team at the Kick-Off meeting for the project. Using the general PL&M system requirements shown above, the following types of objectives should be set early in the planning phase of the project:

"The Objectives of the PL&M Implementation Project in Area X are to:

1 provide management with days of supply and KPI reports, that support day to day decision making; provide inventory level information for the Standard Operating Review on a monthly basis

2 reduce costs in transport by avoiding double shipping and minimizing subcontractor fees

3 implement a sales-driven demand forecasting process to reduce days supply in each warehouse to seven, and reduce line changeovers by 30%

4 allow automatic inventory reconciliation, to reduce the number of physical counts each month to one

5 improve customer service by decreasing out-of-stocks by 50%

....."

EXHIBIT 2.3

3. SELECTING THE PROJECT APPROACH: Implementation Project Scope Options

PURPOSE

The purpose of selecting an approach to PL&M implementation is to make key decisions about how the project will be done. The approach is selected early in the planning phase, and determines the scope of the Area-specific PL&M Implementation Project Plan. Laying out the Area's approach addresses how the business processes will work at the same time as implementing the supporting computer system.

KEY DECISIONS

There are key decisions to be made in order to customize the project to the local situation. The answers to these key questions determine the number and length of tasks on the project schedule.

1. To what extent will business processes be changed during the PL&M implementation? Will new sales and inventory processes be implemented? Will the system be centralized or decentralized?
2. How well does the latest version of PL&M fit the current business environment? How does PL&M map to the existing logistics and manufacturing system?
3. Which PL&M modules will be implemented during this project? Which modules will be implemented on later releases? Which legacy systems should be kept?
4. Of the modules chosen, have all been piloted? Will we be the first to use a particular module? Will we be the first to use a particular module in a new way (e.g., multi-location inventory)?
5. Is it necessary to bring over to PL&M historical transactions at cutover? Or can opening balances be computed and entered into the system? How will sales history be captured?
6. How will various elements be coded: Area codes or CDV's? Which new codes will be implemented?
7. Which location(s) will be rolled out first? How will subsequent locations be rolled out?
8. Which departments will perform which functions during implementation? Which departments will ultimately own which functions?
9. How does the implementation fit around peak activity?
10. What functional and MIS resources can be assigned to the project? What percent of their time can they dedicate to the project? Are extra resources needed?

SAMPLE APPROACH

In the "Project Overview" document, the Project Owner and Leader should make the following type of Approach statement:

"The approach to be followed in Area X PL&M implementation is:

1 Processes to be upgraded during implementation include:
- Transport Planning
- Full-Goods Inventory Reconciliation
- Production Scheduling

New processes to be implemented include:
- Sales Forecasting

Processes out-of-scope for this implementation include:
- Raw Materials Inventory Management
- Bill of Materials
- Purchasing
- Production Cost Tracking

All other processes are to be implemented as in the current business environment.

2 A detailed Gap Analysis will be performed, comparing
- existing transport scheduling process to recommended process
- existing production planning to recommended production planning
- existing sales forecasting process to recommended process
- existing inventory control process to recommended process
- existing S&D system functions to PL&M system functions
- existing S&D data to PL&M data requirements

3 The following PL&M version 1.X.X modules will be implemented during this project:
- Demand Forecast
- Transport Management
- Production Scheduling
- Inventory
- Inventory interface to PS&D

The following PL&M version 1.X.X modules will be implemented during the next project:
- Plant Production Tracking
- Logistics Tracking System
- MRP
- Bulk Delivery

4 This project will include a pilot of the Inventory module in multi-location mode.

5 The following information will be brought over from the existing L&M system:
- all inventory transactions from 1995, on cutover day
- all sales volume history, consolidated by sku, from 1994 and 1995, on cutover day
- all bills of lading from 1995, on cutover day

6 The following Area codes will be used:
- Product codes (item)
- Line number
- Bill of Lading Number

The following PL&M standards and CDV's will be used:
- Location codes
- Truck Type

The approach will be to data enter the base set-up data from the prework documents.

7 The central manufacturing/warehouse location will be done first on a UNIX server. Locations of less than 1000 cases per week (single PL&M user) will be run on a DOS platform. The entire Area will be rolled out during a four-week period in February to avoid peak season.

8 During the initial implementation, the Logistics Operations department will be responsible for setting up inventory control modules. After the initial implementation, the local warehouses/manufacturing locations will be responsible for setting up and maintaining inventory control modules in their site.

EXHIBIT 2.4

4. ESTIMATING TIME LINES:

ESTIMATING METHOD

PL&M implementation project timelines must be aligned to Area daily operations schedules. Lengthy parallel operations are not feasible due to the difficulty of reconciling two systems and a costly duplication of resources. The standard plan, presented in the next section, is a guideline to estimating the amount of time the Area's project will take. The actual timeline depends upon resource availability, readiness and state of the organization (start-up, established or acquisition), in addition to the scope selected in Chapter 3.

ESTIMATING STEPS

An overall timeline for the implementation project, consisting of a Start Date and a Cutover Date, can be estimated as follows:

1 Complete the Operations Schedule Chart in Appendix B, marking the report deadlines and peak workload dates, e.g. peak logistics months.

2 Estimate the existing backlogs of transactions, e.g. 1 week of inventory movements, 6 months of sales history.

3 Designate existing transactions that can be archived from the existing system and that do not need to be transferred to the new system.

4 Design the automated batch transfer of detail transactions that must appear on the new system on the cutover date. If it is not feasible to do an automated batch transfer, the transactions must be re-entered or updated in the new system. Design the data entry function for converting transactions. Estimate the amount of batch and data entry conversion transactions.

5 Choose an sixteen to twenty week period that does not end in the middle of peak workload, and that falls after a close for inventory). The last day of the chosen period is the Cutover Date for PL&M; the first day is the Project Start Date.

6 If your Area has no experience with an L&M system, increase the timeline by 20% to allow for the learning curve.

TIME LINE DEPENDENCIES

The duration of the project will essentially depend on the following factors:

1 Scope of the project: The wider the scope the longer the time required.

2 Level of fit of PL&M: The extend and criticality of the gaps will determine whether the current PL&M version is implementable or not and the level of effort required to implement it.

3 Development effort: The extent of local development required for conversion, reports, modules and interfaces is critical. (This is the number of mandays for programming in your local database language, PROGRESS and perhaps IMPROMPTU)

4 Availability of functional and MIS resources: Resources MUST allocate sufficient time for the appropriate tasks in order to keep the project on planned time. Dedicated resources allow the overlapping of tasks and thus enable earlier completion.

EXHIBIT 2.5

5. ESTIMATING TASKS:
Customizing the Standard Project Plan for the Area

PURPOSE OF THE STANDARD PLAN

A standard project plan facilitates project planning, monitoring and control to ensure successful implementation. The Standard PL&M Implementation Project Plan groups numerous detailed tasks into eight phases marked by measurable milestones and designates the critical path for the project. The Standard Plan is only a guideline: the actual Area Implementation Plan must be customized to the Area's situation!

Appendix E contains Standard Gantt Charts showing all the possible tasks that an Area may have to undertake to implement PL&M. Based upon the Approach and Scope selected by the Area (Chapter 3) the appropriate tasks are chosen from the Standard Gantt Chart to make up the Area's PL&M Implementation Project Plan. The Area's Project Plan is documented in the "Project Overview" document produced during the initial phase.

Tasks and phases may need to be adjusted according to specific Area requirements and/or depending whether the Area is implementing a certified release or a pilot release of PL&M.

The Standard Gantt Chart includes task dependencies that make up the critical path for the project. Phases and tasks are overlapped where possible to minimize the length of time for the project.

Each task normally results in a deliverable. When all deliverables from a phase are complete, a milestone is achieved. Project progress is measured by percentage of milestones achieved. (See PCI EE/CA Project Management Guide).

NOTE: the following pages describe the eight standard phases of a PL&M Implementation Project. The phases are NOT to be scheduled sequentially! Phases run concurrently, with many tasks overlapping time frames. The time frames presented represent elapsed time, not level of effort. (See Chapter 6 for help in estimating level of effort.)

PHASE DESCRIPTIONS

	PHASE NAME	TASKS	DELIVERABLES
1	PL&M Project Start-Up 1-2 WEEKS	Management defines the shape of the implementation project as it will be done in their Area. Objectives, Benchmarks, Benefits, Approach, Scope and Success/Risk Factors are set before the team. Based on Area needs, all necessary tasks are entered on the Gantt Chart. Resources are assigned to the project. The project is officially started.	Project Overview Document: Objectives, Approach, Scope, Gantt Chart Staffing Plan: Dates, Tasks, Resources Kick-Off Meeting
2	Analysis & Design 6-8 WEEKS	Three Gap Analyses are conducted - functional, process and data; the best way of converting the existing information to PL&M is decided; the best way of getting information in/ out of PL&M, and necessary interfaces, are specified. Prework is done: codes, forms, procedures and language that will be used to set up PL&M (see Appendix C.) New and upgraded business processes are developed, ready for implementation. The minimum required PL&M application changes are prioritized and requested.	Gap Analysis Charts Preparation Checklists Setup Matrices Items Locations Customers Transactions Business Processes, Codes, Forms, Procedures Change Requests Technical requirements and platforms Software version order to STC
3	Installation, Setup, Conversion & Development 12-14 WEEKS	The physical environment is set in place. The technical base is established, the system is secured, the final prework is completed, set-up data is entered, conversion and interface programming, and data conversion is completed and unit tested, and additional data is entered. Development of local reports, analysis extracts and modules is carried out.	Hardware Operating system Database setup Final Checklists Complete/correct set-up tables User access setup Backup/Recovry procedures Conversion programs
4	Testing & Review 4-6 WEEKS	All aspects of the new system, interfaces and conversion process are simulated and re-worked according to test plans. The test plans set forth the criteria for end-user acceptance of the new system. The criteria include performance, correct results of processing, ability to recover, and ease of use. The Implementation Leader, Key End Users and Analysts decide whether or not the test results meet the criteria, and authorize the various system modules for use in the Area. As needed, change requests for fixes and enhancements are specified to send to the developers for implementation in later releases of PL&M, or immediate implementation in a pilot situation.	Test Plans and documentation Test results Acceptance Document Issues Log Change Requests

PHASE DESCRIPTIONS
CONTINUED

	PHASE NAME	TASKS	DELIVERABLES
5	Documentation & Translation 15 WEEKS	Standard PL&M training and user manuals are translated and additional documentation is prepared for local development and business processes. Screens are translated as required.	Local language manuals and screens Project documentation
6	Training 4-6 WEEKS	Key end users are trained in preparation for the Gap Analysis. Staff are trained on PL&M in preparation for the Cutover Date. Trainers are trained to teach end users how to work with PL&M. End users from each department learn by using the training system, and are tested for proficiency. MIS support staff learns the technical base of the PL&M software to be able to support the system, create ad hoc reports and support locally developed modules. A training program and training database are prepared that can be used to train staff in the future.	Training database setup Training manuals Trained trainers Trained end users Trained MIS support staff
7	Conversion & Cutover 3-4 WEEKS	PL&M is rolled out into logistics, manufacturing, sales and accounting operations on-site. Live data is entered or loaded into the system and setups reviewed. Conversion Control reports from the existing and the new system are compared for control purposes. A formal handover is conducted from temporary project team members to permanent Area staff.	Control reports Project files Live PL&M system
8	Project Monitoring 16 - 20 WEEKS	This phase runs throughout the entire project. Regular progress reporting and meetings allow risks to be addressed in a timely manner before there is a material impact on the project schedule. Issues Logs are maintained to support decisions about schedule changes. The project is formally wrapped up with a measurement of objectives achieved and a post-implementation review.	Bi-weekly progress reports or Milestone meetings Weekly project team meetings Updated issues log Approved/rejected change requests Updated Gantt chart Project Delivered

6. STAFFING THE PROJECT: Roles, Responsibilities, Skills and Time Required

STAFFING GOAL

In order to meet project deadlines, a PL&M Implementation team should include adequate numbers of management, logistics, manufacturing, sales, finance and MIS resources capable of successfully executing planned tasks in a timely manner. Meeting project deadlines is critical in a PL&M implementation, because of the operational dependency on the system..

A successful staffing plan for an Area's PL&M implementation project is made up by assigning personnel who fit the descriptions given below. Roles marked as Key Resources are minimum staffing required to fulfill an average 16-20-week project plan. Note that additional Key Resources will not necessarily allow the project to be done faster!

RESOURCE DESCRIPTIONS

	Implementation Team Role	Responsibilities	Phase	Position / Skill Levels	Time Commitment
1	Division Project Sponsors	—Set bonus objectives —Recognize milestones —Endorse kick-off & wrap-up	1,8	DIV. PRESIDENT DIV. TECH OPS VP	4 hours per Area implementation project
2	Area Project Sponsors	—Set bonus objectives – Ensure resources —Recognize milestones —Endorse kick-off & wrap-up —Designate Process Owners	1,8	AVP, TECHNICAL DIRECTOR, AFD	8-20 hours over 16 - 20 weeks
3	Div. MIS Steering Committee	—Sets bonus objectives policy —Monitors progress —Maintains commitment	1,8	AREA AVP'S DIV. TECH OPS VP DIV. CFO	2-4 hours over 16 - 20 weeks
4	Process Owners	—Approve Project Plans —Quantify objectives —Review decisions & deliverables —Measure results —Build project team —Designate Implementation Leader	All	PRODUCT AVAILABILITY MANAGER(S)	2-8 hours per week for 16 - 20 weeks
5	Division MIS Director, Project Manager	– Align objectives with PCI strategy – Ensure and monitor project funding – Monitor progress – Resolve issues – Liaise with Somers MIS	All	DIVISION MIS DIRECTOR, PROJECT MANAGER	2-4 hours per week for 16 - 20 weeks + 8 hours for each phase

RESOURCE DESCRIPTIONS
...CONTINUED

	IMPLEMENTATION TEAM ROLE	RESPONSIBILITIES	PHASE	POSITION / SKILL LEVELS	TIME COMMITMENT
6	MIS Manager	—Assists with Project Planning, Monitoring and Setting of Objectives —Assures technical environment —Designates MIS Analyst and Technical Support	All	AREA MIS MANAGER	2 hours per week for 16 - 20 weeks + 8 hours for each Phase + 24 hours in Phase 7
7	Implementation Leader	—Plans Project Tasks —Leads Project Tasks —Coordinates Team & Tasks —Controls scope & deliverables —Leads gap analysis tasks and approves change requests —Documents project progress and issues —Communicates —Makes Test Plans —Trains	All	AREA FUNCTIONAL LEADER FROM LOGISTICS OR MANUFACTURING or CONTRACTOR: Experienced qualified logistics/production manager with systems background or Experienced systems project manager with logistics/production background	100% of time during intensive phases of the 16 - 20 weeks + 2 weeks pre-project preparation + 1 week post-implem. review
8	L&M Operations Systems Analyst	—Analyzes current business processes —Designs PL&M business processes —Gathers information for pre-work and sets up system parameters —Creates analysis documents (including Functional and Process Gap Analysis, and Change Request Specifications) —Leads translation effort —Executes test plans —Trains —Runs Control Reports —Maintains project files —Assists conversion	2, 3,4, 5,6,7	AREA LOGISTICS, PRODUCTION OR SYSTEMS ANALYST: Qualified operations/systems analyst/manager	50% of time for 16 - 20 weeks

RESOURCE DESCRIPTIONS
...CONTINUED

	IMPLEMENTATION TEAM ROLE	RESPONSIBILITIES	PHASE	POSITION / SKILL LEVELS	TIME COMMITMENT
9	Sales Operations Systems Analyst	—Analyzes current business processes —Designs PL&M business processes —Gathers information for pre-work and sets up system parameters —Creates analysis documents (including Functional and Process Gap Analysis, and Change Request Specifications) —Leads translation effort —Executes test plans —Trains —Runs Control Reports —Maintains project files —Assists conversion	2, 3,4, 5,6,7	AREA SALES OPERATIONS ANALYST OR SYSTEMS ANALYST: Qualified sales operations/systems analyst/manager	50% of time for 16 - 20 weeks
10	Technical Support: Analyst	– Conduct and document Data Gap analysis, and assist with Change Request specification – Installs/tunes PL&M database and application – Assists with system set up – Develops and documents local reports & interfaces – Develops/modifies conversion programs – Testing & identification of bugs – Develops and documents local modules – Assists with technical documentation & training	2,3,4, 5,6,7	AREA SYSTEMS ANALYST/ PROGRAMMER: Qualified systems analyst-Progress database programmer Note: vendor support may be required for conversion from packaged systems	80% of time for 16 - 20 weeks
11	FUNCTIONAL OWNERS: Warehouse Managers Sales Managers Production Schedulers	– Represent the Process Owners in project team – Provide input to analysis – Review proposed solutions – Participate in testing – Review translations – Train – Review test results – Perform user acceptance tests for sign-off – Supervise data entry	2,3,4, 5,6,7,8	AREA DEPARTMENT SUPERVISORS	160 hours in Phase 2 + 40 hours in Phase 3 + 40 hours in Phase 4 + 40 hours in Phase 6 + 8 hours in Phase 7 + 24 hours in Phase 8

	IMPLEMENTATION TEAM ROLE	RESPONSIBILITIES	PHASE	POSITION / SKILL LEVELS	TIME COMMITMENT
12	Functional Advisors	—Functional Leadership —Conduct initial walkthroughs —Facilitate solutions and best practices —Consult on benefits and implementation plan —Liaison with STC, Somers, Division —Assist with prioritization of change requests	2,3,4, 5,6	DIVISION TECHNICAL DIRECTOR and SOMERS STAFF	as needed
13	Support Staff	—Package/Install software —Install environment —Tune database —Assist with preparations —Provide documentation —Provide training —Translate application	2,3,4, 5,6,7	AREA MIS and/or STC STAFF and/or CONTRACTORS: e.g. Progress or UNIX specialists, translators	as needed

THE BUSINESS PROCESS AND PL&M: GAP ANALYSIS

Purpose of the Gap Analysis:

- *Identify the best practices surrounding PL&M*
- *Define the local requirements not covered in the current version of PL&M*
- *Allow an obvective, detailed assessment of whether the system is implementable or not*
- *Document the requirements and gaps, develop interim practices, and raise the necessary change requests for the next version*

In this way you will ensure that you positively and actively impact the PCI systems development effort to ensure that you receive the gold standard systems required to run your business in the future, while allowing your Area to start receiving benefits of implementation in the short run.

Based on the analysis and knowledge gained you will assess the effort required to implement the system and plan for the necessary resources to be successful within acceptable time frames.

The GAP CHARTS compare existing systems and processes to PL&M's latest version, describing how the two systems differ in terms of functionality, process and data. They also summarize and prioritize the gaps that will form the basis of creating the detailed change requests.

There are two levels of Gap Analysis:

1. **High Level Analysis:**

- Top level review of the system functionality and impact on existing business processes
- Does the current version fit or do we wait for the next version?
- If the gaps appear to be too big, or we want to proceed to gain some benefits, what are the next steps to enhance MIS capabilities, i.e. options until we get something that fits and covers our requirements?
- How do we ensure that we get a good system that fits the requirements within an acceptable time frame?

2. **Detailed Analysis:**

Whether the system will be implemented immediately or not this step is again necessary in order to:

- Ensure that the key users understand the system's functionality in detail and map this against the local business requirements and current processes.
- Enable Management to make an assessment whether the system does or will address their strategies and requirements e.g.. centralized vs. distributed processing and control, operations improvement information, profitability information, etc.
- Enable MIS to define the technical requirements and plan for the implementation.
- Define data gaps and setup requirements.
- Define functionality gaps.
- Document gaps and raise change requests.

2.3.3 Resources , Roles & Responsibilities Guidelines :

Listed on the following pages are tables showing the resources needed for the implementation and their responsibilities during the project. Those tables can be used as guidelines to defining the needs for a Logistics and Manufacturing implementation.

TABLE 2.3 : Implementation Phases & Resource Allocation

Description of Work	Local						Division			Comments
	Local Sponsor	Key User	Users	IT Manager	IT Analyst	IT Technician	Func. Sponsor	IT Director	STC Contact	
Project Planning Initiate Effort										
define high-level expected benefits; scope							L	I		
identify team members							I	I		
Kick-off Project										
develop preliminary work-plan							I	I		input from HQ; other L&M sites.
orient key team members	I	I					I	I	I	
conduct "level-two" training	I	I		O	I		I		I	1 day session
establish benchmarks; initial snapshot	L						I			e.g. pre-L&M KPI's of expected benefits
define ongoing status communication	I						L			e.g. bi-weekly status rpt; monthly status mtg.
Assess L&M Fit										
identify translation requirements										
review Business Process Assumptions	O	L			I		O			
identify lack of fit issues	O	L			I		O			run < 10 SKU; < 3 location simulation
identify business process change needed	O	L			I		O			
identify work arounds	O	L			I		O			
identify local reporting requirements	O	L			I		O			
adjust scope for unresolved issues	O	L			I		O			
Pre-work										
install system						L				if not feasible, collect pre-work manually
collect and load parameters		L				I				typically 4 - 6 weeks
identify external data requirements		I			L	I				
build external interfaces; local reports					L	I				if appropriate
translate; send translations to STC		L	I		I				I	if appropriate
Initial Runs										
conduct "level 3" training	I	I	I		I		L		I	2-3 days; with hands-on activity
update with STC translated version		I							L	
test external L&M interfaces		I			L	I				
run L&M in parallel with current methods		L	O		I		I			2-3 weeks; key points per module
resolve issues		L			I				I	
Convert System										
load historical data		I			L					
begin use; monitor use	O	L	I		I		I		I	
capture benefits vs. benchmark	L	I					I			
Leader steps	2	11			4	1	3		1	
Involved in steps	4	8	3		12	4	8	4	6	
Optional involvement steps	7		1	1			6			
Total:	13	19	4	1	16	5	17	4	7	

Legend:	
L	Lead role
I	Involved
O	Optional involvement

TABLE 2.4 : Roles & Responsibilities

	Technical Operations	*Information Technology*
Local Implementation Team	**Local Sponsor** - understands the expected benefits / motivation for implementing L&M; communicates priority to Users **Key User** - learns L&M concepts, completes pre-work; leads / answers questions for other users. **User(s)** - learns mechanics of L&M required for day-to-day use.	**Manager** - assists in the development of implementation plans; makes IT resources available for effort. **Analyst** - understands L&M concepts; helps with external data interfaces; first level of support for local issues **Technician** - sets-up required hardware; operating system and loads installation tapes.
Division Team	**Functional Sponsor** - facilitates Division implementation planning and sharing learnings across sites; organizes "user committee" meetings; feeds back to HQ project leader on divisional priorities for enhancements; conducts training and / or trains the trainers. Note: required in Divisions where multiple, simultaneous implementations are planned; in some cases will be a HQ Tech Ops resource.	**Division IT Director** - facilitates Division implementation planning and sharing IT learnings across sites **Support & Training Center** - second level of support for local team issues; feedback to HQ IT Functional Leader and ADC on issues; facilitates training sessions.
Headquarters Team	**Technical Director** - high level direction on L&M content; priorities **Project Leader** - owns detailed L&M content, including training materials and documentation; prioritizes enhancements based on division feedback	**Functional Leaders** - third level of support for functional questions; tracks issues and enhancements; schedules new releases
Asia Development Center Team	*not applicable*	**Application Project Leader** - third level of support for technical questions; coordinates development / release activities

TABLE 2.5 : Business Process Assumptions

General

Process Assumption	Impact if not valid
user takes ownership of understanding and accurate initial setting and maintenance of L&M processing parameters	system results will be inaccurate or misleading

Demand Forecasting

Process Assumption	Impact if not valid
sales forecasting is performed at the SKU, week, location level	difficulty to translate or map current forecasting into terms required by L&M
a weekly process exists where the sales organization takes responsibility for reviewing a sales forecast at the L&M level of detail (SKU, week and location level)	risk of system running unchecked, high forecast error, poor inventory management and planning. time must be allowed for to put in this process
the sales organization publishes planned sales promotions in advance	forecasts will be based only on historical demand and error will be high during promotion weeks resulting in stock-outs.
promotions are defined according to same terms as L&M (see user training manual for details)	promotions will need to be redefined in order to use promotional forecasting functionality. not using the promotion exception functionality will raise forecasting error.
the selling / demand week will be from Sunday to Saturday with from 4 to 7 consecutive selling days in between	L&M is programmed to handle variations on this, but additional testing is recommended before implementing other set-ups

Transportation Management

Process Assumption	Impact if not valid
at a given warehouse, each SKU is supplied by one primary (least cost) location. day-to-day exceptions to this sourcing must be manually scheduled.	ability to automatically generate transfers to balance days of inventory supply will not be useable
all primary transport activity will be scheduled through the L&M bill editor	transfer scheduling algorithm will not properly consider all supply and demand factors.
the status of all primary transport activity will be updated on a daily basis	the transfer scheduling algorithms will use inaccurate, out-of-date information to recommend transfers

Business Process Assumptions (continued)

Production Scheduling

Process Assumption	Impact if not valid
L&M will only present information required to make production scheduling decisions. the system is not expected to make production scheduling recommendations. the production scheduler knows best scheduling practices	sub-optimal production schedules will be created
the production schedule is set weekly, but reviewed with greater frequency (e.g., daily)	the production schedule will not react to unexpected changes in inventory levels and demand / orders
the batching tanks will be properly scheduled outside of L&M, based on the L&M LINE production schedule	the L&M LINE production schedule may not be feasible if batching room constraints are not considered.

Perpetual Inventory Control

Process Assumption	Impact if not valid
physical counts are collected and keyed in on a daily basis	days of supply calculations will not be accurate

Material Requirements Planning

Process Assumption	Impact if not valid
for planning purposes, there is one set of ingredients that go into producing a batch of full goods	multiple batch ingredients
raw material inventory balances are entered into the system (or new L&M perpetual inventory system is being used)	only gross requirements will be reported, not netted against inventory balances.

TABLE 2.6 : Pre-work / Initial Set-up Data Collection

The L&M Configuration Menu contains all the pre-work that needs to be collected and entered before the system can be used properly. The menus are organized by general pre-work and module-specific pre-work module. Refer to the training module for more information on what information is required for each menu item.

Area	Pre-Work Required	Comments
General Set-up		
	Flavors and Sizes	
	Units of Measure	
	SKUs / Full Good Items	
	Locations	includes Hub-SKU and Warehouse-SKU relationship tables (# of records to collect and enter = # of SKU's x # of plants & warehouses)
	Raw Material Items	
Demand Forecasting		
	Bucket Structure	select 1 record from pre-loaded defaults
	Control Parameters	
	Seasonality Groups & Factors	requires access to good historical case sales info
	Weighted Moving Avg Factors	
	Split Factors	requires access to good historical case sales info
	Promo / Exception Groups	need input from sales organization
	Promo / Exception Defaults	need input from sales organization
	Order Demand Discounting	optional - only for environments with significant advanced order based demand.
Production Scheduling		
	Shifts	
	Lines	define lines with associated SKU's; speeds, etc.
	SKU Changeovers	optional - can choose to use Group SKU Changeovers instead
	Group SKU Changeovers	if neither Changeover loaded; system assumes 0
	Timeline Settings	recommend to use pre-loaded data
Transportation Management		
	Hub-Warehouse Parameters	number of hubs x number of warehouses
	Trucks and Pallets	
	Shipment Status Codes	recommend to use pre-loaded data
	Carriers	
MRP / Bill of Materials		
	Product Formulas	**SKU-Concentrate relationships must be set-up for Production Scheduling timeline. Detailed SKU-component information is required if MRP functionality is to be used.**

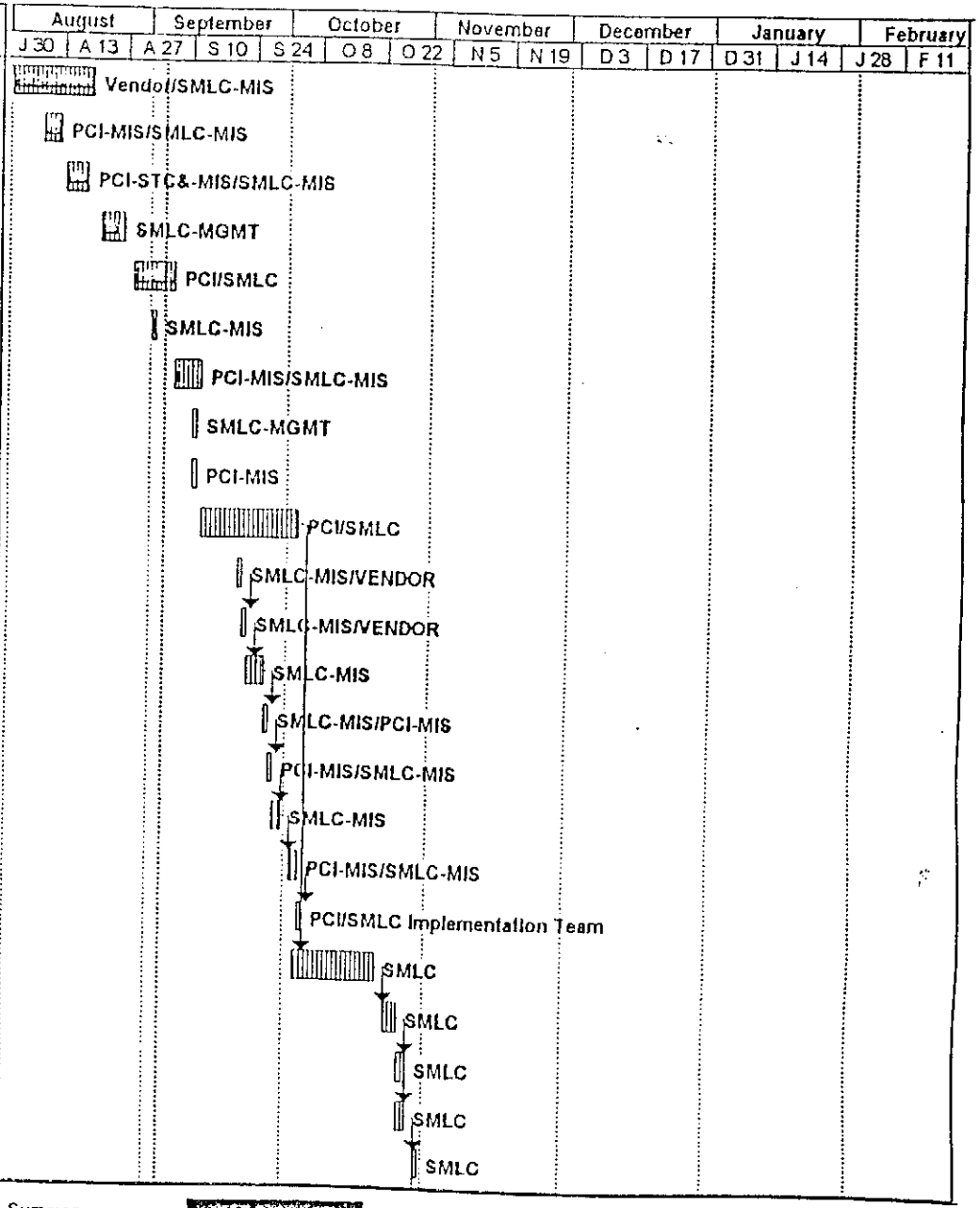
TABLE 2.7 : Day to Day External Data Requirements

Module	Information Required	PL&M Standalone	Interfaced with S&D and F&A (or local system)
Demand Forecasting	Actual Demand History - by whse location* - by demand type (routine or order based)	key in actual demand, derive order-based demand from order shipments in transportation management module	import using generic import program (requires common SKU and location numbering)
Demand Forecasting	Demand Forecast (if L&M forecast generation not used) - by whse location* - by demand type (routine or order based)	Manually enter Forecasted Demand or use PL&M version 1.3 forecasting generation capability, when ready.	import using generic import program (requires common SKU and location numbering)
Inventory Management	Daily Physical Counts - by SKU - by whse location	Manually key in physical counts from faxes or import from an Excel spreadsheet or other formatted ASCII file.	import using generic import program (requires common SKU and location numbering)
Transportation Management	Direct Bulk Orders / Shipments - non-transfers	Manually enter orders as non-transfer bills.	no import exists (future integration point with S&D order system)
Transportation Management	Updates to bill-of-lading / shipment status	Manually update based on input from shipping and receiving warehouse (for transfers)	no import exists (future integration point with perpetual Inventory module)

2.3.4 SMLC Logistics & manufacturing System Implementation Plan :

Following is the implementation plan developed for the implementation of the Logistics & Manufacturing system at Societe Moderne Libanaise pour le Commerce. This Project plan was very accurate specially on the time frame level , because buffer zones were introduced to account for any special exceptional event while remaining efficient and reasonable.

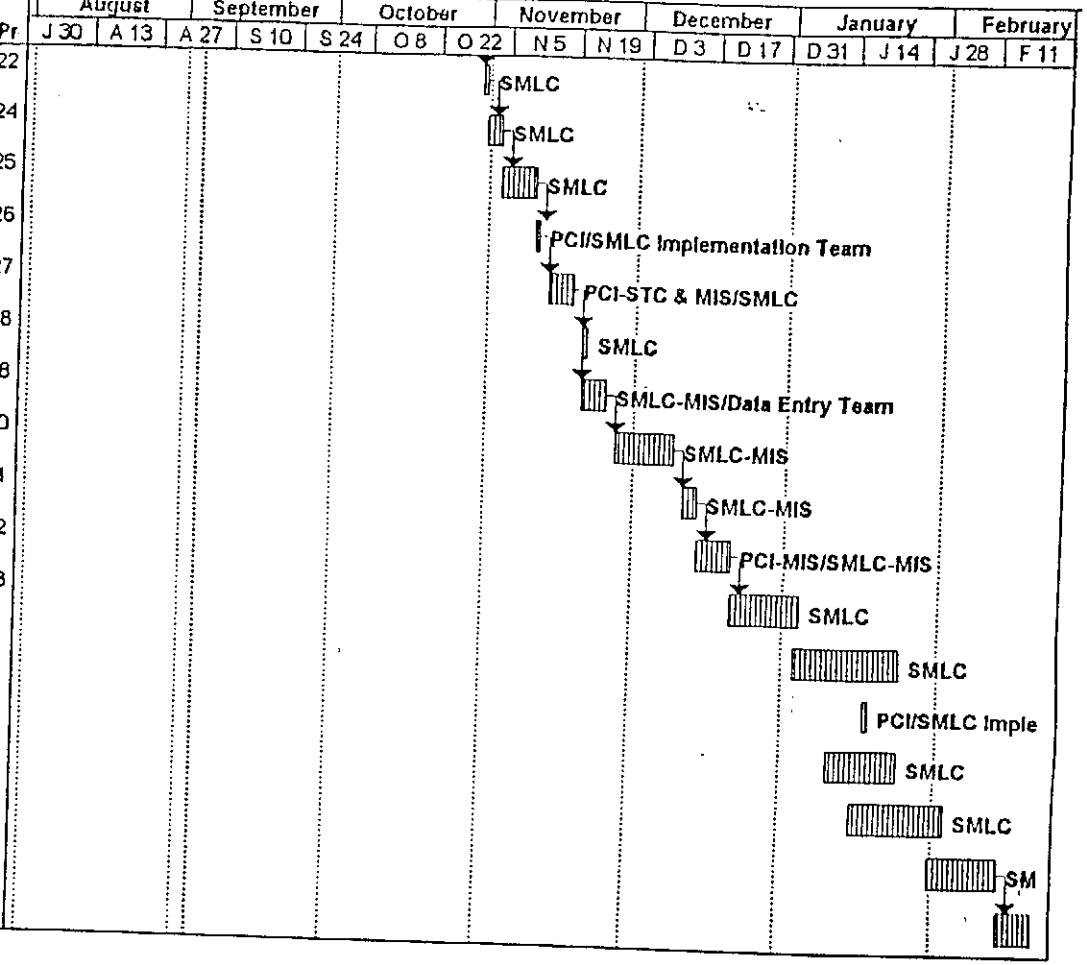
ID	Task Name	Dura	Start	Finish	Pr
1	UNIX Operating System Training	15d	8/1/95	8/18/95	
2	Sample Data Collection	4d	8/8/95	8/11/95	
3	PL&M Level II Training	5d	8/13/95	8/17/95	
4	Define PL&M KPI's Expected Benefits	5d	8/21/95	8/25/95	
5	Pre-Implementation Benefits Exercise	7d	8/28/95	9/5/95	
6	Tender for Hardware & Software	1d	9/1/95	9/1/95	
7	Develop Data Collection Sheets	5d	9/6/95	9/11/95	
8	Issue Purchase Order	1d	9/10/95	9/10/95	
9	Order PL&M Application	1d	9/10/95	9/10/95	
10	Gap Analysis (Current Vs PL&M)	15d	9/12/95	10/2/95	
11	Hardware Installation	1d	9/20/95	9/20/95	
12	Operating System Installation	1d	9/21/95	9/21/95	11
13	Testing of the Installation	2d	9/22/95	9/25/95	12
14	Progress Database Installation	1d	9/26/95	9/26/95	13
15	PL&M Application Installation	1d	9/27/95	9/27/95	14
16	Testing & Tuning of the PL&M	2d	9/28/95	9/29/95	15
17	Orient Key Team Members	2d	10/2/95	10/3/95	16
18	Implementation Review I	1d	10/4/95	10/4/95	17
19	Collect Warehouse Info	14d	10/3/95	10/20/95	10
20	Collect Plants Info	3d	10/23/95	10/25/95	19
21	Collect Trucks Info	2d	10/26/95	10/27/95	20
22	Collect Raw Materials Info	2d	10/26/95	10/27/95	20
23	Collect SKU Info	1d	10/30/95	10/30/95	22



Project. SMLC PL&M Implementation
Date: 9/4/95

Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress

ID	Task Name	Dura	Start	Finish	Pr
24	Collect Promo/Exceptions Info	1d	10/30/95	10/30/95	22
25	Collect 52 Weeks Sales History	3d	10/31/95	11/2/95	24
26	Design Master Files Coding	5d	11/3/95	11/9/95	25
27	Implementation Review II	1d	11/10/95	11/10/95	26
28	PL&M Level III Training	5d	11/13/95	11/17/95	27
29	Form Data Entry Team	1d	11/20/95	11/20/95	28
30	Training on Master Files Entry	5d	11/20/95	11/24/95	28
31	Entry & Configuration of Master Files	10d	11/27/95	12/8/95	30
32	Import Sales History into PL&M	3d	12/11/95	12/13/95	31
33	Log Problems & Faults/Tuning	5d	12/14/95	12/20/95	32
34	Run Demand Forecasting Module	10d	12/21/95	1/3/96	33
35	Run Production Module	15d	1/3/96	1/23/96	
36	Implementation Review III	1d	1/17/96	1/17/96	
37	Run Raw Materials Module	10d	1/10/96	1/23/96	
38	Run Transportation Module	15d	1/15/96	2/2/96	
39	Run Inventory Module	10d	1/31/96	2/13/96	
40	Training on Output Data Interpretation	5d	2/14/96	2/20/96	39



Project: SMLC PL&M Implementation
Date: 9/4/95

Task
Progress
Milestone
Summary
Rolled Up Task
Rolled Up Milestone
Rolled Up Progress

CHAPTER III

SYSTEM DESIGN & METHODOLOGY

3.1 DEMAND FORECASTING :

3.1.1 Components of Demand Forecast :

1. *Weighted Moving Average :* The WMA predicts future demand based on recent actual history . Only weeks having the similar demand structure are used in the calculation of the forecast. Weights are applied to past weekly demand data to derive future demand. Normally, the most recent week will be assigned a higher weighting factor while previous weeks will be assigned a lower weighting factor in a declining manner. This factor (alpha) also called the smoothing constant is predetermined by the forecasters. The alpha is applied to consecutive demand weeks from the most recent to the oldest using the following formula : aplha(1-aplha)^(n-1) for n=1 to ...

2. *Trend Analysis :* Attempts to determine whether demand for a product is growing over time , independent of seasonal factors. The trend correlation coefficient , which is a measure of how strongly related the data points are with each other , is determined by calculation and compared against a threshold. The threshold value is a predetermined value set by forecasters to recognize significant trend phenomenon.

3. *Promo or Exception :* Determines the promo / exception component of the demand equation. Promo/ exception component will categorize past and future weeks of demand

history into separate historical buckets. This will allow future demand to be predicted on similar demand history (demand for Christmas can be based on the demand of previous Christmases). Six different calculation methods are available in the system. The forecasters have to specify which calculation method to use . The methods are :

* P1 : Prior data weighted average method : Average of same past promotions demand.
* P2 : Volume increment method : User specified quantity above normal forecast.
* P3 : Percent increment method : User specified percent above the normal forecast.
* P4 : Prior data, volume increment method : Same quantity increase as last promotion.
* P5 : Prior data, percent increment method : Same percent increase as last promotion.
* P6 : Volume override method : User specified quantity.

4. Seasonal Index : Determines the seasonal impact on the generated demand. The seasonal component of the forecast takes into consideration the effects of the time of the year . Each week of the year will be compared to an average week in a similar period . A seasonal factor will be calculated (week demand / average week demand) and used to de-seasonalize actual demand data. When predicting a future demand , the computed value will be subsequently re-seasonalized to be relevant to the week being forecasted.

5. Day of the Week Splitter : After generating the weekly forecast , the system will use the day-of-the-week splitter in order to derive the daily demand. The day-of-the-week splitter is a table that allocates the percentage contribution of each day of the week to the total week demand. See Fig. 2.1

FIGURE 3.1 : Day Of The Week Splitter

Start Date Sunday :	
Monday	: 25%
Tuesday	: 15 %
Wednesday	: 10%
Thursday	: 15 %
Friday	: 20%
Saturday	: 15%

6. Forecasting **Order of Priority :**

The system starts by de-seasonalizing the historical demand. The second step consists of checking if the week to be forecasted is flagged as a promotion or exception week. If yes , then the future demand forecasting will be calculated using the defined promo/exception method. After obtaining the demand , the seasonal factor will be re-calculated to reflect the effect of time . If no promo / exception demand is detected, the system will use regression analysis to determine the level of correlation between the demand points. If the trend coefficient of correlation is greater than the threshold value, then the forecast will be worked out using the trend formula (extrapolation). If not, the forecast will be calculated using the Weighted Moving Average method. At the end, after obtaining the demand forecast , the seasonality is added to the generated forecast in order to reflect the time impact.

3.1.2 Demand Forecasting Daily Operations :

1. Maintain the promo / exception calendar :

The demand forecasting module refers to the promo/exception calendar to determine when future promotion or exception events are going to occur. The system automatically calculates the promo / exception increment or decrement component of the demand equation for the period related to the promo / exception dates.

Special activities that can affect the company's demand whether positively or negatively , should be pre-identified to the system so that they are taken into consideration. This increase or decrease should be identified to the system as soon as possible in order to provide production and raw material functions with enough time to adjust to the changes in the demand.

2. Maintain actual weekly sales data :

Actual data must be keyed-in into the system in order to measure the variance from the system generated forecast and to base future demand forecasting on the actual data which is more reliable and thus more accurate then the generated one. The operation should be done once per week, since the system requires only weekly actual demand. The actual demand consists of sales + giveaways (free products)+ breakage. This will determine the overall consumption (product need) and allow production to better plan for their production schedules.

3. Generating Weekly Forecast :

When the system is provided with the necessary information, that is actual historical demand, seasonal index , promo / exception calendar and after fine-tuning the system parameters (alpha , trend threshold, number of weeks to be used in WMA...) , the forecaster is ready to run the weekly forecast generation. The system will then combine all the different parameters in order to generate the forecast.

4. Review and Adjustment of weekly forecast :

After generating the forecast , and before committing the generated numbers , the forecaster must review those numbers and make sure they are in accordance with the sales management expectations. This operation can be done by the area managers , each manager for his own area since they are more dedicated and concentrated on their own areas.

5. Generating daily demand :

After reviewing the generated forecast , the system will use the day-of-the-week splitter in order to derive the daily demand from the generated weekly forecast , and this by multiplying the weekly forecast by the percentage of the day from the total weekly demand.

This process should be done on a daily basis , and each time the weekly forecast is generated or reviewed.

The demand forecast generation for the next 4 weeks will be divided as follows : the first two weeks in details ; daily demand is allocated based on the day-of-the-week splitter , and the other two weeks in summary (weekly demand). This forecast if accurate , will provide the company with the necessary information to become pro-active to the changes in the market behavior and demand.

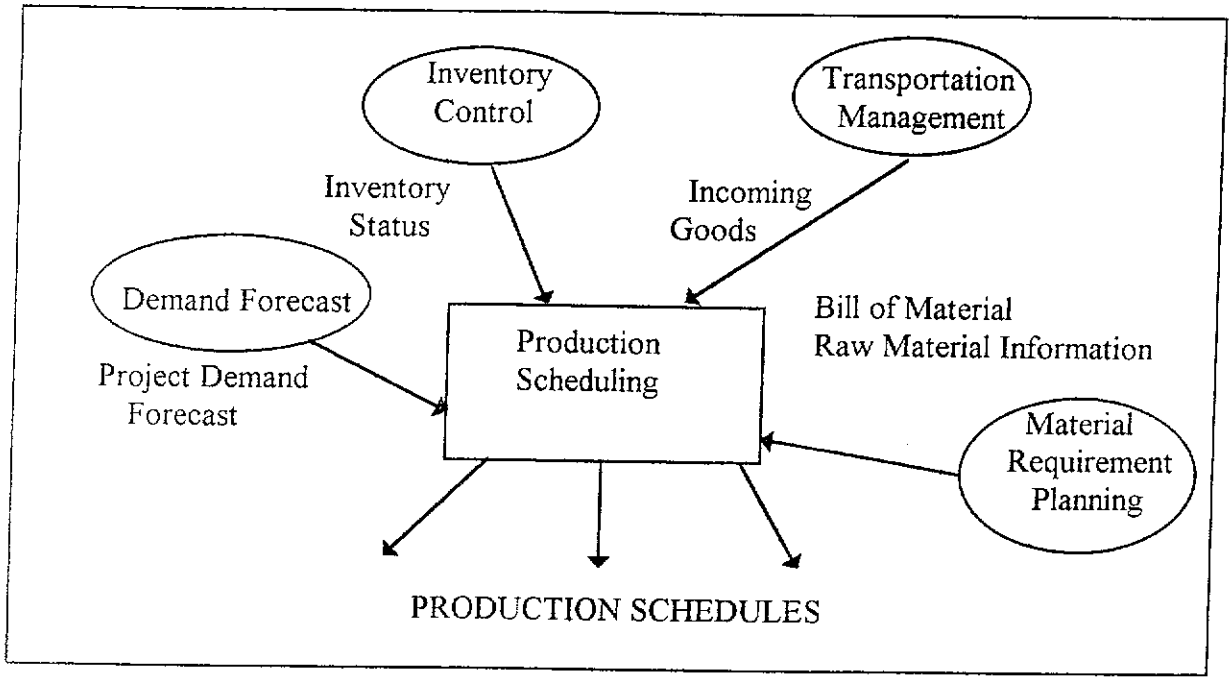
3.2 PRODUCTION SCHEDULING :

3.2.1 Components of Production Planning

1. Module overview :

The production scheduling module is designed to assist plant (production) managers in scheduling production efficiently while at the same time allowing flexibility for discretionary judgment. The purpose of the production scheduling module is to ensure production compliance, thus to satisfy forecasted demand while optimizing line utilization, line efficiency , and reducing waste, and inventory levels as much as possible. There are many parameters ,constrains and considerations that need to be taken into consideration while putting the production schedule. The production scheduling module monitors the current inventory levels and compares it against forecast and previously scheduled production runs. The production scheduler can then run a what-if simulation to determine what to produce on each line and how much to produce in each production batch. Once the product and quantity to be produced are determined the system will generate a list of the needed raw material quantities so that they can be insured for the scheduled production run. Given the dynamic environment settings, the production scheduling tool is invaluable in helping managers make better decisions in less time (see Fig. 3.2).

FIGURE 3.2 : COMPONANTS OF PRODUCTION SCHEDULING



2. System Wide Days Supply (SWDS) :

Refers to the number of days the system is capable of meeting the overall demand at the present overall inventory level.

The system uses this number to reflect to current inventory status across the whole network, that is the warehouses , hubs and plants.

3. No-Return System Wide Days Supply (NRSWDS) :

Is similar to the system wide days supply except that the warehouses with days supply greater or equal to the system wide days supply are excluded while computing the No-Return System Wide Days Supply.

This number reflects the status of the inventories across the network if no inter-warehouse product distribution is allowed. The locations with excessive inventories will not redistribute their products to other warehouses. This will reduce transportation costs because it does not allow for double handling and double transportation of the same products. Thus, supply of products if the NRSWDS is used would only come from hubs.

4. Production Worksheet :

It presents production schedule in columns, listing the product volume, the concentrate units used, the line speed, the production hours, the production start time and end time for products on each line. Actual production data (including rework and breakage) is also captured by the system using the production worksheet, thus enabling management to analyze the efficiency of production .

5. Production Timeline :

It presents a graphical representation of the production schedule highlighting when products will run out, with or without scheduled production, given the current production settings.

Users can switch between the production timeline and the production worksheet and make adjustments to the proposed schedule generated by the system so as to incorporate considerations and constraints before committing to a final schedule.

6. Inventory Inquiry Facilities :

Allows the user to take a macro view of the demand and inventory information for the current and future weeks. The inventory inquiry facility provides the user with two options for inquiry either by location or by SKU (product).

All those facilities and information serve to provide the decision maker with more comprehensive understanding of the logistics and manufacturing scenario before deciding on a course of action.

3.2.2 Performing Daily Operations for Production Scheduling :

1. Request for Daily Schedule :

Production planning usually starts 7-14 days before the actual production date. The first step in obtaining a production schedule is to request for a preliminary production schedule. The system will compare demand forecast to days on hand inventory to obtain production demand. Upon ascertaining the demand information, it will then check against the line capacity information to work out the preliminary schedule.

2. Review & Modify the Production Schedule Worksheet :

The production worksheet contains daily information on the production volume and schedule of each product scheduled for production on a particular line and shift. You can tune the production to best fit your needs under the current production settings and

constraints. The system allows you to change some of the factors that affect production batches . The factors are :

* Start time
* End time
* Line hours
* Concentrate Quantity
* Line Speed
* Production Quantity
* changeover time

Any change in any of the above parameters will automatically reflect on the other factors and the new production quantity will be calculated. This will allow for simulation until the ultimate production schedule is determined and than committed.

3. Review & Modify the Production Timeline :

The production schedule can also be viewed from the production timeline graphical representation. The graphical timeline scheduling tool allows what-if scenarios with a friendly interface. All modifiable parameters available in the worksheet are also available in the timeline screen. The production timeline uses a set of characters to reflect different situations. Those characters are :

* (+) Day on which the SKU is projected to run out of stock
* (-) Non-production day. There will not be enough stock of that SKU without the most recently scheduled production.

* (=) Slack. There is enough inventory to meet demand even without the most recently scheduled production.
* (*) Day on which production is scheduled
* (!) Day on which this product is scheduled for production but on another line. This can happen when one product can be produced on two different production lines.

4. Inquire SKU Demand and Transfer Information :

Allows the user to check out the projected effect of scheduled production and consequently scheduled transportation activities on the SKU availability at different system locations before committing to a production schedule. The SKU the user is inquiring about will be displayed for each location with the on hand quantity, days supply (from inventory physical count), projected daily demand, scheduled transfers and scheduled production giving the projected on hand quantity and days supply.

5. Inquire Transfers & Production Information for a Hub :

Allows the user to check out the projected effect of scheduled production and transfers on a hub location inventories.

This is very useful for checking out the buffer stock reserved in the hub as well as the transferable quantities and remaining on hand space for stocking.

6. Entering Actual Production :

Actual production is keyed into the system on a daily basis to allow management to analyze production efficiency , and line utilization while monitoring and improving accuracy of projected inventories.

7. Review Raw Material Issues :

During a production run, raw material issued for production may not be completely used. This option allows the user to review and record the actual quantity of raw material issued for a production. This quantity is equal to the difference between the quantity of raw material initially issued to the production and the quantity returned after the production. After recording the actual raw material usage, information is posted and raw material inventory is updated.

This information helps in analyzing the production line waste percentages , and gives a hint about any problem in any of the production processes. Results are compared to a set of benchmarks to identify the level of efficiency or point out the occurrence of a problem.

3.3 TRANSPORTATION MANAGEMENT :

3.3.1 Components of Transportation Management :

Transportation management is the timely and effective distribution of full goods from several supply location to several demand locations. This module is based on three main principles of the transportation management techniques :

1. Balancing System Wide Days Supply or No-Return System Wide Days Supply.
2. Observing the warehouse maximum capacity (in days supply)
3. Transferring only products that are critical or below low days supply.

1. Generated / Edited Transfers :

The idea behind generating transfers is that the system will recommend an amount of inventory to transfer from a supply location (hub) to the appropriate demand location. These transfers will balance the inventory of an SKU across the whole network in terms of days supply (10 days supply in location 1 might be 100 cases while 10 days supply in location 2 are 1500 cases) so that all locations will have the same number of days supply per SKU. This will optimize the ability of the warehouse to meet sales demand. Once the system generates a transfer , the user is allowed to edit those generated quantities so that to reflect the current settings under the prevailing constraints, allowing him to take into consideration all other un-identified factors that might affect the transfer quantities. This is done through the transfer editing process. Thus, the system-generated amounts need to be reviewed before turning them into planned shipments.

2. Transportation Management Principles :

a) *No Warehouse should go below its low days supply :* If stock count falls below the low days supply threshold, inventory should be restored to at least this level. Low days supply can be referred to as the optimal or ideal level of inventory striking a balance between too much idle stock and keeping away from potential stock out situations.

b) *No Warehouse should go below its critical days supply :* The critical days supply threshold indicates that a potential out of stock will occur soon.

c) *No warehouse should get more than its fair share of stock :* If a warehouse receives more than its fair share, thus over-supplied , then another warehouse is most likely going to be under-supplied and might consequently face an out-of-stock occurrence. Fair share is achieved when the inventory levels in all warehouses are balanced according to the days of supply by SKU.

d) *No warehouse should accept more than its maximum capacity :* Due to space limitation, the warehouse is subdivided into stocking areas (one for each SKU) indicating the maximum number of cases to be stored in that area. The system looks to this constraint while generating the transfer amounts and thus makes sure that the percent distribution of products within the same warehouse are balanced.

e) *Hold the specified buffer stock at the hub :* if a system buffer days supply limit is imposed, stock would be held back at the distribution hub. The amount held at the hub is equal to the system buffer days supply quantity.

If the system wide days supply is less than the stop buffering days supply threshold, buffering is stopped and held quantities are re-distributed. The stop buffering days supply

indicates that inventory level for the whole system is low, and thus the distribution hub should not hold back its inventory.

f) Transfer quantities are rounded up into shippable amounts : The system after defining the required quantities to balance the system wide days supply , will round up those quantities into shippable amounts in order to prepare the data for truck load generation. for each warehouse the system requires a minimum shippable quantity for each SKU based on which the rounding will be calculated.

g) *Inventory Movement should be based on First-In First-Out (FIFO) :* This will insure product freshness. Direct loading from the production lines should only take place when available inventory cannot meet the demand and an Out-Of-Stock situation is more likely to happen.

3. Computing System Wide Days Supply :

Suppose we have the following setup :

A plant warehouse has 3000 cases of product P1 and each of its three sales warehouses (A,B, and C) has 500 cases of P1. The plant's forecast sales is 500 cases and the warehouse's forecast sales are 400, 300 and 300 cases each.

The system Wide Days Supply and the days supply for each warehouse are calculated as follows :

Plant : - Inventory : 3000

- Demand Forecast : 500
- System Wide Days Supply : Total inventory / Total Forecast

3000+500+500+500 / 500+400+300+300 = 3 days supply

Warehouse A : - Inventory : 500

- Demand Forecast : 400
- Days Supply : inventory / forecast = 500 / 400 = 1.2

Warehouse B : - Inventory : 500

- Demand Forecast : 300
- Days Supply : inventory / forecast = 500 / 300 = 1.3

Warehouse C : - Inventory : 500

- Demand Forecast : 300
- Days Supply : inventory / forecast = 500 / 300 = 1.3

In the example all warehouses' days supply of product P1 are below the system wide days supply. For all warehouses to be at the system wide days supply, the following inventory levels must be met :

- Plant warehouse kept at 1500 (3 * 500) ; the out-transfer amount is 3000-1500 =1500
- Warehouse A raised to 1200 (3 * 400) ; the in-transfer amount is 1200 - 500 = 700
- Warehouse B raised to 900 (3 * 300) ; the in-transfer amount is 900 - 500 = 400

- Warehouse C raised to 900 (3 * 300) ; the in-transfer amount is 900 - 500 = 400

If a system buffer days supply of 1 day is imposed , 1 day of supply of P1 should remain at the hub and thus should not be released to the warehouses . The inventory levels must then be as follows :

- Warehouse A kept at 800 (2 * 400)
- Warehouse B kept at 600 (2 * 300)
- Warehouse C kept at 600 (2 * 300)
- Plant warehouse kept at 4500-800-600-600= 2500 : [(2 * 500) + 500+400+300+300]

2 days supply for the plant + 1 buffer days supply

4. Exceptions to System Wide Days Supply :

If sales demand is expected to be higher at a particular warehouse, this warehouse may be stocked with more inventory than the other warehouses.

In the next transportation scheduling process, the stock level of this warehouse may still be high, perhaps even higher than the system wide days supply. If this occurs, the warehouse may be tagged a No-Return System Wide Days Supply flag so that it is not allowed to ship products from this warehouse to any other warehouse or to return products to the plant warehouse (hub). The system wide days supply will be re-calculated excluding this warehouse with days of supply above the system wide days supply. The new calculated number is referred to as the no-return system wide days supply. The other warehouses will be supplied by balancing the no-return system wide days supply while this warehouse will not be supplied.

5. Transfer Scheduling Process :

The transfer Scheduling process is composed of 4 major steps :

1. Projecting days of supply : The inventory level in days of supply is computed by comparing inventory level with the forecast demand.

2. Determining balancing days of supply : The system wide days supply or the no-return system wide days supply is determined using inventory projections from the days supply and buffer parameters.

3. Determining Transfer Amounts for desired inventory levels : The SWDS or the NRSWDS will provide the desired inventory levels. The inventory to be transferred is computed considering the warehouse maximum capacity.

4. Converting transfer amounts to truck loads : The transfer requirements being rounded into shippable amounts , are then converted into truck loads and truck way-bills while optimizing truck utilization and therefore transportation efficiency.

3.3.2 Performing Daily Operations for Transportation Management :

1. Generate Transfers :

The transfer generation module is based on a number of input parameters. Those parameters have to be specified before the system starts generating the transfer amounts. The parameters are :

1 - *Beginning and End loading time :* Determine, along with the physical inventory time, which in-bound and out-bound shipments are included in the inventory projections. Direct loading opportunities are also identified.

ii. - *Physical inventory time* : Determines what portion of production-in-progress is included in inventory projections.

iii. - *From location* : The location from which the products are to be shipped. Only warehouses having this hub as their sourcing location will be supplied.

iv. - *SKU* : If the transportation manager wants to transfer only one SKU , he can choose to fill this field , otherwise the system will generate transfers for all SKUs supplied from the specified hub (from location).

v. - *Trigger* : Determines which inventory level (critical , low , or top) is used by the receiving location in order to initiate transfers.

vi. - *Production Hedge* : Hedge factor in adjusting scheduled production during inventory projection calculation. It is a ratio used in the calculation of interim production. It relates to an estimation of production efficiency.

vii. - *DS Defaults* : Allow the user to overwrite the specified default DS parameters in the location setup so as to accommodate to a certain emergency or special case. If this field is specified , then the system will no longer consider the number previously defined in the setup while calculating the transfer amounts.

viii. - *Obey Warehouse Maximum ?* : Determines if warehouse capacity should be considered when generating transfer amounts or just calculate the amount of transfers that will meet the targeted days supply for each demand location.

2. Editing Transfers :

Once the system has calculated the transfer amounts based on the identified parameters and under the specified constraints, the transportation manager is allowed to edit those numbers in order to accommodate to any exceptional need.

3. Generate Truck Loads & Truck Way-Bills :

Once the transfer amounts are determined and committed , the system will convert those transfers into shipments or truck loads. The system will take into consideration the parameters concerning the staking of each product as defined in the location setup. It will also consider the truck type that supplies the location the product is being shipped to (number of pallets , staking height).

4. Editing Truck Loads & Printing Truck Way-Bills :

The truck loads generated by the system can also be edited by the user in order to make necessary adjustments. Once all adjustments are made, and truck loads are committed , the system can than print the truck way-bills.

5. Change Status of Shipment :

When the truck way-bill is printed , the status of the shipment is "scheduled". Once the truck leave the warehouse , the shipment status is changed manually into "in transit" and once received by the destination location , the transportation operator should change the status of the way-bill to "received". Once received, the truck shipment will not add over the last physical count since it will be part the next days physical count of the destination location. Otherwise , it will always add up to the last physical count.

3.4 MATERIAL REQUIREMENT PLANNING :

3.4.1 Components of the Material Requirement Planning Module :

1. Overview :

MRP is a process that determines the raw material required to meet the production quantities scheduled on the production lines. It also determines the availability of the required raw material and suggests raw material replenishment quantities.

The MRP module is more like a reporting module than a process module; however the reports generated use a certain methodology in order to determine the quantities needed from each raw material item.

The MRP module uses the following information resources from the production scheduling and inventory control modules :

- Production schedule which tells what will be produced and how much
- Inventory records which provide information on how much raw materials are available on hand.

2. Bill of Materials :

The Bill-of-Materials which is a sub-module within the MRP module maintains information on the type and quantity of each raw material required to produce one unit of a full good. The bill of materials shows the standard raw material quantities required to produce one unit of full good and is known as the theoretical usage.

When printing the MRP reports, the system uses the bill-of-material sub-module (product formula) in order to convert the scheduled production into raw material requirements and

then compares it to the on hand inventories highliting availability or shortages and specifying replenishment quantities.

3. The MRP Process :

The process embedded in the MRP report generation consists of the following steps :

a). Review production schedule in order to determine production quantities

b). Review demand forecast to determine demand quantities for the coming period.

c). Convert production or demand quantities from cases into raw material requirements using the bill-of-material information.

d). Compare required raw material quantities to the on-hand inventories. Determine shortages in case the current inventory level of a specific raw material is below the requirement of the coming period.

e). Generated reports should be reviewed by the purchasing manager to see if any raw material item is running out and what are in this case the needed replenishment quantities.

f). Generated reports are then reviewed by the production manager in order to change production schedules in case the needed raw material quantities cannot be provided.

3.4.2 Performing Daily Operation for MRP :

There are four MRP reports available in the system. They are :

1. New Item Setup Validation :

- Products whose bill-of-materials have not been setup yet

- Products whose bill-of-material have been partially set up. That is, the product has been defined in the bill-of-materials table but not the raw materials components used in producing this item.

By reviewing those reports, the user can insure that the proper set up of these products is carried out.

2. Production Schedule Exceptions Report :

The production schedule exception report highlights the shortfall in raw materials for the day. Information on the shifts and products requiring the raw materials , the amount of raw materials required for production and the shortfalls are all summarized in this report.

3. Requirements Vs Demand Forecast Report :

The raw material requirements weekly forecast report provides information on the projected raw material requirements on a weekly basis. This is a very useful report for the purchasing manager as well as for the production manager in order to be pro-active to the expected status of the raw material inventories in the coming weeks .

4. Requirements Vs Production Scheduling Report :

The raw materials production schedule report lists the raw material requirements for specified production days. It also breaks down the requirements by production line.

3.5 INVENTORY CONTROL :

3.5.1 Components of the Inventory Control Module :

1. Overview :

The inventory control module allows plant and warehouse personnel to track the inventory of all full goods and materials while capturing data required for performance reporting. The system can either of two methods : (1) perpetual ; (2) physical count.

The module allows entry of transactions affecting the inventory movement of finished goods and raw materials throughout the inventory network. The network consists of locations and/or sub-locations.

The transactions that can be entered to the system are categorized under two main categories : (1) Core transactions ; (2) Miscellaneous transactions.

Under each category of transactions , we find two other sub-categories : (1) full goods and (2) raw materials.

Core transaction are pre-loaded into the system at the time of installation and cannot be changed or deleted as they are standard transaction that apply to all installations of bottlers across the world. Non-core transactions are set up by the user into the system due to a specific requirement of the implementation location management. Those non-standard transactions allows the system to be easy to tailor and customize .

Examples of core transactions : * Full Goods : - Load in

- Load out

- Production Breakage
- Warehouse Breakage

* Raw Materials :
- Issues to production
- Transfers into facility (in)
- Transfers from a facility (out)

2. Tracking Inventory Balances :

Throughout the period , the perpetual balance - created by transactions and the physical count - is captured on a daily basis. As transactions and physical counts are entered , daily and period to date variance in inventories can be tracked. This variance is also referred to as "shrinkage". Shrinkage is sometimes a result of incorrectly entering a transaction or a wrong physical count.

3.5.2 Performing Daily Operations for Inventory Control :

1. Record or import full goods daily physical count :

Physical count of finished goods should be taken at the end of each day at all locations, and keyed-in into the system the next day in the morning.

2. Record or import raw materials weekly physical count :

Physical count of raw materials should be taken at the end of each week , and keyed-in into the system at the beginning of each new week in the morning.

6. Transaction Inquiry :

The transaction inquiry option enables the user to review on-line the transactions captured by the system on a specific date.

7. Perpetual Balances Inquiry :

The perpetual balance inquiry option enables you to review on-line the perpetual balances of inventory.

3.6 DEMAND FORECASTING ALGORITHM

3.6.1 Forecast Generation Overview :

The future demand for products will be estimated using four components : Weighted Average demand , Trend , Seasonal index and any variation expected due to exceptional sales activities or external factors

i. Weighted Moving Average Component :

Will predict the future demand based on recent historical demand data maintained in the system on a weekly basis. Only weeks having the same demand structure are used in the calculation of the forecast.

ii. Trend Component :

Will attempt to determine whether demand for a product is growing over time , independent of the seasonal and promotional factors.

iii. Seasonal Component :

Takes into consideration the effects of the time of the year. Each week of the year will be compared to an average week in a similar period of the year. A seasonal factor will be calculated and used to de-seasonalize the historical demand data maintained in the system. It will subsequently be used to re-seasonalize the predicted demand (forecast) to make it relevent to the week being forecasted.

iv. Promo / Exception Component :

Will categorize past and future weeks of demand history (for particular items or groups) into separate historical buckets. This will allow future demand to be predicted based on similar demand history. For example , the demand increase for Christmas should be based on the demand increase that occured for the previous Christmas.

Weekly actual historical demand will be used to predict future demand. The demand data needs to be classified under two major categories :

(1) Normal route sales ; (2) Bulk sales

v. Routine Sales :

Are composed of the normal route sales and the bulk deliveries. Because of these characteristics, the forecasted amount will be viewed as the expected demand. This information should come in from the daily sales transactions (load out - load in and settlement)

vi. Orders :

This represents the demand which comes in less frequently and more sporadically. Lead time is typically greater, but not always the case. Based on the different behavior of "Orders" , a combination of the order forecasts and actual orders will be used in concert to calculate expected demand. A "Discounting" method of hard orders versus forecast is explained in great details below. Information regarding orders could come from the system

used to capture orders or could be delivered by adding up the total order type demand lines on all outbound, forecasted truck way-bills in the transportation management module of the system for each given SKU. Our effort will be to create a new demand bucket for orders which are lumpy in nature, to :

- apply a reduced alpha value and thereby smooth more significantly historical data
- Develop a discounting schedule supporting our predictions of orders outstanding versus hard orders in hand. This schedule will gradually base expected demand more on orders-in-hand and less on the forecasted orders as the current date gets closer to the demand date. We will then apply the same statistical methods for forecast generation as that used for normal routine sales .

Special Orders demand represents orders that are not expected to repeat with any frequency and are not predictable. Therefore, this data must not be used for forecasting purposes. However, in order to reflect actual demand, this number must be added into existing demand calculations

3.6.2 Demand Generation :

Demand generation will determine the total estimated demand for all demand types. The total demand will be based on the following calculation : Routine Sales + Discounted Forecast for order type demand + actual orders (combining all order types)

Forecast for the current and next week will be converted into detailed daily demand while the third and fourth week will be given in summary (weekly demand).

(See Appendix I for Demand Generation algorithm)

CHAPTER IV

LOGISTICS & MANUFACTURING

LEARNINGS & BENEFITS

4.1 OLD PRACTICES Vs PL&M PRACTICES :

An implementation is not successful if not coupled with a change management process. This change should incorporate new practices that insures the optimization of the operations under the new system. Listed below (see Table 4.1) are some of the major changes in the way SMLC does its Logistics activities.

TABLE 4.1 : OLD Vs NEW PRACTICES

OLD PRACTICES	NEW PRACTICES
Pull System : priorities based on received orders from warehouse managers	Push System : Priorities based on balancing system wide days supply and criticality of the SKU
The data base sources are distributed between different applications with many redundant operations	Unique data base source for all logistics and manufacturing operations allowing easier report generation with higher accuracy. Redundant work is eliminated

Forecasting is centralized and made at the plant for all warehouses. Forecast is done once and never reviewed.	Forecasting is made in a de-centralized form with the area managers handling their own forecast. The forecast is reviewed on a weekly basis.
There is little on no clear visibility over inventories across the whole network.	The system give a micro view of all the inventories in the whole network with the possibility to dig into details.
Transport is being scheduled on a weekly basis with no or little visibility of the inventories in the warehouses. No monitoring reports were done to measure the percent cases loaded as scheduled	Transportation Scheduling is made on a daily basis with hints for optimum transfer amounts to balance the system wide days supply. Transportation management KPIs have been defined and are monitored on a daily basis.
Accountability is perceived as only a logistics task. No clear responsibilities for the other functions affecting the logistics activities.	Accountability for all parts involved is precise and measurable. Each logistics function performance is linked to a set of KPIs indicating the degree of efficiency and accuracy of operation.

4.2 PL&M BEST PRACTICES :

A - Forecasting :

1. Sales history tracked by week , by SKU , by location.
2. Marketing plan for promotions or any other exception are defined into the system as required. This information is directly coordinated with the production personnel and transportation and warehouse staff.
3. Forecast is reviewed on a weekly basis. The adjusted forecast as well as the generated forecast accuracy are calculated and reported on a weekly basis.

B - Production Scheduling :

1. Production scheduled performed weekly and reviewed daily.
2. Production efficiency is measured on a daily basis by production line.
3. Production compliance is checked against product availability in the whole network. The macro view of the company's inventories help highlighting priority actions.
4. Production schedule is coordinated with raw material staff to insure the availability of the needed items for date production.

C - Transportation Management :

1. One-to-One product sourcing relationships per SKU.
2. Transportation activity scheduled and updated daily.

3. All transportation activities are scheduled through the system.

D - Material Requirement Planning :

1. Unique product formula for each SKU on each production line.
2. Material availability reports printed and reviewed daily.

E - Inventory Control :

1. Raw material and finished goods inventory transactions tracked on a daily basis.
2. Perpetual balances checked against physical count weekly.
3. Raw material physical count taken weekly.
4. Finished goods physical count take daily.
5. All inventory transactions maintained daily in the system .
6. Inventory reconciled daily , and books closed periodically (synchronize perpetual balances and physical count)

4.3 SYSTEM BENEFITS :

A - The Integrated Logistics & Manufacturing system overall benefits are :

1. Improve response capabilities to demand shipts
2. Reduce working capital needs by eliminating excessive inventories.
3. Optimize required warehouse space by reducing inventory levels and improving warehouse asset utilization.

4. Ensure product freshness by lowering the days of supply of products in warehouses to the optimal level.
5. reduce back-orders and out-of-stocks situations by improving transportation efficiency and balancing product distribution across the network.
6. Cut transportation cost through improving transportation efficiency and maximizing transportation asset utilization. Double handling and double transportation costs are eliminated.
7. Improve warehouse efficiency by tracking all inventory transactions.
8. Improve Production compliance due to system wide visibility .

B - Demand Forecasting Benefits :

1. Statistically based projection of demand that can be used as a guideline for the reviewed and adjusted weekly forecast
2. Group decision on business volume. All inter-dependent functions affecting the demand or supply coordinate intensively through the system in order to generate the demand forecast.
3. Traceable performance due to weekly accuracy reports (see sample at end of chapter). Every week , the system generated forecast and the adjusted forecast are compared to the actual demand. Accuracy is calculated by product , by location as well as overall accuracy (very useful for the production personnel).
4. Adjustable assumptions and directly re-calculated effects. Any modification in the parameters of the demand forecast will be directly taken into consideration in the next demand generation process.

5. Improved forecast accuracy. The weekly forecast is generated from the system after careful maintenance of the demand parameters. The forecast is also reviewed on a weekly basis by the directly involved personnel (area managers) in order to account for any un-defined exceptional event.

. Reduced out-of-stocks and expired products. The accurate forecast (as shown in Chapter 2 by the chart of economic impact of inaccurate forecast) allows to meet demand requirements with no or minimum excess inventories.

C - *Production Scheduling Benefits :*

1. Sequence production to reflect operating best practices .
2. Conditions can be changed and schedule recalculated automatically. This allows the production manager to run simulation and "what-if" analysis before committing to a schedule, thus insuring production compliance.
3. Generate daily schedule from site specific parameters. The system takes into consideration the different line performances while calculating the production parameters and their projected effect on the company's global inventory level.
4. Minimize changeover time by running sister products and indicating when one run ends and the next begins.
5. Retains all production information from timeline. All variables that can affect the production output are available on the same graphical representation (timeline screen). This allows the scheduler to have a clear view of the production process and a global understanding of the current operation status.

6. Ensures awareness of product shortages.

7. Allows the production scheduler to reduce the system wide days supply of all products to the lowest possible under the prevailing conditions (production capacity , raw material availability , warehouse space availability...)

8. Supports improvement in production line efficiencies.

D - Transportation Management Benefits :

1. Minimizes the chances of product shortages by ensuring the fair share distribution of all items across the network.

2. Maximizes the truck utilization.

3. Smoothes out the demand spikes on production.

4. Generates and document shipping activities for operation audit tracking.

5. Balances inventory across the whole network , eliminating the redundant inter-warehouse transportation. The plant location warehouses (hubs) are the only source of product shipment.

6. Reduces primary transportation cost per case.

7. Improves % cases loaded as ordered by a daily monitoring for performend transportation activities. The actual transportation activities are measured against schedule and discrepancies are calculated and highlighted and accountabilities allocated.

E - Inventory Control Benefits :

1. Facilitates accurate accounting of all inventory transactions. Detailed audit reports per inventory transaction type can be easily generated allowing an improved monitoring of inventory operations.
2. Generates meaningful variance reports. The perpetual balances are compared against daily physical count highlighting differences and allowing daily control over inventory transactions. Adjustments are done daily and thus inventories are reconciled at the end of every day.
3. Assists in identifying inventory shrinkage issues due the audit trail available in the system.

F - Material Requirement Planning Benefits :

1. Ties raw material needs to demand forecast or production schedule.
2. Generates useful ordering reports by comparing on hand inventories of raw material to needed material for the neat period.
3. Identifies material issues before production run.
4. Reduce raw material outages , while insuring that no excessive inventories are held.

4.4 LIMITATIONS :

During the research some limitations were identified. Some of those are :

1. Multiple truck definition for one warehouse : The truck load generation algorithm was based on the assumption that a warehouse is supplied only with one type of trucks. However, in the actual setup , SMLC supplies its warehouses with different truck types (8 pallets, 16 pallets , 24 pallets ...). This fact disabled us to use fully the transportation module.
2. The system requires the specification of a single supply location (hub) for a product to a warehouse. However in our current setting some products can be delivered from two different hubs. This limitation obliged us to change our sourcing matrix each and every time we wanted to send a product from the non-default hub to a warehouse.
3. It was very difficult to estimate the savings in the transportation operations due to the non-accurate classification of the company's expenses in that particular domain.
4. The inventory module (perpetual inventory) was not used due to the fact that our warehouses are not yet hooked to the same wide area network and that it is not very comprehensive.

4.5 FUTURE RESEARCH :

A research about an inventory module incorporating perpetual balances, transaction documentation and suggested purchase orders using optimization techniques can add value to this topic and close the circle of logistics chain of activities.

4.6 CONCLUSION & RECOMMENDATIONS :

Many implementations have failed to provide the company with the promised objectives in spite of having the right tool. The system functionality is definitely a major corner stone of a successful implementation , yet the implementation approach is a key to the success. Proper planning and resource allocation coupled with a strong commitment of both the sponsor and the owner insure the achievement of the identified objectives. May any of those components be missed , and its the whole implementation who is in danger. If the company intends to benefit from the added value that such a system can provide , they have to empower their implementation teems to carry out properly the required change management processes. Changing the way people do business is never easy specially in the industrial environments where personnel academic level is very low and attitudes towards new technologies are very negative and repulsive.

The best way to overcome resistance is through providing the following :

1. Education & communication
2. Participation & involvement
3. Facilitation & continuous support
4. Negotiation & agreement
5. Top Management Reinforcement

Another important recommendation in such implementations is to insure the alignment of all functional managers in order to ease the change management process required to optimize the use of the new system.

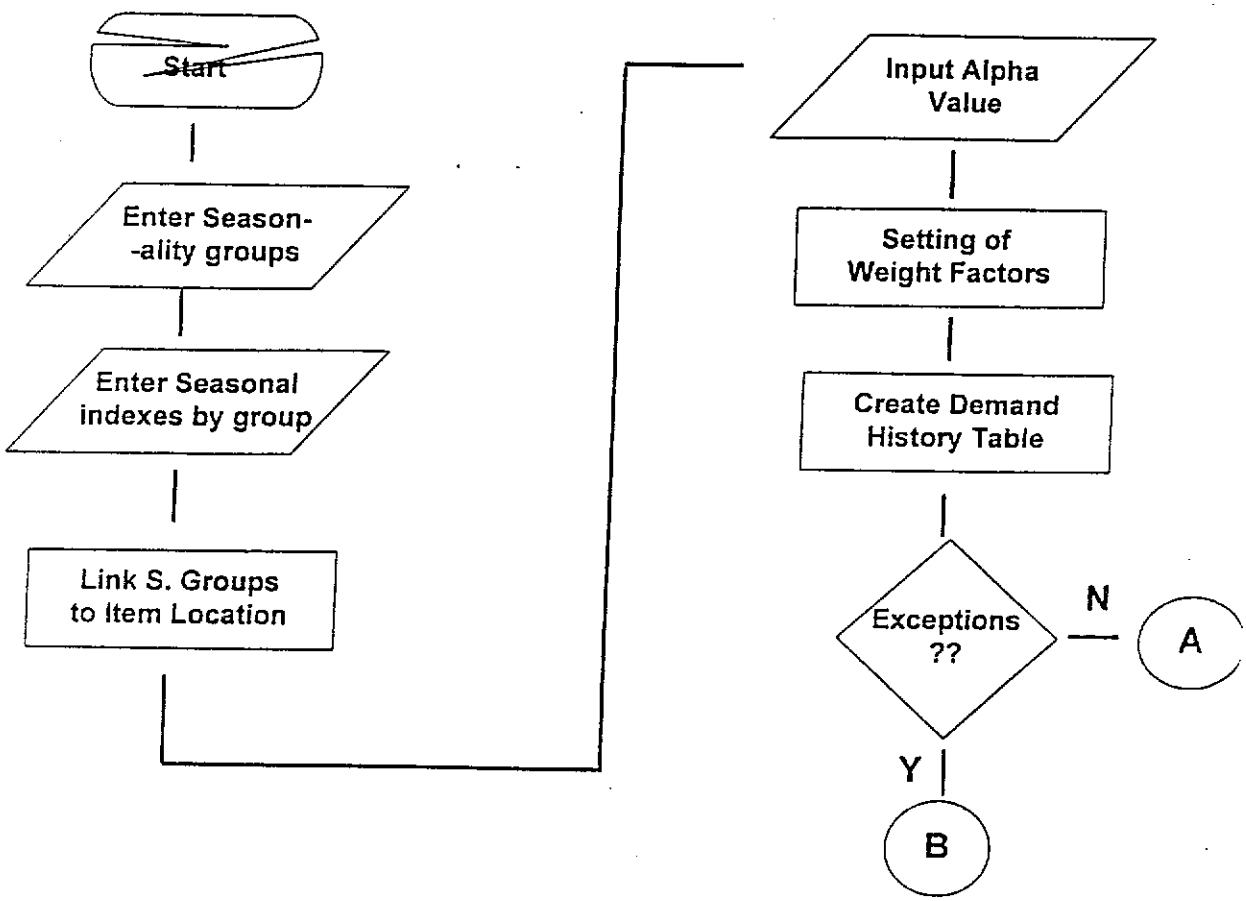
Finally , it is very important to note that only successful implementations contribute positively to the overall corporate efficiency while an incomplete implementation will be a burden on the shoulders of the personnel using it and an overhead on the company's finance.

The integrated logistics system implemented at SMLC power lies in the fact that the system has incorporated operation research techniques difficult to be calculated manually into the normal set of logistics and manufacturing operations . Thus, the company will benefit from the added value of such techniques while the process behind those techniques remain transparent to the end user.

Awareness about tomorrow's challenges and requirements , will ultimately push all organizations to embrace new technologies and to incorporate into their suite of operations such scientific techniques.

APPENDIX I

DEMAND FORECASTING ALGORITHM



Weighting Factors & Alpha Value

(Process 1.2)

Algorithm

To calculate the weights we will use a "smoothing constant" Alpha to determine how much each demand in the past will contribute to the next week demand forecast, however we can override the calculated weights, since the sum of the weights is not greater than 1.

Weighting at Alpha = 0.30

		Weighting
Most recent weighting	$alpha(1 - alpha)^0$	0.300
Data 1 time period older	$alpha(1 - alpha)^1$	0.210
Data 2 time period older	$alpha(1 - alpha)^2$	0.147
Data 3 time period older	$alpha(1 - alpha)^3$	0.103
Data 4 time period older	$alpha(1 - alpha)^4$	0.072

D4 - Weighted Moving Average Weighting Table :

Alpha for Routine Weight at: 0.30
Alpha for Orders Weight at: 0.10

[1] Week Minus	[2] Routine Weight	[3] Orders Weight
01	0.300	0.100
02	0.210	0.090
03	0.147	0.081
04	0.103	0.073
05	0.072	0.066
06	0.050	0.059
07	0.035	0.053

Generate Weekly Forecast

(Process 8)

Algorithm

The following calculations are used to generate forecasts. A standard forecasting method will be used unless a promotion / exception activity has been defined. The following abbreviations are used to simplify the calculation

WMA = Weighted Moving Average
= ΣX_n alpha (1- alpha)$^{n-1}$ / Σ alpha (1-alpha)$^{n-1}$
where X_n is the demand for weeks as n goes from 1 to 10 (backwards in time)
n = user defined variable indicating number of weeks on which to run the algorithm

Trend Formulas:

$$r = \frac{n\sum XY - (\sum X)(\sum Y)}{\sqrt{n\sum X^2 - (\sum X)^2}\sqrt{n\sum Y^2 - (\sum Y)^2}}$$

$$Trend = m = \frac{n\sum XY - (\sum X)(\sum Y)}{n\sum X^2 - (\sum X)^2}$$

$$b = \frac{\sum Y}{N} - m\frac{\sum X}{N}$$

TD = Trended Demand
TD (x) = mx + b (Based on a moving n week data pool)
x = week for which we are calculating
m = trend line
b = Y intercept of the linear regression line

WSI = Weekly Seasonality Index

Trend X Weighted Moving Average :

0 - Standard Forecast Method

IF r >= 0.75 OR r<=-0.75 THEN
Forecast = TD * WSI
ELSE
Forecast = WMA * WSI
END IF

Work Weekly Actual Demand Table :

[1] Location	[2] SKU	[3] Year	[4] Week	[5] Total Actual Demand	[6] Actual Order Demand	[7] Actual Special Order Demand	[8] Actual Routine Demand
Pepsi Plant	001	94	01	2,886	100	10	2,776
Pepsi Plant	001	94	02	2,989			2,989
Pepsi Plant	001	94	03	3,423	300		3,123
Pepsi Plant	001	94	04	3,449	125		3,324
Pepsi Plant	001	94	05	4,495	500		3,995
Pepsi Plant	001	94	06	4,650			4,650
Pepsi Plant	001	94	07	6,119	1000		5,119
Pepsi Plant	001	94	08	5,681	400		5,281

D1 - Weekly Actual Demand Table :

[1] Location	[2] SKU	[3] Year	[4] Week	[6] Actual Order Demand	[8] Actual Routine Demand
Pepsi Plant	001	94	01	100	2,776
Pepsi Plant	001	94	02		2,989
Pepsi Plant	001	94	03	300	3,123
Pepsi Plant	001	94	04	125	3,324
Pepsi Plant	001	94	05	500	3,995
Pepsi Plant	001	94	06		4,650
Pepsi Plant	001	94	07	1000	5,119
Pepsi Plant	001	94	08	400	5,281

[1] Location
Location where the sales occurred

[2] SKU
Unit of Stock

[3] Year
Year in which the sales occurred in "YY"

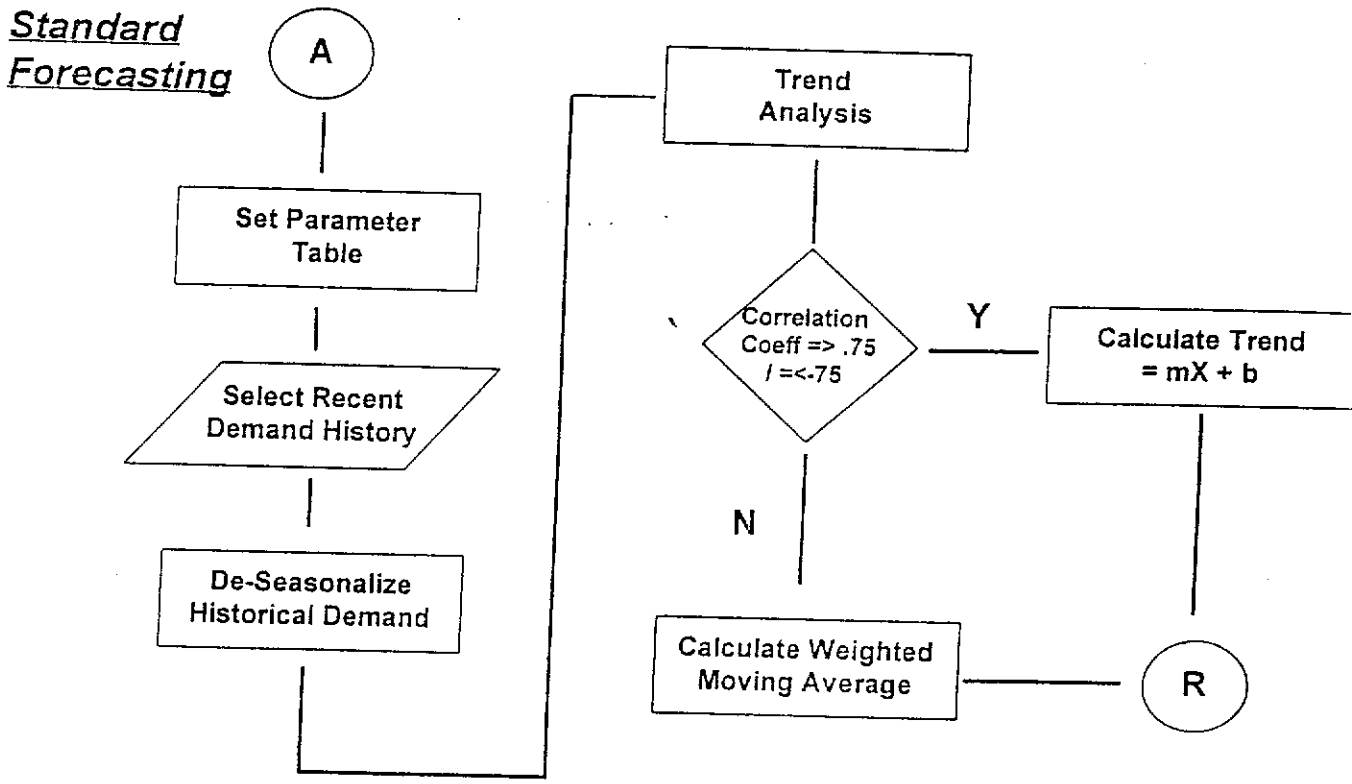
[4] Week
Week in which the sales occurred (From 01 to 53)

[5] Total Actual Demand
Total cases demand on that location during the week

[6] Actual Order Demand
Cases ordered during the week with Bills type B.
Actual Demand that is defined by sporadic order frequency and lumpy demand

[7] Actual Special Order Demand
Cases ordered during the week with Bills type C.
Actual Demand that is exceptional and not expected to repeat with any regularity.

[8] Actual Routine Demand
Actual Demand that fall into the category of demand that comes in a steady flow with little lead time.
Actual Demand = (Total Cases sold during the week) -
(Cases sold during the week with Bills type B and C.)
[8] = [5] - [6] - [7]


Standard Forecasting
A
Set Parameter Table
Select Recent Demand History
De-Seasonalize Historical Demand
Trend Analysis
Correlation Coeff => .75 / =<-75
Y
Calculate Trend = mX + b
N
Calculate Weighted Moving Average
R

Parameter Tables

(Process 1.1)

Algorithm

In this process the user or an interface system should be able to enter the parameters to generate the Weighted Average Demand Forecast.

The Number of Weeks is the parameter that you use to specify the number of weeks to generate the forecast for. Therefore if you specify ***Week From*** equal 45 and ***Number of Weeks*** equal 04 , the system will generate Forecast Demand for weeks 45, 46, 47, 48.

D8 - Moving Average Generation Parameter Table:

[1] Year	[2] Week From	[3] Weighted Moving Average Weeks	[4] Trend Weeks	[5] Correlation Coefficient Threshold
94	45	04	10	0.75

[1] [2] - Year/ Week From are the parameters that you use to specify the starting Year/Week number that the system will calculate the forecast for.

[3] - Weighted Moving Average Weeks is the parameter that you use to specify the number of weeks to generate the forecast using the Weighted Moving Average.

[4] - Trend Weeks is the parameter that you use to specify the number of weeks to generate the forecast using the Trend Method.

[5] - Correlation Coefficient Threshold is the value to be compared to the trend correlation coefficient to decide if the trend demand or weighted moving average will be used.

Location PEPSI	SKU	Year	Week (X)	Deseasonalized Actual Demand (Y)	(XY)	(X)^2	(Y)^2	Forecast TD
PEPSI	001	94	01	3,470	3,470	1	12,040,900	3,466
PEPSI	001	94	02	3,783	7,566	4	14,311,089	3,720
PEPSI	001	94	03	3,856	11,568	9	14,868,736	3,975
PEPSI	001	94	04	3,910	15,640	16	15,288,100	4,229
PEPSI	001	94	05	4,489	22,445	25	20,151,121	4,483
PEPSI	001	94	06	5,000	30,000	36	25,000,000	4,738
PEPSI	001	94	07	5,332	37,324	49	28,430,224	4,992
PEPSI	001	94	08	5,334	42,672	64	28,451,556	5,247
PEPSI	001	94	09	5,432	48,888	81	29,506,624	5,501
PEPSI	001	94	10	5,500	55,000	100	30,250,000	5,756
			55	46,106	274,573	385	218,298,350	
			[T1]	[T3]	[T4]	[T5]	[T6]	

PEPSI	001	94	11					6,010

[9] n= 10

[10] Correlation Coefficient

r = .966

= ((n*[T4]) - ([T1]*[T3])) / ((((n*[T5]) - (([T1])^2))^(1/2)) * (((n*[T6]) - (([T3])^2))^(1/2))),

[11] Trend (m)

m = 254

= ((n*[T4]) - ([T1]*[T3])) / ((n*[T5]) - (([T1])^2)),

[12] Intercept (b)

b = 3,211

=(([T3]/ n) - (m*([T1]/n)))

[13] Result

TD(X) = 3,211 + 254X

Work Trend Demand Table (Cont') :

[1] Location
Location where demand occurred

[2] SKU
Unit of Stock

[3] Year
Year in which demand occurred

[4] Week
Week in which demand occurred

[5] Deseasonalized Actual Demand
Total cases sold during the week without the seasonal component

[6] X multiplied by Y
Week Number multiplied by Deseasonalized Actual Demand

[7] Squared of X
Squared of the Week Number

[8] Squared of Y
Squared of the Deseasonalized Actual Demand

[9] TD
Forecast for the period based on Regression Analysis

D7 - Trend Demand Table :

Location	SKU	Year	Week	Trend Slope (m)	Trend Demand (TD)
PEPSI	001	94	01	254	3,466
PEPSI	001	94	02	254	3,720
PEPSI	001	94	03	254	3,975
PEPSI	001	94	04	254	4,229

[1] Location
Location where demand occurred

[2] SKU
Unit of Stock

[3] Year
Year in which demand occurred

[4] Week
Week in which demand occurred

[5] Trend Demand

Important :
This algorithm is used to calculated the Trend for both the Routine Demand Forecast and Order Demand Forecast.

Calculate Weighted Moving Average Demand

(Process 5)

Algorithm

We will use the ***"Weighted Moving Average"*** to forecast the average demand for our products. In this method the most recent occurrences are more indicative of the future than those in the more distant past.
To calculate the weights we will use a ***"smoothing constant" alpha*** to determine how much the increment of each sale in the past will be decreased by.

Work Average Demand Table :

[1] Location	[2] SKU	[3] Year	[4] Week	[5] Deseasonalized Actual Demand	[6] Weight	[7] Weighted Actual Demand	[8] Weighted Moving Average Demand Forecast
PEPSI	001	94	01	3,470	2.47%	86	
PEPSI	001	94	02	3,783	3.53%	134	
PEPSI	001	94	03	3,856	5.04%	194	
PEPSI	001	94	04	3,910	7.20%	282	
PEPSI	001	94	05	4,489	10.29%	462	
PEPSI	001	94	06	5,000	14.70%	735	
PEPSI	001	94	07	5,332	21.00%	1,120	
PEPSI	001	94	08	5,334	30.00%	1,600	4,894
PEPSI	001	94	09	[T1] 35,174	[T2] 94.24%	[T3] 4,612	

[1] Location
Location for which the forecast is being calculated

[2] Year
Year in which the demand occurred 'YY'.

[3] Week
Week in which the demand occurred 'YY'.

[4] SKU
Unit of Stock

[5] Deseasonalized Actual Demand
Actual Demand without The Seasonal Component

[6] Weight
Weight applied to previews number of weeks based on the Forecast Parameters and the Weighting Factors.

[7] Weighted Actual Demand
The demand without the Seasonal Component and weighted based on the Weighting Factor
[7] = [5] * [6]

[8] Weighted Moving Average Demand Forecast

Deseasonalize Actual Demand

(Process 4)

Algorithm

In this process the ***Seasonal Component of the Demand*** is eliminated from the volume of demand . To eliminate the Seasonal impact, the Actual Demand is divided by a Seasonality Index.

D14 - SKU/Location Table :

[1] Location	[2] SKU	[3] Seasonal Group Id
Pepsi Plant	Diet Pepsi	Pepsi02
Pepsi Plant	Pepsi Max	Pepsi02
Pepsi Plant	Pepsi Regular	Pepsi01
Pepsi Plant	Crystal Pepsi	Pepsi02
Segui warehouse	Crystal Pepsi	Pepsi02
Segui warehouse	Pepsi Regular	Pepsi01

Work Deseasonalized Weekly Actual Demand :

[1] Location	[2] SKU	[3] Year	[4] Week	[5] Actual Routine Demand	[6] Actual Order Demand	[8] Seasonal Index	[9] Deseasonalized Actual Routine Demand	[10] Deseasonalize Actual Order Demand
Pepsi Plant	001	94	01	2,776	100	0.80	3,470	125
Pepsi Plant	001	94	02	2,989		0.79	3,783	
Pepsi Plant	001	94	03	3,123	300	0.81	3,856	370
Pepsi Plant	001	94	04	3,324	125	0.85	3,910	147
Pepsi Plant	001	94	05	3,995	500	0.89	4,489	572
Pepsi Plant	001	94	06	4,650		0.93	5,000	
Pepsi Plant	001	94	07	5,119	1000	0.96	5,332	1041
Pepsi Plant	001	94	08	5,281	400	0.99	5,334	404

[1] Location
Location where the sales occurred

[2] SKU
Unit of Stock

[3] Year
Year in which the sales occurred in "YY"

[4] Week
Week in which the sales occurred (From 01 to 53)

CHAPTER IV

LOGISTICS & MANUFACTURING

LEARNINGS & BENEFITS

4.1 OLD PRACTICES Vs PL&M PRACTICES :

An implementation is not successful if not coupled with a change management process. This change should incorporate new practices that insures the optimization of the operations under the new system. Listed below (see Table 4.1) are some of the major changes in the way SMLC does its Logistics activities.

TABLE 4.1 : OLD Vs NEW PRACTICES

OLD PRACTICES	NEW PRACTICES
Pull System : priorities based on received orders from warehouse managers	Push System : Priorities based on balancing system wide days supply and criticality of the SKU
The data base sources are distributed between different applications with many redundant operations	Unique data base source for all logistics and manufacturing operations allowing easier report generation with higher accuracy. Redundant work is eliminated

Forecasting is centralized and made at the plant for all warehouses. Forecast is done once and never reviewed.	Forecasting is made in a de-centralized form with the area managers handling their own forecast. The forecast is reviewed on a weekly basis.
There is little on no clear visibility over inventories across the whole network.	The system give a micro view of all the inventories in the whole network with the possibility to dig into details.
Transport is being scheduled on a weekly basis with no or little visibility of the inventories in the warehouses. No monitoring reports were done to measure the percent cases loaded as scheduled	Transportation Scheduling is made on a daily basis with hints for optimum transfer amounts to balance the system wide days supply. Transportation management KPIs have been defined and are monitored on a daily basis.
Accountability is perceived as only a logistics task. No clear responsibilities for the other functions affecting the logistics activities.	Accountability for all parts involved is precise and measurable. Each logistics function performance is linked to a set of KPIs indicating the degree of efficiency and accuracy of operation.

4.2 PL&M BEST PRACTICES :

A - Forecasting :

1. Sales history tracked by week , by SKU , by location.
2. Marketing plan for promotions or any other exception are defined into the system as required. This information is directly coordinated with the production personnel and transportation and warehouse staff.
3. Forecast is reviewed on a weekly basis. The adjusted forecast as well as the generated forecast accuracy are calculated and reported on a weekly basis.

B - Production Scheduling :

1. Production scheduled performed weekly and reviewed daily.
2. Production efficiency is measured on a daily basis by production line.
3. Production compliance is checked against product availability in the whole network. The macro view of the company's inventories help highlighting priority actions.
4. Production schedule is coordinated with raw material staff to insure the availability of the needed items for date production.

C - Transportation Management :

1. One-to-One product sourcing relationships per SKU.
2. Transportation activity scheduled and updated daily.

3. All transportation activities are scheduled through the system.

D - Material Requirement Planning :

1. Unique product formula for each SKU on each production line.
2. Material availability reports printed and reviewed daily.

E - Inventory Control :

1. Raw material and finished goods inventory transactions tracked on a daily basis.
2. Perpetual balances checked against physical count weekly.
3. Raw material physical count taken weekly.
4. Finished goods physical count take daily.
5. All inventory transactions maintained daily in the system .
6. Inventory reconciled daily , and books closed periodically (synchronize perpetual balances and physical count)

4.3 SYSTEM BENEFITS :

A - The Integrated Logistics & Manufacturing system overall benefits are :

1. Improve response capabilities to demand shipts
2. Reduce working capital needs by eliminating excessive inventories.
3. Optimize required warehouse space by reducing inventory levels and improving warehouse asset utilization.

4. Ensure product freshness by lowering the days of supply of products in warehouses to the optimal level.
5. reduce back-orders and out-of-stocks situations by improving transportation efficiency and balancing product distribution across the network.
6. Cut transportation cost through improving transportation efficiency and maximizing transportation asset utilization. Double handling and double transportation costs are eliminated.
7. Improve warehouse efficiency by tracking all inventory transactions.
8. Improve Production compliance due to system wide visibility .

B - Demand Forecasting Benefits :

1. Statistically based projection of demand that can be used as a guideline for the reviewed and adjusted weekly forecast
2. Group decision on business volume. All inter-dependent functions affecting the demand or supply coordinate intensively through the system in order to generate the demand forecast.
3. Traceable performance due to weekly accuracy reports (see sample at end of chapter). Every week , the system generated forecast and the adjusted forecast are compared to the actual demand. Accuracy is calculated by product , by location as well as overall accuracy (very useful for the production personnel).
4. Adjustable assumptions and directly re-calculated effects. Any modification in the parameters of the demand forecast will be directly taken into consideration in the next demand generation process.

5. Improved forecast accuracy. The weekly forecast is generated from the system after careful maintenance of the demand parameters. The forecast is also reviewed on a weekly basis by the directly involved personnel (area managers) in order to account for any un-defined exceptional event.

. Reduced out-of-stocks and expired products. The accurate forecast (as shown in Chapter 2 by the chart of economic impact of inaccurate forecast) allows to meet demand requirements with no or minimum excess inventories.

C - *Production Scheduling Benefits :*

1. Sequence production to reflect operating best practices .
2. Conditions can be changed and schedule recalculated automatically. This allows the production manager to run simulation and "what-if" analysis before committing to a schedule, thus insuring production compliance.
3. Generate daily schedule from site specific parameters. The system takes into consideration the different line performances while calculating the production parameters and their projected effect on the company's global inventory level.
4. Minimize changeover time by running sister products and indicating when one run ends and the next begins.
5. Retains all production information from timeline. All variables that can affect the production output are available on the same graphical representation (timeline screen). This allows the scheduler to have a clear view of the production process and a global understanding of the current operation status.

6. Ensures awareness of product shortages.

7. Allows the production scheduler to reduce the system wide days supply of all products to the lowest possible under the prevailing conditions (production capacity , raw material availability , warehouse space availability...)

8. Supports improvement in production line efficiencies.

D - Transportation Management Benefits :

1. Minimizes the chances of product shortages by ensuring the fair share distribution of all items across the network.

2. Maximizes the truck utilization.

3. Smoothes out the demand spikes on production.

4. Generates and document shipping activities for operation audit tracking.

5. Balances inventory across the whole network , eliminating the redundant inter-warehouse transportation. The plant location warehouses (hubs) are the only source of product shipment.

6. Reduces primary transportation cost per case.

7. Improves % cases loaded as ordered by a daily monitoring for performend transportation activities. The actual transportation activities are measured against schedule and discrepancies are calculated and highlighted and accountabilities allocated.

E - Inventory Control Benefits :

1. Facilitates accurate accounting of all inventory transactions. Detailed audit reports per inventory transaction type can be easily generated allowing an improved monitoring of inventory operations.
2. Generates meaningful variance reports. The perpetual balances are compared against daily physical count highlighting differences and allowing daily control over inventory transactions. Adjustments are done daily and thus inventories are reconciled at the end of every day.
3. Assists in identifying inventory shrinkage issues due the audit trail available in the system.

F - Material Requirement Planning Benefits :

1. Ties raw material needs to demand forecast or production schedule.
2. Generates useful ordering reports by comparing on hand inventories of raw material to needed material for the neat period.
3. Identifies material issues before production run.
4. Reduce raw material outages , while insuring that no excessive inventories are held.

4.4 LIMITATIONS :

During the research some limitations were identified. Some of those are :

1. Multiple truck definition for one warehouse : The truck load generation algorithm was based on the assumption that a warehouse is supplied only with one type of trucks. However, in the actual setup , SMLC supplies its warehouses with different truck types (8 pallets, 16 pallets , 24 pallets ...). This fact disabled us to use fully the transportation module.
2. The system requires the specification of a single supply location (hub) for a product to a warehouse. However in our current setting some products can be delivered from two different hubs. This limitation obliged us to change our sourcing matrix each and every time we wanted to send a product from the non-default hub to a warehouse.
3. It was very difficult to estimate the savings in the transportation operations due to the non-accurate classification of the company's expenses in that particular domain.
4. The inventory module (perpetual inventory) was not used due to the fact that our warehouses are not yet hooked to the same wide area network and that it is not very comprehensive.

4.5 FUTURE RESEARCH :

A research about an inventory module incorporating perpetual balances, transaction documentation and suggested purchase orders using optimization techniques can add value to this topic and close the circle of logistics chain of activities.

4.6 CONCLUSION & RECOMMENDATIONS :

Many implementations have failed to provide the company with the promised objectives in spite of having the right tool. The system functionality is definitely a major corner stone of a successful implementation , yet the implementation approach is a key to the success. Proper planning and resource allocation coupled with a strong commitment of both the sponsor and the owner insure the achievement of the identified objectives. May any of those components be missed , and its the whole implementation who is in danger. If the company intends to benefit from the added value that such a system can provide , they have to empower their implementation teems to carry out properly the required change management processes. Changing the way people do business is never easy specially in the industrial environments where personnel academic level is very low and attitudes towards new technologies are very negative and repulsive.

The best way to overcome resistance is through providing the following :

1. Education & communication
2. Participation & involvement
3. Facilitation & continuous support
4. Negotiation & agreement
5. Top Management Reinforcement

Another important recommendation in such implementations is to insure the alignment of all functional managers in order to ease the change management process required to optimize the use of the new system.

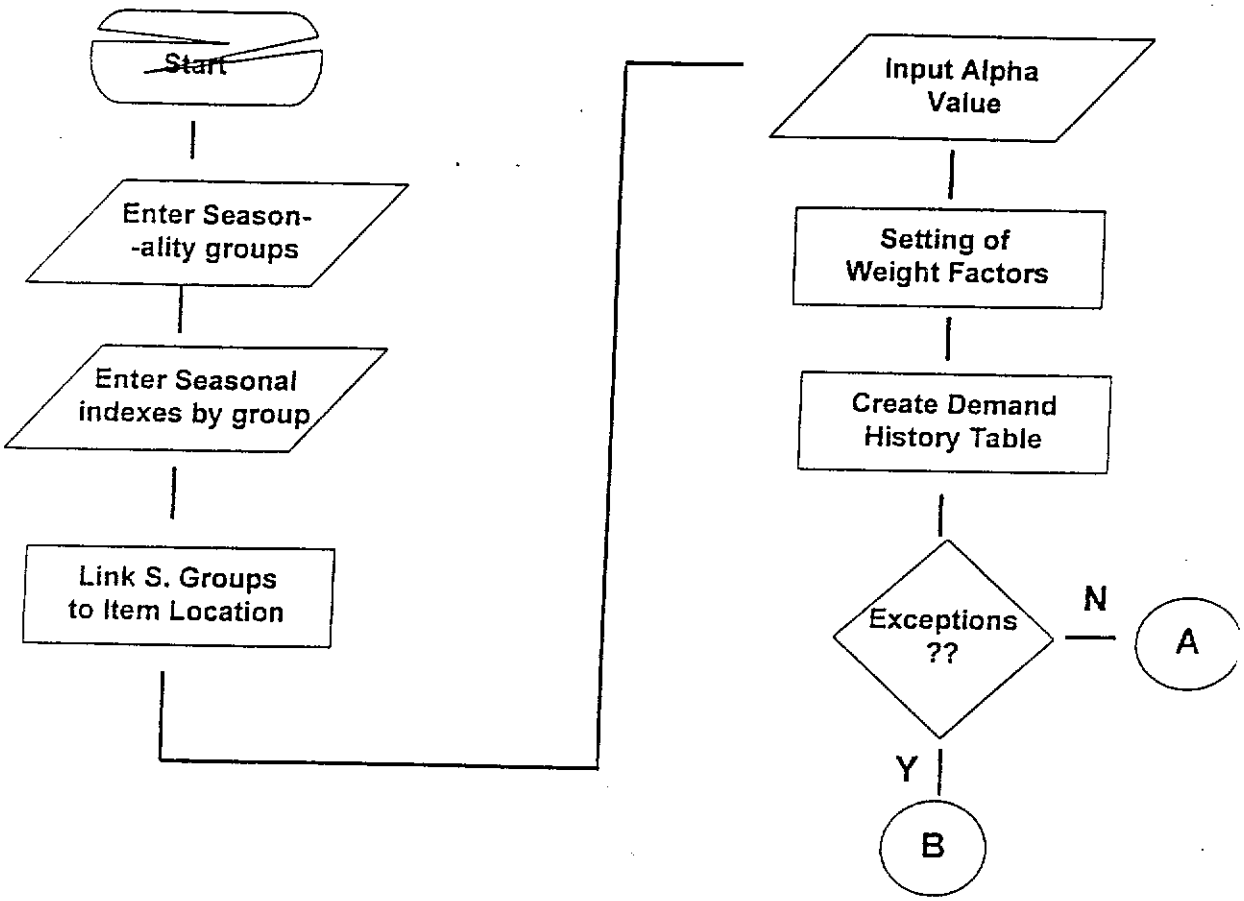
Finally , it is very important to note that only successful implementations contribute positively to the overall corporate efficiency while an incomplete implementation will be a burden on the shoulders of the personnel using it and an overhead on the company's finance.

The integrated logistics system implemented at SMLC power lies in the fact that the system has incorporated operation research techniques difficult to be calculated manually into the normal set of logistics and manufacturing operations . Thus, the company will benefit from the added value of such techniques while the process behind those techniques remain transparent to the end user.

Awareness about tomorrow's challenges and requirements , will ultimately push all organizations to embrace new technologies and to incorporate into their suite of operations such scientific techniques.

APPENDIX I

DEMAND FORECASTING ALGORITHM



Weighting Factors & Alpha Value

(Process 1.2)

Algorithm

To calculate the weights we will use a "smoothing constant" Alpha to determine how much each demand in the past will contribute to the next week demand forecast, however we can override the calculated weights, since the sum of the weights is not greater than 1.

Weighting at Alpha = 0.30

		Weighting
Most recent weighting	$alpha(1 - alpha)^0$	0.300
Data 1 time period older	$alpha(1 - alpha)^1$	0.210
Data 2 time period older	$alpha(1 - alpha)^2$	0.147
Data 3 time period older	$alpha(1 - alpha)^3$	0.103
Data 4 time period older	$alpha(1 - alpha)^4$	0.072

D4 - Weighted Moving Average Weighting Table :

Alpha for Routine Weight at: 0.30
Alpha for Orders Weight at: 0.10

[1] Week Minus	[2] Routine Weight	[3] Orders Weight
01	0.300	0.100
02	0.210	0.090
03	0.147	0.081
04	0.103	0.073
05	0.072	0.066
06	0.050	0.059
07	0.035	0.053

Generate Weekly Forecast

(Process 8)

Algorithm

The following calculations are used to generate forecasts. A standard forecasting method will be used unless a promotion / exception activity has been defined. The following abbreviations are used to simplify the calculation.

WMA = Weighted Moving Average
= ΣX_n alpha (1- alpha)$^{n-1}$ / Σ alpha (1-alpha)$^{n-1}$
where X_n is the demand for weeks as n goes from 1 to 10 (backwards in time)
n = user defined variable indicating number of weeks on which to run the algorithm

Trend Formulas:

$$r = \frac{n\sum XY - (\sum X)(\sum Y)}{\sqrt{n\sum X^2 - (\sum X)^2}\sqrt{n\sum Y^2 - (\sum Y)^2}}$$

$$Trend = m = \frac{n\sum XY - (\sum X)(\sum Y)}{n\sum X^2 - (\sum X)^2}$$

$$b = \frac{\sum Y}{N} - m\frac{\sum X}{N}$$

TD = Trended Demand
TD (x) = mx + b (Based on a moving n week data pool)
x = week for which we are calculating
m = trend line
b = Y intercept of the linear regression line

WSI = Weekly Seasonality Index

Trend X Weighted Moving Average :

0 - Standard Forecast Method

IF r >= 0.75 OR r<=-0.75 THEN
Forecast = TD * WSI
ELSE
Forecast = WMA * WSI
END IF

Work Weekly Actual Demand Table :

[1] Location	[2] SKU	[3] Year	[4] Week	[5] Total Actual Demand	[6] Actual Order Demand	[7] Actual Special Order Demand	[8] Actual Routine Demand
Pepsi Plant	001	94	01	2,886	100	10	2,776
Pepsi Plant	001	94	02	2,989			2,989
Pepsi Plant	001	94	03	3,423	300		3,123
Pepsi Plant	001	94	04	3,449	125		3,324
Pepsi Plant	001	94	05	4,495	500		3,995
Pepsi Plant	001	94	06	4,650			4,650
Pepsi Plant	001	94	07	6,119	1000		5,119
Pepsi Plant	001	94	08	5,681	400		5,281

D1 - Weekly Actual Demand Table :

[1] Location	[2] SKU	[3] Year	[4] Week	[6] Actual Order Demand	[8] Actual Routine Demand
Pepsi Plant	001	94	01	100	2,776
Pepsi Plant	001	94	02		2,989
Pepsi Plant	001	94	03	300	3,123
Pepsi Plant	001	94	04	125	3,324
Pepsi Plant	001	94	05	500	3,995
Pepsi Plant	001	94	06		4,650
Pepsi Plant	001	94	07	1000	5,119
Pepsi Plant	001	94	08	400	5,281

[1] Location
Location where the sales occurred

[2] SKU
Unit of Stock

[3] Year
Year in which the sales occurred in "YY"

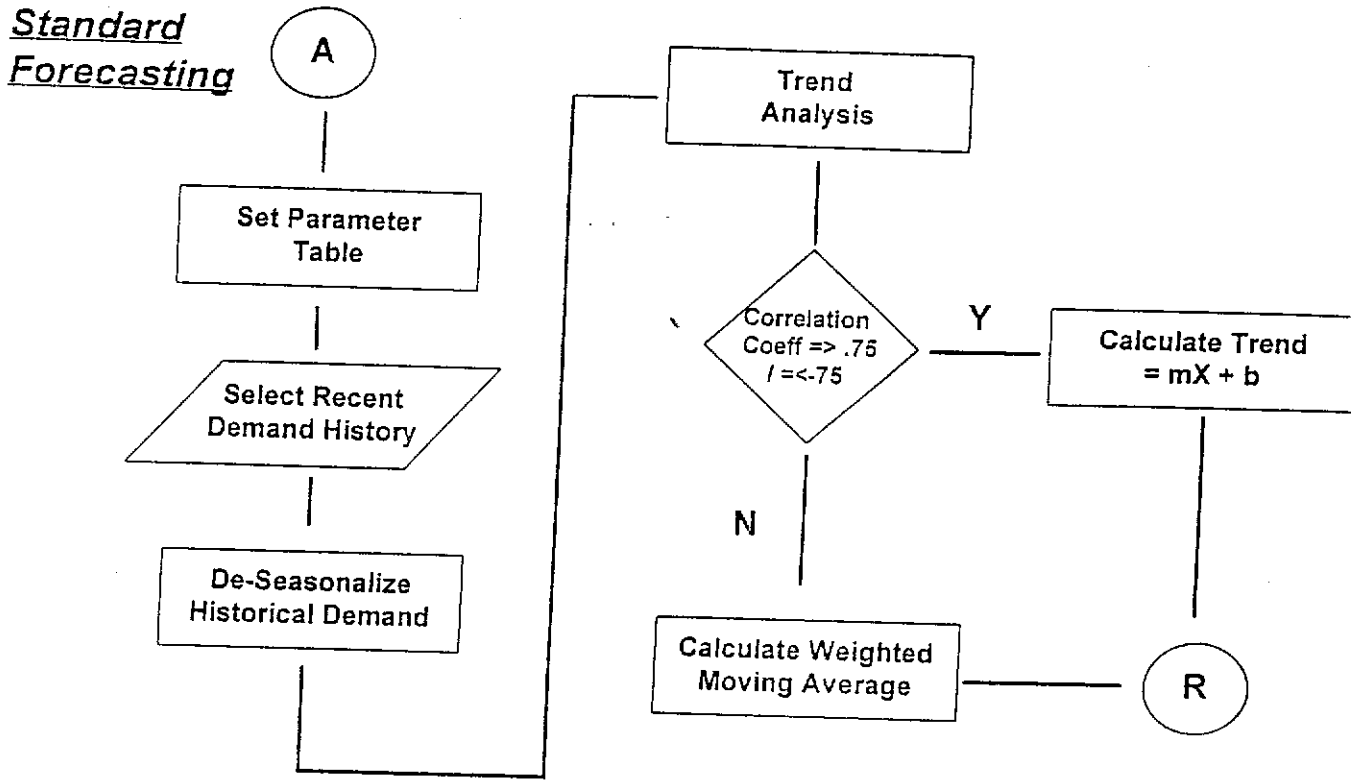
[4] Week
Week in which the sales occurred (From 01 to 53)

[5] Total Actual Demand
Total cases demand on that location during the week

[6] Actual Order Demand
Cases ordered during the week with Bills type B.
Actual Demand that is defined by sporadic order frequency and lumpy demand

[7] Actual Special Order Demand
Cases ordered during the week with Bills type C.
Actual Demand that is exceptional and not expected to repeat with any regularity.

[8] Actual Routine Demand
Actual Demand that fall into the category of demand that comes in a steady flow with little lead time.
Actual Demand = (Total Cases sold during the week) -
(Cases sold during the week with Bills type B and C.)
[8] = [5] - [6] - [7]


Standard Forecasting
A
Set Parameter Table
Select Recent Demand History
De-Seasonalize Historical Demand
Trend Analysis
Correlation Coeff => .75 / =<-75
Y
Calculate Trend = mX + b
N
Calculate Weighted Moving Average
R

Parameter Tables

(Process 1.1)

Algorithm

In this process the user or an interface system should be able to enter the parameters to generate the Weighted Average Demand Forecast.

The Number of Weeks is the parameter that you use to specify the number of weeks to generate the forecast for. Therefore if you specify ***Week From*** equal 45 and ***Number of Weeks*** equal 04 , the system will generate Forecast Demand for weeks 45, 46, 47, 48.

D8 - Moving Average Generation Parameter Table:

[1] Year	[2] Week From	[3] Weighted Moving Average Weeks	[4] Trend Weeks	[5] Correlation Coefficient Threshold
94	45	04	10	0.75

[1] [2] - Year/ Week From are the parameters that you use to specify the starting Year/Week number that the system will calculate the forecast for.

[3] - Weighted Moving Average Weeks is the parameter that you use to specify the number of weeks to generate the forecast using the Weighted Moving Average.

[4] - Trend Weeks is the parameter that you use to specify the number of weeks to generate the forecast using the Trend Method.

[5] - Correlation Coefficient Threshold is the value to be compared to the trend correlation coefficient to decide if the trend demand or weighted moving average will be used.

Location PEPSI	SKU	Year	Week (X)	Deseasonalized Actual Demand (Y)	(XY)	(X)^2	(Y)^2	Forecast TD
PEPSI	001	94	01	3,470	3,470	1	12,040,900	3,466
PEPSI	001	94	02	3,783	7,566	4	14,311,089	3,720
PEPSI	001	94	03	3,856	11,568	9	14,868,736	3,975
PEPSI	001	94	04	3,910	15,640	16	15,288,100	4,229
PEPSI	001	94	05	4,489	22,445	25	20,151,121	4,483
PEPSI	001	94	06	5,000	30,000	36	25,000,000	4,738
PEPSI	001	94	07	5,332	37,324	49	28,430,224	4,992
PEPSI	001	94	08	5,334	42,672	64	28,451,556	5,247
PEPSI	001	94	09	5,432	48,888	81	29,506,624	5,501
PEPSI	001	94	10	5,500	55,000	100	30,250,000	5,756
			55	46,106	274,573	385	218,298,350	
			[T1]	[T3]	[T4]	[T5]	[T6]	
PEPSI	001	94	11					6,010

[9] n= 10

[10] Correlation Coefficient

r = .966

= ((n*[T4]) - ([T1]*[T3])) / ((((n*[T5]) - (([T1])^2))^(1/2)) * (((n*[T6]) - (([T3])^2))^(1/2))),

[11] Trend (m)

m = 254

= ((n*[T4]) - ([T1]*[T3])) / ((n*[T5]) - (([T1])^2)),

[12] Intercept (b)

b = 3,211

=(([T3]/ n) - (m*([T1]/n)))

[13] Result

TD(X) = 3,211 + 254X

Work Trend Demand Table (Cont') :

[1] Location
Location where demand occurred

[2] SKU
Unit of Stock

[3] Year
Year in which demand occurred

[4] Week
Week in which demand occurred

[5] Deseasonalized Actual Demand
Total cases sold during the week without the seasonal component

[6] X multiplied by Y
Week Number multiplied by Deseasonalized Actual Demand

[7] Squared of X
Squared of the Week Number

[8] Squared of Y
Squared of the Deseasonalized Actual Demand

[9] TD
Forecast for the period based on Regression Analysis

D7 - Trend Demand Table :

Location	SKU	Year	Week	Trend Slope (m)	Trend Demand (TD)
PEPSI	001	94	01	254	3,466
PEPSI	001	94	02	254	3,720
PEPSI	001	94	03	254	3,975
PEPSI	001	94	04	254	4,229

[1] Location
Location where demand occurred

[2] SKU
Unit of Stock

[3] Year
Year in which demand occurred

[4] Week
Week in which demand occurred

[5] Trend Demand

Important :
This algorithm is used to calculated the Trend for both the Routine Demand Forecast and Order Demand Forecast.

Calculate Weighted Moving Average Demand

(Process 5)

Algorithm

We will use the ***"Weighted Moving Average"*** to forecast the average demand for our products. In this method the most recent occurrences are more indicative of the future than those in the more distant past. To calculate the weights we will use a ***"smoothing constant" alpha*** to determine how much the increment of each sale in the past will be decreased by.

Work Average Demand Table :

[1] Location	[2] SKU	[3] Year	[4] Week	[5] Deseasonalized Actual Demand	[6] Weight	[7] Weighted Actual Demand	[8] Weighted Moving Average Demand Forecast
PEPSI	001	94	01	3,470	2.47%	86	
PEPSI	001	94	02	3,783	3.53%	134	
PEPSI	001	94	03	3,856	5.04%	194	
PEPSI	001	94	04	3,910	7.20%	282	
PEPSI	001	94	05	4,489	10.29%	462	
PEPSI	001	94	06	5,000	14.70%	735	
PEPSI	001	94	07	5,332	21.00%	1,120	
PEPSI	001	94	08	5,334	30.00%	1,600	4,894
PEPSI	001	94	09	[T1] 35,174	[T2] 94 24%	[T3] 4,612	

[1] Location
Location for which the forecast is being calculated

[2] Year
Year in which the demand occurred 'YY'.

[3] Week
Week in which the demand occurred 'YY'.

[4] SKU
Unit of Stock

[5] Deseasonalized Actual Demand
Actual Demand without The Seasonal Component

[6] Weight
Weight applied to previews number of weeks based on the Forecast Parameters and the Weighting Factors.

[7] Weighted Actual Demand
The demand without the Seasonal Component and weighted based on the Weighting Factor
[7] = [5] * [6]

[8] Weighted Moving Average Demand Forecast

Deseasonalize Actual Demand

(Process 4)

Algorithm

In this process the ***Seasonal Component of the Demand*** is eliminated from the volume of demand . To eliminate the Seasonal impact, the Actual Demand is divided by a Seasonality Index.

D14 - SKU/Location Table :

[1] Location	[2] SKU	[3] Seasonal Group Id
Pepsi Plant	Diet Pepsi	Pepsi02
Pepsi Plant	Pepsi Max	Pepsi02
Pepsi Plant	Pepsi Regular	Pepsi01
Pepsi Plant	Crystal Pepsi	Pepsi02
Segui warehouse	Crystal Pepsi	Pepsi02
Segui warehouse	Pepsi Regular	Pepsi01

Work Deseasonalized Weekly Actual Demand :

[1] Location	[2] SKU	[3] Year	[4] Week	[5] Actual Routine Demand	[6] Actual Order Demand	[8] Seasonal Index	[9] Deseasonalized Actual Routine Demand	[10] Deseasonalize Actual Order Demand
Pepsi Plant	001	94	01	2,776	100	0.80	3,470	125
Pepsi Plant	001	94	02	2,989		0.79	3,783	
Pepsi Plant	001	94	03	3,123	300	0.81	3,856	370
Pepsi Plant	001	94	04	3,324	125	0.85	3,910	147
Pepsi Plant	001	94	05	3,995	500	0.89	4,489	572
Pepsi Plant	001	94	06	4,650		0.93	5,000	
Pepsi Plant	001	94	07	5,119	1000	0.96	5,332	1041
Pepsi Plant	001	94	08	5,281	400	0.99	5,334	404

[1] Location
Location where the sales occurred

[2] SKU
Unit of Stock

[3] Year
Year in which the sales occurred in "YY"

[4] Week
Week in which the sales occurred (From 01 to 53)

Calculate Trend Demand

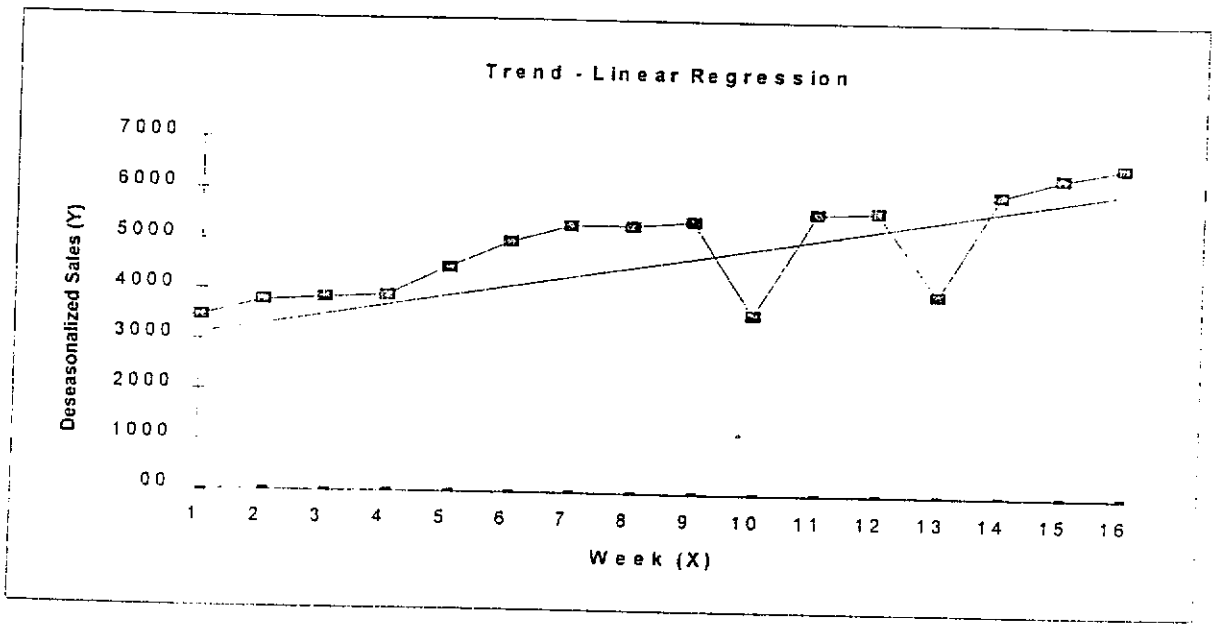
(Process 7)

Algorithm

We use the Linear Regression Analysis to calculate ***The Trend Component of the Forecast***.
Linear Regression Analysis is predicting one variable from the other when the two have a linear relationship. By convention, the variable being predicted or dependent variable is denoted Y, and the variable that helps with the prediction or dependent is X.

In our case, we have ***Week*** as ***X*** and ***Deseasonalized Demand*** as ***Y***. We are assuming that Week and Deseasonalized Demand has a linear relationship, that could be positive or negative.
The Liner Regression is a mathematical method that calculates the best line based on bivariate data set. Sometimes the data available doesn't have a ***Linear Relationship***, that if not detected can distort the Trend calculation. The Correlation Coefficient can be used to detect if the data set has ***Nonlinear Relationship***.

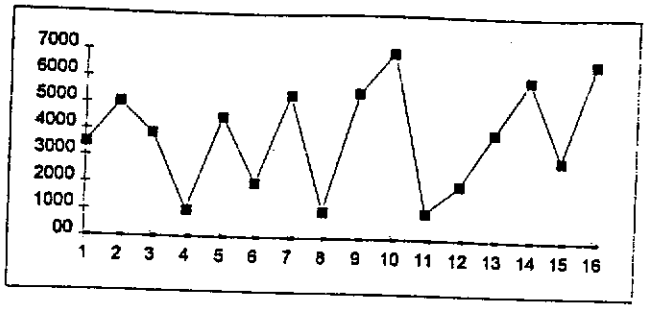
Scatter plot with Linear Relationship:



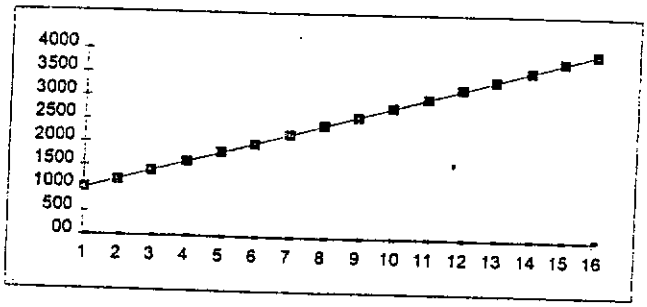
Correlation :

Correlation is a summary measure of the strength of the relationship. A correlation of 1 indicates a perfect straight-line relationship, with higher values of one variable associated with higher values of the other , for example as the week number increase we have an increase in demand . A correlation or -1 indicates a perfect negative straight-line relationship, with both variable decreasing as the other decreases.
The usual interpretation of intermediate correlation between -1 and 1 is that the size (absolute value) of the correlation indicates the strength of the relationship, and the sign (Positive or Negative) indicates the direction (increasing or decreasing).
The usual interpretation of a correlation of "0" is that there is no relationship, just randomness.

Dataset with Linear Relationship:



Dataset with Linear Relationship:



Correlation Formula :

$$r = \frac{n\sum XY - (\sum X)(\sum Y)}{\sqrt{n\sum X^2 - (\sum X)^2}\sqrt{n\sum Y^2 - (\sum Y)^2}}$$

Trend (m) Formula :

$$Trend = m = \frac{n\sum XY - (\sum X)(\sum Y)}{n\sum X^2 - (\sum X)^2}$$

Intercept (b) Formula :

$$b = \frac{\sum Y}{N} - m\frac{\sum X}{N}$$

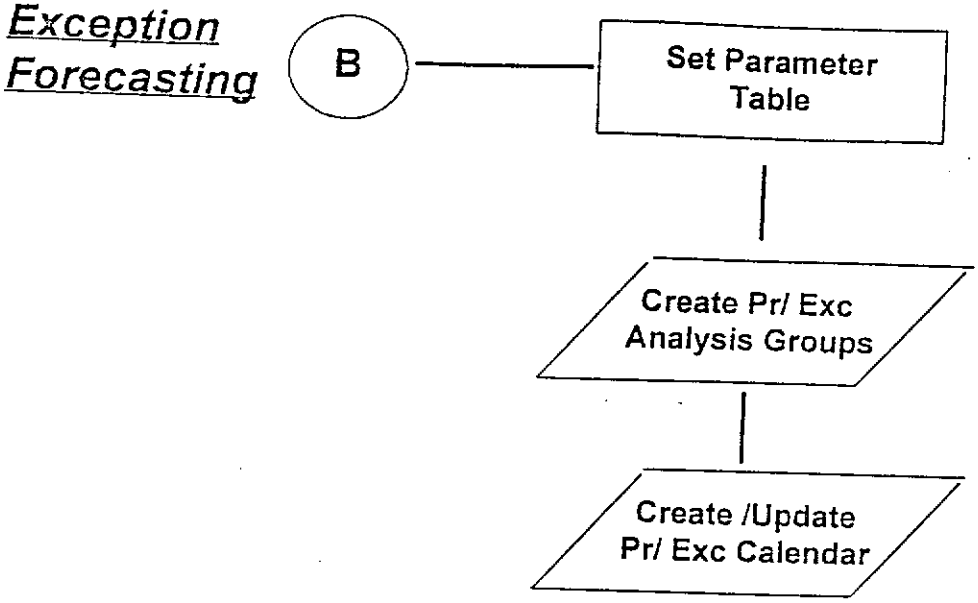
Forecast :

TD(X) = **b** + **m**X

Where :
X = Week Number at each data point
Y = Deseasonalized Demand at each data Point
n = Number of Weeks
Σ = Sum of all

Work Trend Demand Table:

[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]


Exception Forecasting
B
Set Parameter Table
Create Pr/ Exc Analysis Groups
Create /Update Pr/ Exc Calendar

Define Promotional Groups

(Process 1.6)

Algorithm

In this process the user will enter the Promo/Exception Identification and Description.

D16 - Promotion Group Analysis

[1]	[2]	[3]
ANALYSIS GROUP ID	**Analysis Group Description**	**SKU**
DIET	Diet Beverages	001
DIET	Diet Beverages	010
DIET	Diet Beverages	022
PEPSI	Pepsi Regular & Diet	001
PEPSI	Pepsi Regular & Diet	002

[1] Analysis Group ID

The analysis group id. This analysis group is user-defined, not necessarily related to product and size and one SKU can belong to more than one Analysis Group

[2] Analysis Group Description

[3] SKU

Promo/Exception Calendar

(Process 1.3)

Algorithm

The other component of forecast is the ***"Promotion/Exceptions"***, that will take in account marketing promotions holidays, infrastructure programs or any event that can be identified and quantified as related to a significant increase or decrease on demand.

The Promotion/Exceptions should be entered in the ***Promo/Exception Calendar*** by location and SKU. If you inform a range of year/week, the system will automatically calculate and add the exception increment or decrement amount to the week related to the exception dates.

The impact of future promotions or exceptions will be predicted using the following methods:

1. - the weighted average of like promotion/exception demand history
2. - a volume/quantity above the expected demand for a normal week
3. - the percentage above the expected demand for a normal week
4. - the volume / quantity change impact from like promotion / exception history
5. - the percentage impact from like promotion / exception demand history
6. - absolute override of expected case volume (user production)

This table details the information used by each method:

# Method Name	Historical Data Used			Adjustment Type			Manual Entry Required?
	None	Normal	Like Promo's / Exceptions	None	Volume	Percent	
B1 Prior Data Weighted Average			x	x			
B2 Increment Volume		x			x		x
B3 Increment Percent		x				x	x
B4 Prior Data, Increment Volume		x	x		x		
B5 Prior Data, Increment Percent		x	x			x	
B6 Override Volume	x				x		x

Note that for methods 4 and 5, the volume and percent numbers will be generated from demand data, not from user entries.

D5 - Exception Calendar Table:

[1] LOCATION	[2] SKU	[3] Year	[4] Week From	[5] Week To	[6] Exception Id	[7] Exception Description	[8] Percent Increment	[9] Volume Increment / Amount	[10] Exception Increment Method
PEPSI (METHOD B3)	001	94	38	38	BATMAN	Promotion Batman	0.20		Percent Increment
PEPSI (METHOD B2)	001	94	42	42	BTLINTRO	Introduction of Bottles 8 OZ		1,000	Volume Increment
SEGUI (METHOD B4)	001	94	43	43	BTLINTRO	Introduction of Bottles 8 OZ			Prior Promo/Exception Data, Volume Increment
ALLES (METHOD B1)	001	94	47	47	THKGVNG	Thanksgiving			Prior Promo/Exception Data Weighted Average
SEGUI (METHOD B6)	001	94	53	53	XMAS	Christmas		23,000	Override Volume
PEPSI (METHOD B1)	001	94	45	45	CLMBS	Columbus Day			Prior Promo/Exception Data Weighted Average
SEGUI (METHOD B5)	001	94	10	10	NYEAR	New Year's Day			Prior Promo/Exception Data Percent Increment

[1] Location
Location where the Promotion / Exception will occur.

[2] SKU
Stock Keeping Unit

[3] Year
Year in which the promo\exception will happen

[4] Week From
Starting week in which the promo\exception will happen

[5] Week To
Ending week in which the promo\exception will happen

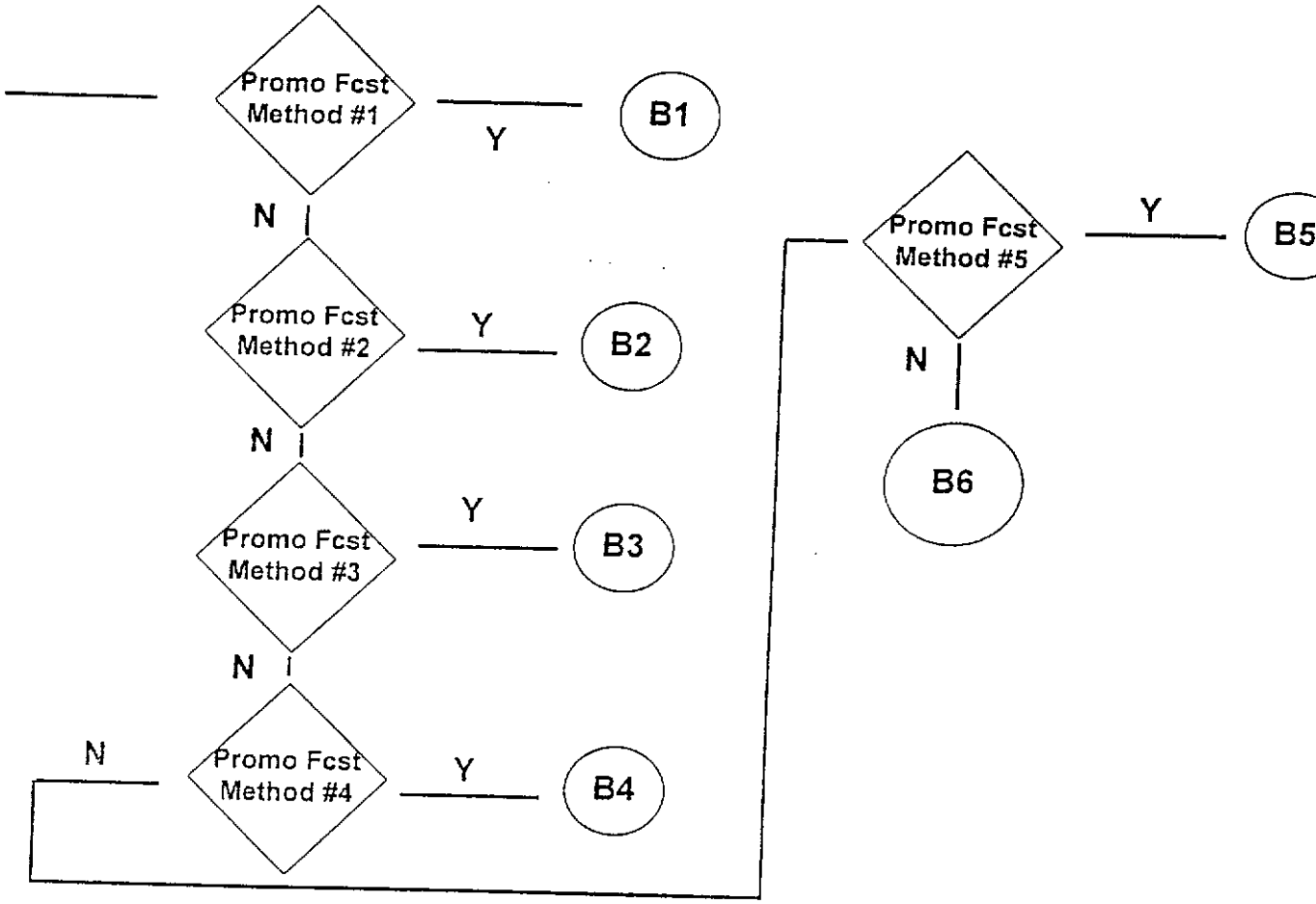
[6] Exception Identification
A code identifying the Promo/Exception

[7] Exception Description
Description of the Promo/Exception

[8]Percent Increment
The percentage increase or decrease of demand that is excepted as a result of a promo/exception

[9]Volume Increment / Amount
The volume increase or decrease of demand that is excepted as a result of a promo/exception

[10] Incremental Promo/Exception Calculation Method


Promo Fcst Method #1
Y
B1
N
Promo Fcst Method #2
Y
B2
N
Promo Fcst Method #3
Y
B3
N
N
Promo Fcst Method #4
Y
B4
Promo Fcst Method #5
Y
B5
N
B6

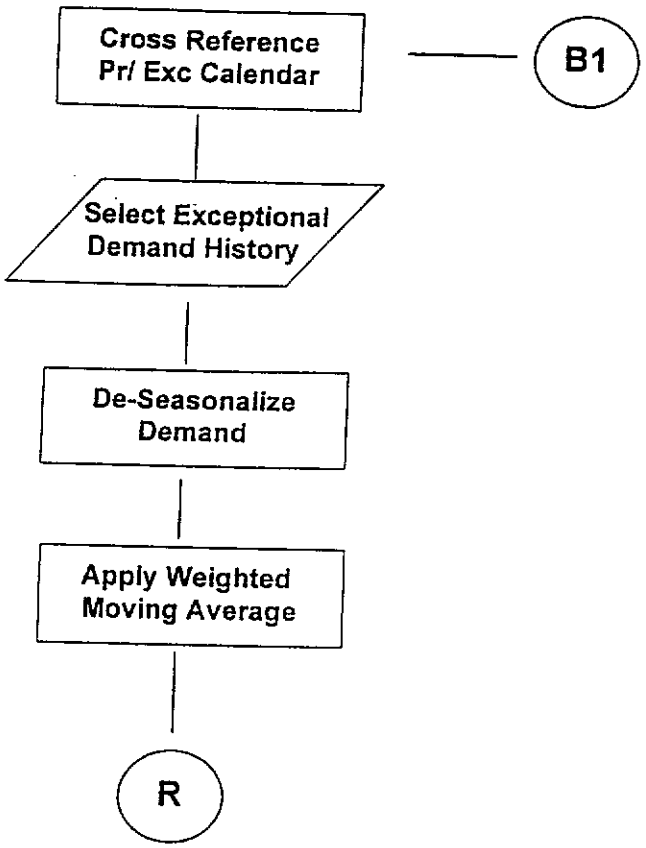
Calculate Promo/Exceptions Demand

(Process 6)

Algorithm

In this process the system calculates the Promo\Exception Demand Forecast, when Prior Promo/Exception Data method is specified. The Promo / Exception Calendar is used to identify the duration of the promo/exception effect.

Promo / Exception Forecast Method:
Prior Promo/ Exception Data Weighted Avg.



Example Promo/Exception B1:

Work Promo/Exception Demand Forecast Table:

Year	Week	Exception Description	Deseasonalized Actual Demand
91	34	Columbus Day	750
92	34	Columbus Day	890
93	34	Columbus Day	1,300

Work Weighted Moving Average Promo/Exception Incremental Table:

Year	Week	Deseasonalized Actual Demand	Weight	Weighted Promo/Exception Volume Demand for the Week	Promo/Exception Volume Demand For the Week
91	34	750	0.147	110	
92	34	890	0.210	187	
93	34	1,300	0.300	390	
94	34				[T2] / [T1] = 1,405
			0.657	687	
			[T1]	[T2]	

Calculate the moving average demand volume using 10 prior weeks with the same Promo\Exception Id as Promo/exception week being forecasted.

Total Deseasonalized Forecast
= (Weighted Moving Average)
= 1,405

Week Seasonal Index = 0.82

Total Seasonalized Forecast
=(Total Deseasonalized Forecast * Week Seasonal Index)
= (1,405 * 0.82) = 1,152

Example Promo/Exception B2 :

D6 - Average Demand Table:

Location	Year	Week	SKU	Average Demand Forecast
PEPSI	94	17	001	4,894

D7 - Trend Demand Table:

Location	Year	Week	SKU	Trend Demand Forecast
Pepsi Plant	94	17	001	1,624

D5 - Exception Calendar Table:

Location	SKU	Year	Week From	Week TO	Exception Id	Exception Description	Percent Increment	Volume Increment / Amount	Exception Increment Method
Pepsi Plant	001	94	17	17	IntBottles	Introduction of Bottles 8 OZ.		1,000	Volume Increment

D2 - Weekly Seasonal Table:

Location	Year	Week	Seasonal Group	Seasonal Index
Pepsi Plant	94	17	Pepsi02	0.82

D9- Promo\Exception Demand Table:

Location	Year	Week	SKU	Promo\Exception Demand Forecast
Pepsi Plant	94	17	001	1,000

Trend Demand = 1,624
Correlation Coefficient (CC)= 0.50 (CC <).75 - use Weighted Moving Average)

Weighted Moving Average Demand = 4,894
Deseasonalized Forecast
= (Weighted Moving Average Demand)
= (4,894)

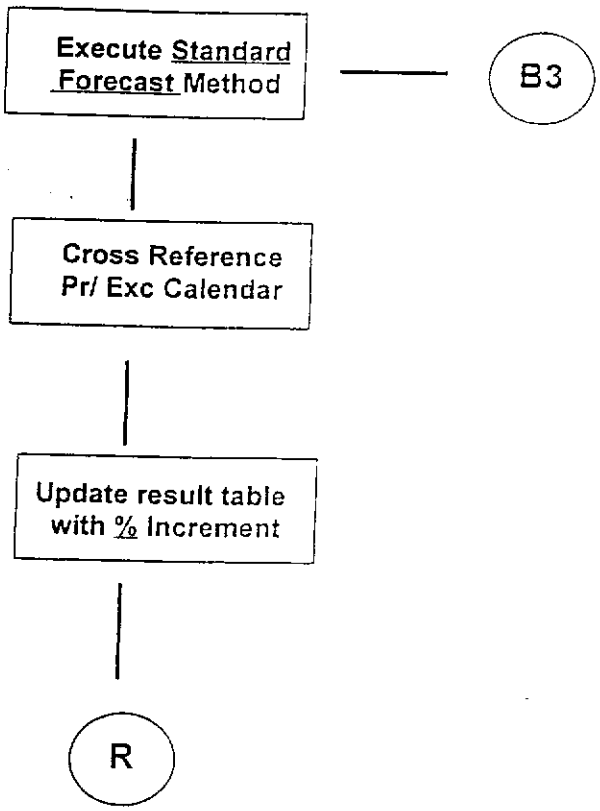
Week Seasonal Index = 0.82

Seasonalized Forecast
= (Deseasonalized Forecast * Week Seasonal Index)
= (4,894 * 0.82) = 4,013

Promo\Exception Demand
Increment Method = Volume Increment
Incremental Volume = 1,000

Total Forecast
=(4,013 + 1,000) = 5,013

Promo / Exception Forecast Method:
Volume Increment



Example Promo/Exception B3 :

D6 - Average Demand Table:

Location	Year	Week	SKU	Average Demand Forecast
Pepsi Plant	94	17	001	4,894

D7 - Trend Demand Table:

Location	Year	Week	SKU	Trend Demand Forecast
PEPSI	94	17	001	1,624

D5 - Exception Calendar Table:

Location	SKU	Year	Week From	Week To	Exception Id	Exception Description	Percent Increment	Volume Increment / Amount	Exception Increment Method
Pepsi	001	94	17	17	Batman	Promotion	0.02		Increment Percentage

D2 - Weekly Seasonal Table:

Location	Year	Week	Seasonal Group	Seasonal Index
PEPSI	94	17	Pepsi02	0.82

D9- Promo\Exception Demand Table:

Location	Year	Week	SKU	Promo\Exception Demand Forecast
PEPSI	94	17	001	101

Trend Demand = 1,624
Correlation Coefficient (CC)= 0.50 (CC <).75 - use Weighted Moving Average)

Weighted Moving Average Demand = 4,894

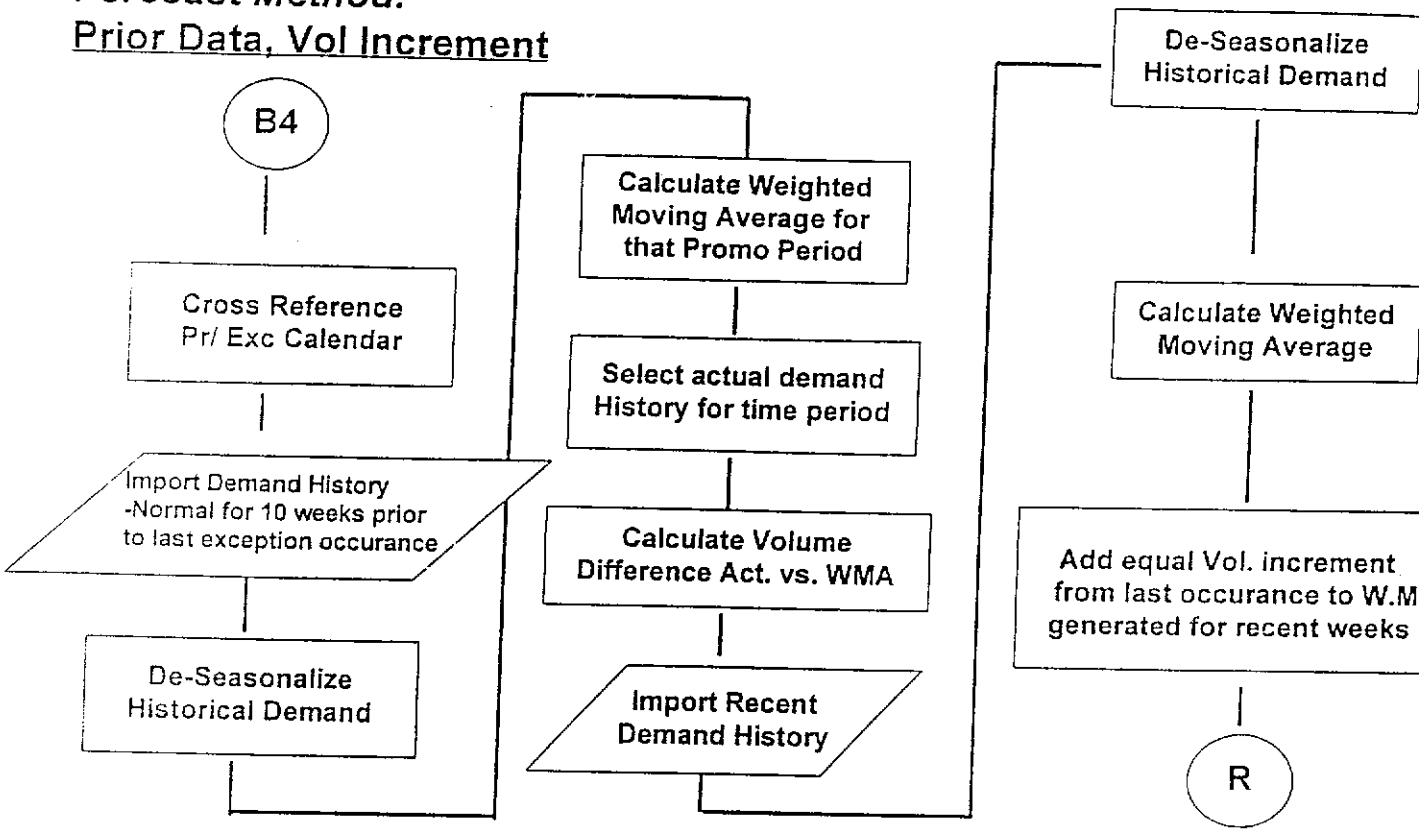
Promo\Exception Demand
Increment Method = Percent Increment
Percentage of Demand = 0.02

Total Deseasonalized Forecast
= (Weighted Moving Average Demand) * (1 + Promo\Exception Demand)
= (4,894 * 1.02) = 4,992

Week Seasonal Index = 0.82

Total Seasonalized Forecast
= (Total Deseasonalized Forecast * Week Seasonal Index) = (4,992 * 0.82) = 4,093

Promo / Exception
Forecast Method:
Prior Data, Vol Increment



Example Promo/Exception B4:

Work Promo/Exception Demand Forecast Table:

Year	Week	Exception Description	Deseasonalized Actual Demand
93	24		800
93	25		810
93	26		820
93	27		830
93	28		840
93	29		850
93	30		860
93	31		870
93	32		880
93	33		890
93	34	Columbus Day	1,300

Work Weighted Moving Average Promo/Exception Incremental Table:

Year	Week	Deseasonalized Actual Demand	Weight	Weighted Promo/Exception Volume Demand for the Week	Promo/Exception Volume Demand For the Week
93	24	800	0.012	10	
93	25	810	0.017	14	
93	26	820	0.025	20	
93	27	830	0.035	29	
93	28	840	0.050	42	
93	29	850	0.072	61	
93	30	860	0.103	88	
93	31	870	0.147	128	
93	32	880	0.210	185	
93	33	890	0.300	267	
93	34				**[T2] / [T1] = 870**
			0.972	845	
			[T1]	[T2]	

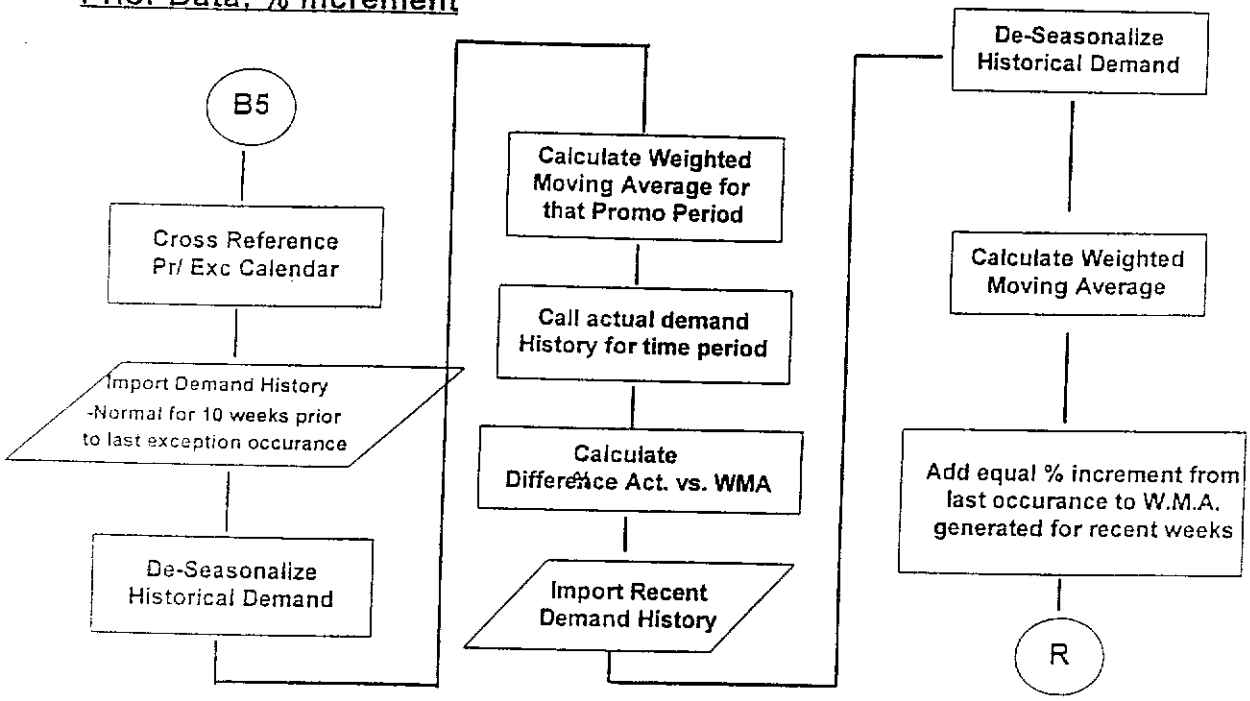
Calculate the moving average demand volume using 10 prior weeks from the last promo/exception week: Subtract the Moving Average Forecast for the last Promo/Exception from Deseasonalized Actual Demand of the last Promo\Exception. (1,300 - 870) = 430

Weighted Moving Average Demand = 4,894
Standard Actual Demand
Increment Method = Prior Promo/Exception Data Volume Increment

Total Deseasonalized Forecast
= (Weighted Moving Average Demand) + (Volume Increment)
= (4,894 + 430) = 5,324

Week Seasonal Index = 0.82
Total Seasonalized Forecast
= (Total Deseasonalized Forecast * Week Seasonal Index)
= (5,324 * 0.82) = 4,365

Promo / Exception Forecast Method:
Prior Data, % Increment



Example

Promo/Exception B5:

Work Promo/Exception Demand Forecast Table:

Year	Week	Exception Description	Deseasonalized Actual Demand
93	24		800
93	25		810
93	26		820
93	27		830
93	28		840
93	29		850
93	30		860
93	31		870
93	32		880
93	33		890
93	34	Columbus Day	1,300

Work Weighted Moving Average Promo/Exception Incremental Table:

Year	Week	Deseasonalized Actual Demand	Weight	Weighted Promo/Exception Volume Demand for the Week	Promo/Exception Volume Demand For the Week
93	24	800	0.012	10	
93	25	810	0.017	14	
93	26	820	0.025	20	
93	27	830	0.035	29	
93	28	840	0.050	42	
93	29	850	0.072	61	
93	30	860	0.103	88	
93	31	870	0.147	128	
93	32	880	0.210	185	

93	33	890	0.300	267	
93	34				**[T2] / [T1] = 870**
			0.972	845	
			[T1]	[T2]	

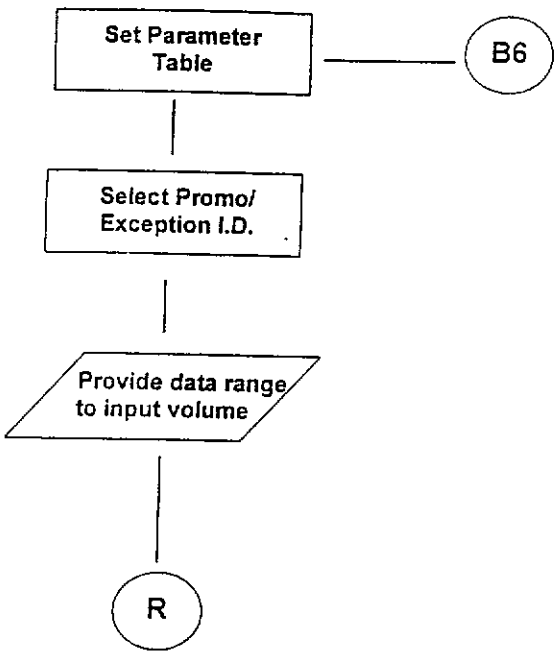
Calculate the moving average demand volume using 10 prior weeks from **the last promo/exception week:**
Subtract the Moving Average Forecast for the last Promo/Exception from **Deseasonalized Actual Demand** of the last Promo\Exception. (1,300 - 870) = 430
Calculate the incremental percentage for the Promo/Exception, 430 / 870 = 0.49

Weighted Moving Average Demand = 4,894
Standard Actual Demand
Increment Method = Prior Promo/Exception Data Percentage Increment

Total Deseasonalized Forecast
= (Weighted Moving Average Demand) * (1+ Percentage Increment)
= (4,894 * (1 + 0.49)) = 7,292

Week Seasonal Index = 0.82
Total Seasonalized Forecast
= (Total Deseasonalized Forecast * Week Seasonal Index) = (7,292 * 0.82) = 5,980

Promo / Exception Forecast Method:
Volume Override



Example Promo/Exception B6 :

D5 - Exception Calendar Table:

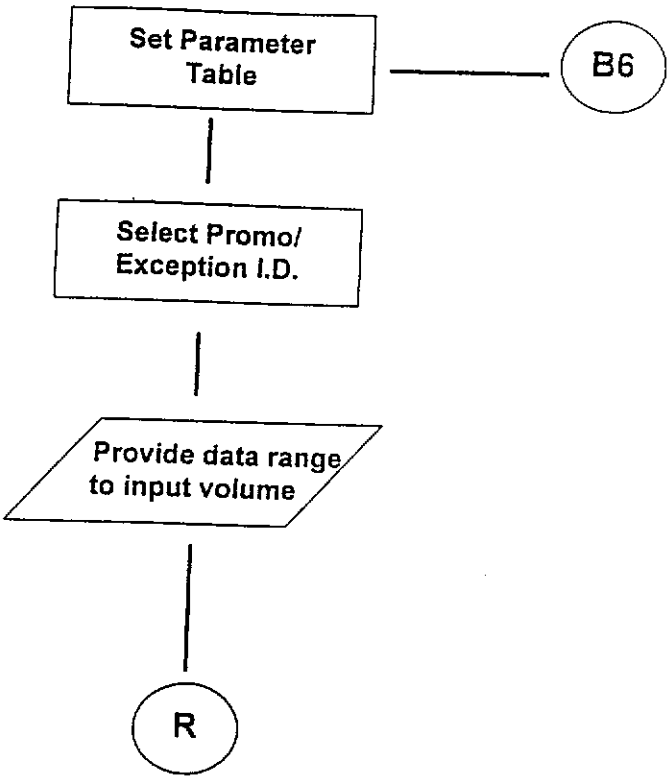
Location	SKU	Year	Week From	Week TO	Exception Id	Exception Description	Percent Increment	Volume Increment / Amount	Exception Increment Method
Pepsi Plant	001	94	17	20	IntBottles	Introduction of Bottles 8 OZ.		20,000	Override Volume

D9- Promo\Exception Demand Table:

Location	Year	Week	SKU	Promo\Exception Demand Forecast
PEPSI	94	17	001	20,000

Total Seasonalized Forecast
= (Promo\Exception Demand)
= 20,000

Promo / Exception Forecast Method:
Volume Override



Adjust & Review Weekly Forecast

(Process 9)

Algorithm

In this process the user should be able to review the ***Forecast Components***, the ***Forecast Error*** for previews forecasting weeks and adjust the ***Generated Forecast*** if necessary.

Work Weekly Forecast Table :

[1] Location	[2] SKU	[3] Year	[4] Week	[5] Actual Demand	[6] Seasonal Index	[7] Weighted Moving Average Forecast	[8] Trend Demand (TD)	[9] Promo / Exception	[10] Total Forecast X Seasonal	[11] Adjusted Forecast	[12] Gen. Error	[13] Gen. (%) Error	[14] Adj. Error	[15] Adj. (%) Error
Pepsi Plant	001	94	01	2,776	0.80									
Pepsi Plant	001	94	02	2,989	0.79	3,470	1,624	0	2,869	3,000	120	0.04	11	0.00
Pepsi Plant	001	94	03	3,123	0.81	3,654	1,624	0	3,091	3,500	32	0.01	377	0.12
Pepsi Plant	001	94	04	3,324	0.85	3,746	1,624	0	3,322	3,500	2	0.00	676	0.20
Pepsi Plant	001	94	05	3,995	0.89	3,811	1,624	0	3,536	4,000	459	0.11	5	0.00
Pepsi Plant	001	94	06	4,650	0.93	4,055	1,624	0	3,922	5,000	728	0.16	350	0.08
Pepsi Plant	001	94	07	5,119	0.96	4,377	1,624	0	4,357	5,000	762	0.15	(119)	(0.02)
Pepsi Plant	001	94	08	5,281	0.99	4,689	1,624	0	4,802	5,500	479	0.09	219	0.04
Pepsi Plant	001	94	09		1.01	4,894	1,624	0	5,107					

[10] Total Forecast with Seasonal Component

[11] Adjusted Forecast
Forecast adjusted by the user

[12] Generated Error
Generated Error = absolute value (Actual Demand - Total Forecast X Seasonal)
[12] = [5] - [10]

[13] Percentage Generated Error
Percentage Generated Error = Generated Error / Actual Demand
[12] = [5] - [10] / [5]

[14] Adjusted Error
Adjusted Error = absolute value (Actual Demand - Adjusted Forecast)
[12] = [5] - [10]

[15] Percentage Generated Error
Percentage Generated Error = Adjusted Error / Actual Demand
[12] = [5] - [11] / [5]

[16] Correlation Coefficient
Trend Correlation Coefficient for the week

Demand Generation

Demand Generation will determine the total estimated demand for all demand types. The total demand will be based on the following calculation:

forecast for routine type demand
+ discounted forecast for order type demand
+ actual orders (both regular and special orders together)
= total generated demand

Forecasts in the current and next week will be needed at a daily level. The following two weeks will be needed only at a weekly level. In order to accomplish this, a demand bucket structure will be used.

Demand Bucket Structure

A demand bucket structure is generated based upon the following rules:

- daily buckets are created for the next two weeks
- weekly buckets are created for the following two weeks
  - any days that are specified as non-selling days by the user are included in the prior selling day daily bucket
- the weeks begin on the user-specified demand week start day

In the following example, Saturdays and Sundays are specified as non-selling days. The demand week starts on Friday. This is typical, because what is expected to be sold during a given week (Monday - Friday) , will need to be available in the warehouse on the preceding Friday.

Week Number	Bucket Number	Demand Date	Dates Including	Days Included
Week 1	1	1-Oct	October 1 - 3	Friday, Saturday and Sunday
	2	4-Oct	4-Oct	Monday
	3	5-Oct	5-Oct	Tuesday
	4	6-Oct	6-Oct	Wednesday
	5	7-Oct	7-Oct	Thursday
Week 2	6	8-Oct	October 8 - 10	Friday, Saturday and Sunday
	7	11-Oct	11-Oct	Monday
	8	12-Oct	12-Oct	Tuesday
	9	13-Oct	13-Oct	Wednesday
	10	14-Oct	14-Oct	Thursday
Week 3	11	15-Oct	October 15 - 21	Friday - Thursday
Week 4	12	22-Oct	October 22 -28	Friday - Thursday

Another way of looking at this bucket structure would be the following:

Week	First					Second					Third	Fourth
Day	F,S,S	M	T	W	R	F,S,S	M	T	W	R	Fri-Th	Fri-Th
Dates	Oct 1-3	Oct-4	Oct-5	Oct-6	Oct-7	Oct 8-10	Oct-11	Oct-12	Oct-13	Oct-14	Oct 15-21	Oct 22-28
Bucket	1	2	3	4	5	6	7	8	9	10	11	12
Routine Qty												
Order Qty												
TotalQty												

Mapping the Generated Forecasts into the Bucket Structure

Routine Forecasts

The various forecasting algorithms specified in this document will be used to create weekly forecasts based on historical demand. Thes weekly forecasts will be generated for both routine and order based demand at the SKU - warehouse level.

These weekly routine forecast numbers will be split to daily numbers based on upon the split factor table. Here is an example of a split factor table:

LOCATION	FRI	SAT	SUN	MON	TUES	WED	THURS
Allen	30%	0%	0%	10%	15%	20%	25%
Baker	20%	0%	0%	20%	20%	20%	20%
Cooks	10%	0%	0%	10%	20%	30%	30%
Sarah	20%	0%	0%	20%	20%	20%	20%

These split factors will be used to create the numbers in the daily buckets for the current week and the following week. For example, given the above splitter table and the following routine forecasts:

Warehouse	Product	Weekly Routine Demand Forecast			
		Oct 1 - 7	Oct 8 - 14	Oct 15 -21	Oct 22 -28
ALLEN	1236	500	1000	1500	2000
BAKER	1236	1000			
COOKS	1236	1500	1500	1500	1500
SARAH	1236	2000	1500	2000	2500

The demand buckets would be loaded with the following numbers:

Week	First					Second					Third	Fourth
Day	F,S,S	M	T	W	R	F,S,S	M	T	W	R	Fri-Th	Fri-Th
Dates	Oct 1-3	Oct-4	Oct-5	Oct-6	Oct-7	Oct 8-10	Oct-11	Oct-12	Oct-13	Oct-14	Oct 15-21	Oct 22-28
Bucket	1	2	3	4	5	6	7	8	9	10	11	12
ALLEN	150	50	75	100	125	300	100	150	200	250	1500	2000
BAKER	200	200	200	200	200	200	200	200	200	200	1000	1000
COOKS	150	150	300	450	450	150	150	300	450	450	1500	1500
SARAH	400	400	400	400	400	300	300	300	300	300	2000	2500

Note that when weeks are not loaded or entered, the preceding week's forecast is used for the current week (BAKER warehouse).

Order Forecasts

Since we will be adding in "hard", actual orders to generate the demand, we only want to include the part of the order forecast that is believed to be still "outstanding". Typically, the closer the forecast is to the current date, the fewer orders do we presume to be outstandi

The first step is to map the demand into the demand bucket in the same way as the mapping for the routine forecasts. For example, give the following weekly order demand forecast,

Warehouse	Product	Weekly Order Demand Forecast			
		Oct 1 - 7	Oct 8 - 14	Oct 15 -21	Oct 22 -28
SARAH	1236	500	500	1000	2000

and the following order demand split factors,

LOCATION	FRI	SAT	SUN	MON	TUES	WED	THURS
Sarah	20%	0%	0%	20%	20%	20%	20%

the undiscounted demand bucket table would be:

Week	First / Current					Second					Third	Fourth
Day	F,S,S	M	T	W	R	F,S,S	M	T	W	R	Fri-Th	Fri-Th
Dates	Oct 1-3	Oct-4	Oct-5	Oct-6	Oct-7	Oct 8-10	Oct-11	Oct-12	Oct-13	Oct-14	Oct 15-21	Oct 22-28
Bucket	1	2	3	4	5	6	7	8	9	10	11	12
SARAH	100	100	100	100	100	100	100	100	100	100	1000	2000

However, we need to discount these amounts to leave us with only the orders that we still believe to be outstanding. To do this we need a table like the following:

Week	First / Current					Second					Third	Fourth
Day	F,S,S	M	T	W	R	F,S,S	M	T	W	R	Fri-Th	Fri-Th
Dates	Oct 1-3	Oct-4	Oct-5	Oct-6	Oct-7	Oct 8-10	Oct-11	Oct-12	Oct-13	Oct-14	Oct 15-21	Oct 22-28
Bucket	1	2	3	4	5	6	7	8	9	10	11	12
Current Day:												
Fri, Sat, Sun		0%	20%	40%	50%	70%	90%	100%	100%	100%	100%	100%
Monday			0%	20%	40%	60%	80%	90%	100%	100%	100%	100%
Tuesday				0%	20%	50%	70%	80%	90%	100%	100%	100%
Wednesday					10%	30%	50%	70%	80%	90%	95%	100%
Thursday						10%	30%	40%	80%	90%	95%	100%

If the current day is Wednesday, October 6th, then the resulting demand table would be the following:

Week	First / Current					Second					Third	Fourth
Day	F,S,S	M	T	W	R	F,S,S	M	T	W	R	Fri-Th	Fri-Th
Dates	Oct 1-3	Oct-4	Oct-5	Oct-6	Oct-7	Oct 8-10	Oct-11	Oct-12	Oct-13	Oct-14	Oct 15-21	Oct 22-28
Bucket	1	2	3	4	5	6	7	8	9	10	11	12
SARAH				0	10	30	50	70	80	90	950	2000

If the current day is Thursday, October 7th, then the resulting demand table would be the following:

Week	First / Current					Second					Third	Fourth
Dates	Oct 1-3	Oct-4	Oct-5	Oct-6	Oct-7	Oct 8-10	Oct-11	Oct-12	Oct-13	Oct-14	Oct 15-21	Oct 22-28
Bucket	1	2	3	4	5	6	7	8	9	10	11	12
SARAH						10	30	40	80	90	950	2000

Orders and Special Orders

The actual orders and special orders for a given warehouse can be determine by looking at the bills-of-lading. Bills that are from a given warehouse and have SKU's of type "O" for order or "S" for Special Orderon their detail lines represent order demand. An example of this bill of lading table may be the following:

Bill Number	From	To	Status	Ship / Load Date	Product	Quantity
0000011	SARAH	RED	Scheduled	06 - Oct - 94	1236	50
0000012	SARAH	RED	Scheduled	07 - Oct - 94	1236	40
0000013	COOKS	RED	Scheduled	08 - Oct - 94	1236	30
0000014	SARAH	RED	Scheduled	09 - Oct - 94	1236	20
0000015	SARAH	RED	Scheduled	14 - Oct - 94	1236	10
0000016	SARAH	RED	Scheduled	19 - Oct - 94	1236	5

For generating demand, we are only concerned with the from location and the ship / load date. If we map the demand for product into the bucket table we would get the following table:

Week	First / Current					Second					Third	Fourth
Dates	Oct 1-3	Oct-4	Oct-5	Oct-6	Oct-7	Oct 8-10	Oct-11	Oct-12	Oct-13	Oct-14	Oct 15-21	Oct 22-28
Bucket	1	2	3	4	5	6	7	8	9	10	11	12
ALLEN												
BAKER												
COOKS						30						
SARAH				50	40	20				10	5	

Demand Generation Summary

In order to generate total demand we need to add the routine forecast, a discounted order forecast and actual order demand. In our example:

Routine Forecast

Week	First / Current					Second					Third	Fourth
Day	F,S,S	M	T	W	R	F,S,S	M	T	W	R	Fri-Th	Fri-Th
Dates	Oct 1-3	Oct-4	Oct-5	Oct-6	Oct-7	Oct 8-10	Oct-11	Oct-12	Oct-13	Oct-14	Oct 15-21	Oct 22-28
Bucket	1	2	3	4	5	6	7	8	9	10	11	12
ALLEN	150	50	75	100	125	300	100	150	200	250	1500	2000
BAKER	200	200	200	200	200	200	200	200	200	200	1000	1000
COOKS	150	150	300	450	450	150	150	300	450	450	1500	1500
SARAH	400	400	400	400	400	300	300	300	300	300	2000	2500

+ Discounted Order Forecast (October 6th example for SARAH only):

Week	First / Current					Second					Third	Fourth
Day	F,S,S	M	T	W	R	F,S,S	M	T	W	R	Fri-Th	Fri-Th
Dates	Oct 1-3	Oct-4	Oct-5	Oct-6	Oct-7	Oct 8-10	Oct-11	Oct-12	Oct-13	Oct-14	Oct 15-21	Oct 22-28
Bucket	1	2	3	4	5	6	7	8	9	10	11	12
SARAH				0	10	30	50	70	80	90	950	2000

+ Actual Orders

Week	First / Current					Second					Third	Fourth
Dates	Oct 1-3	Oct-4	Oct-5	Oct-6	Oct-7	Oct 8-10	Oct-11	Oct-12	Oct-13	Oct-14	Oct 15-21	Oct 22-28
Bucket	1	2	3	4	5	6	7	8	9	10	11	12
ALLEN												
BAKER												
COOKS						30						
SARAH				50	40	20				10	5	

= Total Generated Demand

Week	First					Second					Third	Fourth
Day	F,S,S	M	T	W	R	F,S,S	M	T	W	R	Fri-Th	Fri-Th
Dates	Oct 1-3	Oct-4	Oct-5	Oct-6	Oct-7	Oct 8-10	Oct-11	Oct-12	Oct-13	Oct-14	Oct 15-21	Oct 22-28
Bucket	1	2	3	4	5	6	7	8	9	10	11	12
ALLEN	150	50	75	100	125	300	100	150	200	250	1500	2000
BAKER	200	200	200	200	200	200	200	200	200	200	1000	1000
COOKS	150	150	300	450	450	180	150	300	450	450	1500	1500
SARAH	400	400	400	450	450	380	350	370	380	400	2955	4500

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